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CRACK IN THE FOUNDATION: DEFENSE TRANSFORMATION AND THE UNDERLYING ASSUMPTION OF DOMINANT KNOWLEDGE IN FUTURE WAR

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ABSTRACT

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This paper examines and evaluates the basic assumption that underpins much of the defense transformation initiative. The intellectual foundation for building tomorrow's military force rests on the unfounded assumption that technologies emerging from the "information revolution" will lift the fog of war and permit U.S. forces to achieve a very high degree of certainty in future military operations. The assumption of dominant knowledge in future war threatens to undermine the best efforts of senior military and civilian officials and create vulnerabilities in future American forces. The paper examines the origin and growth of the assumption and demonstrates how it has pervaded and corrupted joint and service visions of future war and is already having a negative effect on doctrine and organization. The paper exposes the fallacy of near-certainty in future war using logic and military history including analysis of recent conflicts. Desert Storm, Somalia, Kosovo, and Operations Enduring Freedom and Iraqi Freedom receive particular attention. The paper also evaluates Joint experimentation and concept development and makes recommendations concerning the next steps to take in defense transformation. The paper concludes that an embrace of the uncertainty of war, balanced Joint Forces, effective joint integration, and adaptive leadership will prove critical to future national security.

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CRACK IN THE FOUNDATION

> From Plato to NATO, the history of command in war consists of an endless quest for certainty.
>
> — Martin Van Creveld

A failure to examine critically the fundamental assumption that underpins much of the defense transformation initiative threatens to undermine the best efforts of senior military and civilian officials and create vulnerabilities in future American forces. While this failure may not affect initiatives connected with homeland security, the ballistic missile defense program, or business practice reforms, it has permitted the development of an unrealistic vision of future conventional war. The intellectual foundation for building tomorrow's military force rests on the unfounded assumption that technologies emerging from the "information revolution" will lift the fog of war and permit U.S. forces to achieve a very high degree of certainty in future military operations.

Concepts for future war assume the ability to achieve "information superiority." Information superiority is defined variously as "the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting an adversary's ability to do the same" or "an imbalance in one's favor in the information domain with respect to an adversary" or "that degree of dominance in the information domain which permits the conduct of operations without effective opposition." It is further assumed that information superiority will permit "dominant battlespace knowledge" or "the comprehensive awareness of all the decision-relevant elements within a defined battlespace, and the ability to predict, with a very high degree of confidence, nearterm enemy actions and combat outcomes." Another definition of dominant battlespace knowledge (DBK) is similar: "DBK involves everything from automated target recognition to knowledge of an opponent's operational scheme and the networks relied on to pursue that scheme. The result will be an increasing gap between U.S. military forces and any opponent in awareness and understanding of everything of military significance in any area in which we may be engaged." In addition to these terms, various others such as information dominance, dominant awareness, knowledge superiority, situational understanding, robust intelligence, and predictive intelligence represent a similar message: sensors, communications,

computers, and information technologies will provide near-certainty in future war and permit the United States to overmatch future enemies.[1]

All descriptions of how near certainty is to be achieved are based primarily on emerging technologies. A Global Information Grid of "persistent surveillance" will gather information and share that information in a networked "collaborative information environment." Automated systems will fuse that intelligence and make possible "virtual collaboration among geographically dispersed" analysts who will generate intelligence and, ultimately, knowledge. Some even assume that this "robust intelligence" will deliver not only a clear appreciation for the current situation, but also generate "predictive intelligence" that will allow US forces to "anticipate the unexpected."[2] Despite its enthusiastic embrace, the assumption of near-certainty in future war is a dangerous fallacy.

This is not to say that the Department of Defense should pursue transformation with diminished vigor; many changes and initiatives are long overdue and the possibilities associated with emerging technologies are significant. Indeed, initiatives to develop and field new sensor, communications, and information management capabilities hold great promise for increasing the effectiveness of our military forces. The dramatic advances in command and control technologies, especially abilities to gain real-time access to imagery and maintain a clear picture of friendly forces, vastly improved the agility and interoperability of units during Operation Iraqi Freedom. The ability to translate intelligence into action was clearly evident in attacks on the Iraqi leadership as well as the flexibility to modify plans for the air campaign. Flawed assumptions about the nature of future war, however, are impeding effective change and preventing our forces from taking full advantage of emerging capabilities. What is required is a focused effort to define the nature of future conventional war at the operational and tactical levels as a basis for transformation efforts. The first step is to abandon explicitly the assumptions that future war will lie mainly in the realm of certainty and that American forces will be able to achieve and maintain information dominance during combat operations. If we fail to do so, transformation efforts based on that assumption would disadvantage rather than advantage our forces and create vulnerability rather than build strength.

MANDATE FOR CHANGE

> I have an uneasy feeling that in engineering, as in other parts of our education and perhaps in many other parts of our experience, we are getting out of touch with the single, limiting circumstance, the resistant, intractable material, the hard particular that gets snowed by the general theoretical proposition.
>
> —Elting Morison

For over a decade, the issue of defense reform generated numerous studies, a vast amount of literature, considerable debate, and disappointing results.[3] Recognizing the lack of progress, President George W. Bush pledged "new thinking and hard choices" in defense. However, the time needed to make a comprehensive assessment as well as bureaucratic inertia slowed the Administration's efforts. Responses to the September 11, 2001 terrorist attacks including military operations in Afghanistan and the Philippines, homeland security initiatives, intelligence reforms, the build-up in the Persian Gulf region and Operation Iraqi Freedom caused further delay. Despite these obstacles and competing priorities, the Bush Administration remained committed to defense transformation. Indeed, only three months after the ill fated flight in that remote field in Pennsylvania and the murderous attacks on New York and Washington, D.C., President Bush renewed his commitment to reform defense citing a "sense of urgency" based on "the need to build this future force while fighting a present war." It would not be easy; he likened the effort to "overhauling an engine while you're going at eighty miles an hour." He insisted, however, that America had "no other choice."[4] In September 2002, Secretary of Defense Donald Rumsfeld told senior defense officials that the war on terrorism was not an excuse to delay defense transformation any further. He urged the Department to "accelerate our organizational, operational, business, and process reforms."[5]

According to the 2001 Quadrennial Defense Review (QDR), the purpose of defense transformation "is to maintain or improve US Military pre-eminence" through "the evolution and deployment of combat capabilities that provide revolutionary or asymmetric advantages to US Forces." Although transformation is often described as a continuous process rather than a destination, the QDR stated that current transformation efforts would have succeeded when "we divest ourselves of legacy forces and they move off the stage and resources move into new concepts, capabilities and organizations that maximize our warfighting effectiveness and the combat potential of our men and women in uniform." Successful transformation would allow the United States to "dominate future military competitions."[6]

The Department of Defense worked to impose direction and unity of effort on defense transformation.[7] Under President George W. Bush, the Department has made progress in many areas including business practices, acquisition, and joint interoperability (the ability of the services and other agencies to plan and operate together synergistically). The Pentagon developed a new process for determining defense requirements to help ensure the relevancy of equipment and compatibility among all of the services. A "Joint Capability Integration and Development System" now prioritizes service requirements based on their contribution to "joint warfighting capabilities." The initiative holds promise for solving long-term problems like communications incompatibilities between the services. The Joint Requirements Oversight Council (JROC) increased its influence over the procurement process. "Evolutionary Acquisition and Spiral Development" processes aimed to accelerate the delivery of advanced capabilities.[8] Efforts to improve the interoperability of the services included standardized communications, standard tactical procedures for operations such as close air support and urban combat, realistic joint training at all appropriate levels of command, and the establishment of Standing Joint Task Force Headquarters for each of the Regional Combatant Commands. The Department undertook a study to determine how to build on the successes of the Goldwater-Nichols Act of 1986 and advance joint professional military education. Inter-agency training and standardization of procedures to harmonize all elements of national power also received attention. The Office of Force Transformation now evaluates each of the service's transformation activities to recommend ways to integrate them into broader Defense Department efforts.[9] The most significant initiative, however, received little public attention -- the development of "Joint Operations Concepts" that articulate how American forces intend to fight the wars of the future.

The intellectual component of transformation will have a profound and lasting influence on future defense organization, education, training, and even institutional culture. President Bush pledged in February 2001, that "our defense vision" would "drive our defense budget, not the other way around."[10] In August 2002, Secretary Rumsfeld directed the Chairman of the Joint Chiefs of Staff, General Richard Myers, to develop Joint Operations Concepts based on the Defense Planning Guidance. Secretary Rumsfeld intended to use the document to "test proposals from the various services" and determine whether they match the joint vision of future war.[11] The Joint Staff and Joint Forces Command, with assistance of the services, developed the concepts to describe "how the Joint Force intends to operate" and "provide the foundation for the development and acquisition of new capabilities." Their work will have broad implications; it is also intended to shape "development and acquisition of future capabilities across doctrine,

organization, training, materiel, leadership and education, personnel, and facilities."[12] In fact, the Department of Defense is already basing resource decisions on its idealized view of future military operations.[13] As Vice Chairman of the Joint Chiefs of Staff General Peter Pace observed, there are high hopes that this "validated war-fighting concept that the services have all worked on together" will also increase joint interoperability.[14] As the 2001 Quadrennial Defense Review stated, "choices made today may constrain or enhance options tomorrow."[15] It is important to get the conception of future combat operations right.

Many of the ideas set out in the Joint Operations Concepts are fundamentally sound and propose using new technologies to operate effectively in emerging strategic and operational environments.[16] Operation Iraqi Freedom exposed many of these capabilities to the American public. Proposals to use advances in communications and information technologies to permit collaborative planning and allow decentralized operations based on mission-oriented orders are particularly promising. The concept also identifies the need to keep forces dispersed, then concentrate rapidly as future adversaries develop many of the long-range surveillance and precision fires capabilities that America currently possesses. It is difficult to argue with the call for powerful joint forces capable of unprecedented strategic, operational, and tactical mobility – these seem precisely the capabilities that America needs to counter attempts to deny entry into a theater of operations and accelerate the deployment of Army units in particular. If resourced, the stated priority of developing an enhanced strategic lift capability will achieve a high degree of responsiveness and strategic agility. Perhaps most important, emphasis on joint integration and the "networking" of the force takes head on a pressing lesson from Desert Storm, operations in Afghanistan, and Operation Iraqi Freedom – that the services need a joint command and control architecture and a common understanding of how they operate together. The emphasis on Joint Forces that train together habitually will also generate vast improvements in combat capability.[17] While technology is certain to improve the quality and timeliness of intelligence, the assumption that emerging technologies will lead to near-certainty undermines many of the positive aspects of defense transformation.

The new joint concept envisions "Full Spectrum Dominance Through Joint Integration." The concept promises to "defeat any adversary or control any situation across the full range of military operations" based on the capability to "sense, understand, decide, and act faster than any adversary in any situation." Commanders will receive "precise, fused intelligence at all levels of war" to facilitate "decision superiority," or the ability to make decisions faster than the enemy. Additionally, the high degree of certainty in future war will permit commanders to employ "tailored" joint forces in "globally and operationally distributed operations."[18]

Joint Operations Concepts contains weaknesses and contradictions, all of which derive from the assumption of near certainty in future war. Contradictions arise mainly from the tension between that assumption and realities associated with the strategic environment and likely characteristics of future enemies. Overall the strategic environment is "dynamic, uncertain, and complex."[19] Similarly, the paper describes potential adversaries as complex, adaptive, and capable of determined action with destructive technologies. Readers are warned that unique cultural, political, and geographical factors might enhance enemy capabilities and make enemy behavior difficult to predict. Likely enemy actions such as blurring the distinction between combatants and non-combatants or operating from ungoverned territories and urban areas will challenge US forces further. Because of American technological advantages, enemies will disguise their behavior and "avoid US strengths and exploit our perceived weaknesses."[20]

Without explanation, what the paper portrayed as immanent uncertainties associated with an adaptive enemy operating in a complex environment succumb to the network and "robust intelligence." The enemy is reduced to "a system of nodes and linkages." Without addressing how specific obstacles to certainty might be overcome, the paper asserts that the "Joint Force must gain and maintain information superiority." A new definition of information superiority acknowledges a two-way fight for intelligence, but then assumes that US forces and commanders will win that fight:

> The power of superiority in the information domain mandates that we fight for it as a first priority even before hostilities begin. This requires that we develop doctrine, TTPs, organizational relationships and technologies to win this two-sided fight. The quality of our information position depends upon the accuracy, timeliness and relevance of information from all sources. A priority responsibility of command is to ensure access to all relevant information sources within and among all DoD organizations, and in coalition operations with our mission partners. The continuous sharing of information from a variety of sources enables the fully networked Joint Force to achieve the shared situational awareness necessary for decision superiority.[21]

The contradiction between the assumption of information superiority in future war and the "dynamic, uncertain, and complex" security environment undermines the intellectual foundation for defense transformation. The cause of that contradiction is the assumption that US forces will be able to achieve information superiority and dominant battlespace knowledge in future war.

Officers who worked on Joint Operations Concepts were skeptical about those assumptions and sought to suppress what they viewed as an unrealistic vision of war. Although they were successful in editing out the most extreme assertions such as claims that "robust intelligence" would permit commanders "not only to understand the adversary's current

situation, but also to anticipate the unexpected," they were unable to eliminate the basic assumption of information superiority.[22]

Although the lack of evidence associated with the assumption of near-certainty in future war and its fundamental incompatibility with realities of the strategic environment seem sufficient to abandon the idea, the belief in information superiority and dominant knowledge in future war proved surprisingly resilient. Although, many questioned these assumptions, there was no official debate or deliberate effort to scrutinize them.[23]

When faced with criticism of dominant knowledge and its companion concepts, proponents avoided tough questions with increasingly ambiguous language and the argument that technology was still forthcoming. New terminology was in a perpetual state of reinvention. Adjectives such as dominant, seamless, precision, adapted, networked, integrated, tailorable, scalable, transparent, focused, robust, and full dimensional appeared with increasing frequency and were often linked together to multiply ambiguity. The difficulty of confronting directly the assumption of certainty in future war grew more remote as the confusing imprecise lexicon of transformation expanded. Additionally, qualifiers softened initial claims of perfect intelligence, but documents contained otherwise undiminished support for certainty in future war. "Perfect" became "near-perfect," but the meaning and consequences of the assumption remained unchanged.[24]

A combination of advocacy and passivity has also prevented exposure of flawed concepts and the assumptions that underpin them. Concept authors take ownership of their work and resolve to defend it rather than abandon bad ideas and go back to the drawing board. In briefings and working sessions, the language of transformation, when combined with PowerPoint slides, seems to lull what otherwise might be critical audiences into passivity. PowerPoint's "bulletizing" of ideas leads to shallow analysis. Color graphics and contrived charts substitute for thought and logic, yet create a facade of analytic credibility. The briefing dynamic often betrays an unspoken agreement between presenter and audience to give a higher priority to getting through the slides than examining the ideas and proposals that those slides represent.

While, it is clear that significant changes in the services and Department of Defense are necessary and are long overdue in some cases, it is dangerous to regard change as a virtue in itself. Change has become a mantra and the general need to adapt to new realities in defense gave "out of the box" ideas special status, often regardless of quality or degree of development. The Department of Defense and each of the services have held conferences on how to effect change. The services portrayed themselves in the midst of radical transformation and all

adopted the language of transformation even as some of the best-developed concepts for change were disregarded.[25] There are clear incentives to support the flawed vision of future war. In addition to the possibility of being labeled as an unimaginative Luddite, those who are not seen as sufficiently visionary stand to lose the confidence of senior leadership. Indeed, retired Vice Admiral Arthur Cebrowski, the head of the Department of Defense's Office of Force Transformation, stated that the "future elite must recognize disruptive technologies or processes, and the associated opportunities they present, as they emerge."[26] A failure to support new concepts might also result in a loss of resources for one's service or program. New "metrics" that grade how "transformative" programs are serve as a basis for funding decisions.[27]

The underlying assumption about future war generated contradictions in Joint Operations Concepts and is undermining the vitally important enterprise of defense transformation. There is an obvious contradiction between acknowledging the uncertainty of contemporary strategic and operational environments and asserting that war in those environments will be nearly certain, low cost, low risk, and efficient. Acceptance of a flawed vision of future war persists despite an utter lack of evidence and recent combat experience that runs directly counter to it. Understanding the origin of the idea of near-certainty in future war and how it gained official sanction will prove helpful in repairing the intellectual foundation of defense transformation.

MISUNDERSTOOD VICTORY AND THE ALLURE OF SIMPLE TRUTH

> What I want to suggest here is the persistent human temptation to make life more explicable by making it more calculable; to put experience into some logical scheme that by its order and niceness will make what happens seem more understandable, analysis more bearable, decision simpler…. And this seems to have been the human tendency from the time of Plato's quantification of the Guardian's role right on down.
>
> —Elting Morison

The years 1989 through 1991 marked a watershed in American national security policy. Events forced America away from the familiar dangers of the Cold War and the structures designed to control those dangers. Dramatic geopolitical changes including the emancipation of Eastern Europe, the breakup of the Soviet Empire, and the concomitant end of the Cold War moved American national security interests away from containing and deterring the Soviet

Union toward other priorities such as the promotion of regional stability and prevention of nuclear proliferation. The changes were welcome, but brought with them a high degree of uncertainty. Ebullient optimism about a "New World Order" followed the triumph of capitalism and democracy over communism and totalitarianism, but was short lived. Indeed, the post-Cold War world emerged as anything but "orderly;" conflicts engulfed Southwest Asia, the Balkans, and portions of Africa. Scholars began to describe the world of the 1990s as chaotic and increasingly prone to devastating conflict.[28]

By the middle 1990s, dialectic was apparent between profound uncertainty concerning the strategic environment and the belief that future war will lie squarely in the realm of certainty. Confidence in American power grew out of victory in the Cold War and the impressive performance of the US military in the 1991 Gulf War. The causes of overwhelming victory in the Gulf War, however, were misunderstood and that misunderstanding generated flawed assumptions about the nature of future war. Flushed with victory and impressed with American technological superiority, many believed that new technologies in the areas of surveillance, communications, long-range precision weaponry, and stealth made possible a new way of waging war. An emerging thesis of future war depended on an unfounded yet widely accepted belief that sensors, communications, and information technologies would generate near-certainty in armed conflict.

By the mid-1990s, many observers concluded that the overwhelming military victory in Desert Storm provided not only a demonstration of American military prowess, but also revealed a solution to post-Cold War national security problems. In 1994, defense analyst Andrew Krepinevich suggested that America might be on the verge of a military revolution. He argued that such a revolution: "occurs when the application of new technologies into a significant number of military systems combines with innovative operational concepts and organizational adaptations in a way that fundamentally alters the character and conduct of conflict."[29] The prevailing explanation for victory in the Gulf War – technological superiority – led many to believe that America had already generated or now had the opportunity to craft a "revolution in military affairs" or RMA. A National Defense University study that consulted major commanders from the Gulf War, for example, suggested that if America invested its defense dollars mainly to develop new technologies, it could create capabilities that would "shock and awe" potential adversaries and thereby compel behavior consistent with US interests. In short, the technology would not only provide a capability, it would also provide a strategy. The argument relied on the ability to achieve a high degree of certainty in future war.

> While there is much talk about "military revolutions" and winning the "information war," what is generally meant in this lexicon and discussion is translated into defense programs that relate to accessing and "fusing" information across command, control, intelligence, surveillance, target identification, and precision strike technologies. What is most exciting among these revolutions is the potential to achieve "dominant battlefield awareness," that is, achieving the capability to have near-perfect knowledge and information of the battlefield while depriving the adversary of that capacity and producing "systems of systems" for this purpose.[30]

Despite the focus of Krepinevich and others on the organizational and conceptual components of military revolutions, emphasis remained on technology. The belief in near-certainty in future war led many to conclude that a strategy of "shock and awe," the term popularized seven years later during Operation Iraqi Freedom, was the answer to the problem of future war.

Some advocates were particularly enthusiastic about the RMA. Immediately following the 1991 Gulf War, Colonel John Warden, the lead planner for the Desert Storm air campaign announced "a new kind of war had its birth in Mesopotamia." He asserted that America's technological capabilities including the ability to identify, target, and hit critical nodes with precision strikes rendered the Iraqi cause hopeless after the first week of bombing. The fact that the Iraqi Army was not removed from Kuwait until after four additional weeks of bombing and a large ground offensive seemed not to matter. Warden declared the Gulf War as the first in a new era of "hyper-war" in which American forces would have the unprecedented ability to "find the enemy 24 hours a day and strike…with precision means."[31]

The belief that industrial age warfare had been supplanted by yet-to-be-defined information age warfare gained wide acceptance. Adherents to the technological superiority explanation for overwhelming victory in the Gulf not only advocated the aggressive pursuit of new technologies such as sensors and precision weapons, they also argued that the capabilities associated with these technologies would be decisive in future war. New concepts for the employment of these technologies, many believed, could bias future military operations dramatically in favor of the U.S. for the foreseeable future.[32]

When evidence from the Gulf War became accessible, however, studies revealed that the technological superiority explanation for overwhelming victory was simplistic. Dr. Stephen Biddle, one of the first analysts to gain access to detailed data on the ground war, concluded that it was a combination of Iraqi errors, American technological superiority, and a dramatic skill imbalance between Iraqi and coalition forces that produced powerful, "nonlinear" results.[33]

Indeed, Desert Storm was a far less "precise" war than many believed in the immediate aftermath of victory. American forces encountered significant difficulties and experienced a high

degree of uncertainty.[34] The air forces were unable to target the Iraqi nuclear program due to a lack of intelligence. Air crews fought through inadequate intelligence, equipment malfunctions, and poor weather. The ground offensive permitted some Iraqi units to escape, in part, due to imprecise communications and differences in perspectives between theater, army, and corps commanders. Confusion and incomplete information characterized ground operations at the Corps level and below.[35] Additionally, imprecise coordination measures between Air Force and Army units created gaps in responsibility that permitted Iraqi armored forces to move unimpeded by air power.[36] Perhaps the most significant consequence of uncertainty was the decision in Washington to implement a cease fire after one hundred hours of ground combat, a decision that permitted much of the Iraqi Republican Guard to withdraw with equipment, repress incipient uprisings, and bolster the regime of Saddam Hussein.[37]

The effects of air power were impressive, but were also exaggerated. The Gulf War Air Power Study concluded that the air war revealed "no fundamental breaks with the past." Numbers of enemy vehicles destroyed in the air campaign were inflated, due, in part, to successful Iraqi deception operations. After the air campaign, the Iraqi Army retained a large force of over 1750 tanks, 900 armored personnel carriers, and 1450 artillery pieces. Despite claims that the Iraqis were incapable of communicating with or repositioning forces, large Republican Guard units reoriented to the West in an attempt to block the coalition enveloping attack. Republican Guard forces were well supplied and morale was high; units fought with determination.[38] Air power did, however, disrupt Iraqi command of control, constrain Iraqi logistics, dismantle the air defense system, cause significant attrition on enemy ground forces, decrease enemy morale (and in the case of some conscript units break their will to fight), bolster the confidence of friendly troops, and ensure freedom of action of U.S. and coalition units with absolute air supremacy. Those accomplishments were critical to achieving the overwhelming victory. They did not, however, signal revolutionary change in the nature of war.[39]

Others argued that generalizing about the nature of future war based on the experience of Desert Storm was inherently unwise. Historian Martin van Creveld noted the myriad weaknesses of the Iraqi military and observed that the war occurred almost exclusively on coalition terms and lacked "the interplay between opposing forces that an alert opponent would have created."[40] The Gulf War Air Power Study warned explicitly against basing conclusions about the nature of future war on Operation Desert Storm because of political, geographic, and military factors unique to that experience. The study concluded that the Gulf War presented ideal conditions for an air campaign (i.e. air supremacy, desert terrain, and a mechanized conventional enemy); it would be unrealistic thinking to hope for similar conditions in future

conflict.[41] The survey identified two major factors that limited the effectiveness of air power despite those ideal conditions: "the inherent uncertainties in the information on which action in war must inevitably be based; and the often unseen or unpredictable consequences of those actions."[42] Yet, the technological explanation for victory grew and contributed to the belief that a revolution in military affairs might soon produce near-perfect intelligence that, when combined with precision weaponry, would constitute the key to future victories.[43]

Misperceptions persisted despite evidence and analysis to the contrary, in part, because popular images from the Gulf War portrayed impressive technologies and flawless operations that went exactly according to plan. In contrast to media coverage of Operation Iraqi Freedom, reporters did not witness close combat on the ground and the public was left with only videos of precision strikes against fixed targets and hapless Iraqi conscripts surrendering in droves without a fight. By the time that mistaken claims of technological success such as the destruction of mobile SCUD missile launchers in Iraq's western desert or the defeat of the Iraqi spoiling attack at Khafji by air power were corrected, the public's attention had turned away from the war. Misunderstood success created the idea that America was in the midst of a revolution in military affairs.[44] Only one obstacle remained for those who advocated pursing the dream of the RMA – what the Gulf War Air Power Study had called "the inherent uncertainties" of war and "unseen or unpredictable consequences" of actions in combat.[45] With precision intelligence, precision weapons could become the decisive instruments of war.

Disconnecting armed conflict from ambiguity and uncertainty, however, meant overturning Carl von Clausewitz's theory of war. The theory contained in Clausewitz's *On War* had a profound influence on American military thought, especially after the Vietnam War. *On War* provided much of the intellectual foundation for the post-Vietnam renaissance in doctrine, education, and training -- reforms that produced the forces of Operation Desert Storm.[46] Military officers embraced Clausewitz's description of war as complex and unpredictable. Air and ground training centers tried to replicate the conditions of battle with live exercises against capable, thinking enemies. The prevailing conception of war as unpredictable and chaotic shaped service cultures; the Army and Marine Corps encouraged mission orders, initiative at all levels of leadership, and decentralization.

While Clausewitz did not treat uncertainty in war in an organized manner, he identified several factors that cause it: the "politics" of war, the human dimension of war, the complexity of war, and the interaction or non-linearity of war.[47] Those factors are not susceptible to elimination with technology.

A fundamental source of uncertainty is the political nature and context of war. Writing in the wake of Prussia's defeat in the Napoleonic Wars of the early nineteenth century, Clausewitz witnessed the French Revolution unleash powerful social and political dynamics that changed the nature of war. War was an extension of politics by other means; war's conduct depended in large measure on subjective factors such as the will of the people, the wisdom of political objectives, and consistency between those objectives and military strategy. Other factors, such as the culture, political identity and interests of the people who are the object of military operations or populate the battleground increase complexity and influence the course of events. Because the political determinants of war rarely exhibit homogeneity, constancy, or certainty, political tensions and ambiguities carry over into military strategy and operations. Because war is indeed an extension of politics, it is impossible to have uncertain, unpredictable strategic and operational environments, yet enjoy certainty in military operations.[48]

Because so many factors interact to determine the conditions of war, it is impossible to achieve certainty or guarantee outcomes. Because of war's complexity, Clausewitz stressed the pervasiveness of chance and the need for a commander to use intuition, look for opportunities, and turn the unpredictability of war to advantage.[49]

One such struggle or interaction takes place in the psychological and emotional realms and effects fighting power on both sides. War is a unique human activity that involves killing and the prospect of death. Uncertainty both derives from and reinforces the strains of war in ways that defy prediction. In his classic study of battles spanning six centuries, historian John Keegan found that this dimension of war provided continuity in the experience of combat despite dramatic social, organizational, and technological change. He observed that: "What battles have in common is human: the behavior of men struggling to reconcile their instinct for self-preservation, their sense of honor and the achievement of some aim over which other men are ready to kill them."[50] Similarly, Clausewitz observed that danger, "is part of the friction of war."[51] Indeed, what some refer to as the moral domain of war involves psychological and emotional dynamics that defy quantification or prediction.

Even if sensors were able to identify all enemy positions, the human and psychological dimensions of war would preserve uncertainty. Clausewitz was sensitive to the qualitative and moral sources of fighting ability. Clausewitz provided an example of how the human and psychological dimension of war preserves uncertainty. In the following passage, Clausewitz observed that prior to direct contact with the enemy it is impossible to know "whether the first shock of battle will steel the enemy's resolve and stiffen his resistance, or whether, like a Bologna flask, it will shatter as soon as its surface is scratched." Even with near-perfect

information on the enemy one still has to "guess the extent of debilitation and paralysis that the drying up of particular sources of supply and the severing of certain lines of communication will cause in the enemy; guess whether the burning pain of the injury he has been dealt with make the enemy collapse with exhaustion or, like a wounded bull, arouse his rage; guess whether the other powers will be frightened or indignant, and whether and which political alliances will be dissolved or formed."[52] Additionally, the enemy commander's intentions remain unclear until he is forced to reveal them. Clausewitz observed that war is not "directed at inanimate matter." It is directed at an "animate object that reacts."[53]

Several scholars have compared Clausewitz's observation concerning war as an "interaction of opposites" with contemporary non-linearity and chaos theories. In addition to psychological and emotional interactions, war at its fundamental level entails interaction between the combatant forces. Clausewitz also observed that various factors that influence war also interact with one another and make linear progression toward goals and objectives impossible. Clausewitz suggested that the theory of war be considered as "an object suspended between three magnets" of the "blind natural force of violence, hatred, and enmity…, chance and probability…, and war's rational subordination to the policy of government." Consistent with Chaos theory, these countless and continuous interactions in an unstable environment generate innumerable possibilities that defy prediction.[54]

Clausewitz observed that uncertainty and the factors that preserve it generate a friction that makes "action in war like movement in a resistant element."[55] Friction is both a product and a cause of uncertainty. Friction, however, is not immutable and technology can greatly reduce it. There is no doubt that technology has ameliorated sources of uncertainty since Clausewitz observed that three quarters of the factors on which action in war is based are wrapped in the "fog" of war.[56] Digital communications and the ability to see all friendly forces and much of the enemy on a digital maps, has reduced the fog of war greatly. During Iraqi Freedom, images of American forces using global positioning systems to move rapidly despite blinding desert sandstorms illustrated come of the power associated with these technologies. Equipment that permits staffs to develop orders and graphics rapidly and burst them across the battle area so all participants have a common operating picture and understanding of the plan has also reduced friction and increased speed of action. Routine training at the joint level and standardized tactics will reduce further the friction and uncertainty of war. While it is vitally important to take all possible measures to reduce uncertainty and friction, it is equally important to recognize those factors that preserve uncertainty as a basic feature of war.

As technology advances, new sources of uncertainty emerge. Precision weapons, for example, demand better intelligence. The speed, precision, lethality, and range of weapon systems have compressed events in time such that commanders must make decisions faster and therefore have less time to process and evaluate intelligence. The sheer volume of information available and the fact that much of it is conflicting or irrelevant "noise" confuses situations further.

The technology-based assumption of dominant battlespace knowledge gained acceptance even though technology could not remove the causes of uncertainty that Clausewitz identified. In January of 1995, Admiral William Owens, the Vice Chairman of the Joint Chiefs of Staff, suggested that it would soon be possible to "see and understand everything on the battlefield." Just seven months later he declared that new technologies "will allow us to dominate battlefield awareness for years to come…. And while some people say there will always be a 'fog of war,' I know quite a lot about these programs."[57] Whether one accepts certainty or uncertainty as the dominant condition of war is important because the type of force one designs, the training that force conducts, the education of officers, and military culture will differ greatly based on that fundamental belief.

Admiral Owens' assertion of certainty in future wars appealed to Americans' faith in technological solutions to complex problems as well as a more general cultural belief in progress through applied science and engineering.[58] It was also a case of wishful thinking—a definition of war as one would like war to be. Admiral Owens was not alone in overlooking the human and psychological dimensions of war. Many other military theorists have simply ignored those factors that could not be quantified.[59] Clausewitz's criticism of his contemporaries who posed simple, prescriptive solutions to the problem of war remains appropriate today: "They aim at fixed values; but in war everything is uncertain…. They direct inquiry exclusively toward physical quantities, whereas all military action is entwined with psychological forces and effects. They consider only unilateral action, whereas war consists of continuous interactions of opposites."[60] Clausewitz used words like uncertain, dangerous, primordial violence, hatred, and destruction to describe the physical and emotional milieu of war.[61] Admiral Owens' image of war permitted a "system of systems" approach that promised to "dissipate the fog of war" and permit the use of force "without the same risks as before."[62] As Alan Beyerchen has observed, this sort of reduction is natural among people who are educated to understand linear systems and are thereby conditioned to believe that "truth" lies in simplicity rather than complexity.[63]

The new theories of war took on names that evoked a sense of control and swept the imagination off the battlefield and into the computer room and command center: cyber war, third

wave warfare, information age war, and later, network-centric warfare. Each version of an evolving theory of war was grounded in the assumption that technology would provide certainty. Under these constructs, wars would be efficient and even more humane. Near-perfect information would make possible precise application of force from great distances which would, in turn, reduce the risk to US forces, minimize "collateral damage," and even make the battlefield a safer place for the enemy; US forces would use the exact amount of force necessary to achieve desired effects.

Although it became fashionable to include selective, usually flawed historical examples to justify new theories of war, there was a sense among true believers that emerging technologies were so revolutionary that historical experience no longer applied. Paradoxically, the future appeared much clearer to them than the past or present. Because of misunderstood victory in the Gulf War, American faith in technological solutions, a simplistic understanding of the nature of war, and a desire to make war easier and even humane, faith in certainty continued to gather adherents. Even contrary combat experience could not overcome its appeal and growing acceptance.

The American experience in Somalia between December 1992 and early 1994 might have exposed the folly of assuming information superiority. The United States military intended Operation Restore Hope to be what it was then calling an "operation other than war." The mission was to impose enough stability for the United Nations to first stop mass starvation, then facilitate long-term political and economic reforms. The complex operational environment included the lack of central government, the absence of law and order, and a complex web of competing clans. Ultimately, the complexity of the social-political situation in Somalia interacted with UN initiatives to create a chaotic, unpredictable situation that undermined the plans of the United Nations and the United States.

Technological sources of intelligence were of little value in Somalia. Commanders relied on human intelligence as the primary source of information. As General Anthony Zinni, then Director of Operations at United Nations Task Force Somalia recalled, he had access to very good technical intelligence, but sensors could not: "penetrate the faction leaders and truly understand what they were up to. Or maybe understand the culture, the clan association affiliation, the power of the faction leaders, and maybe understanding some of the infrastructure too."[64] The experience in Somalia demonstrated the folly of assuming that military certainty can derive from sensors and other technical means of gathering and assessing information.

Ambiguities in American policy objectives contributed to uncertainty, especially as operations shifted from humanitarian assistance to capturing a powerful clan leader, General

Mohammed Farah Aidid. To protect his base of power Aidid undermined the United Nations' effort. After militiamen loyal to General Aidid ambushed two Pakistani units on 5 June 1993 a battalion of US Army Rangers and Special Operations Forces received the mission to hunt down and capture the warlord. That fundamental change in American military operations was authorized under a previous United Nations resolution, but the significance of the decision was lost on the five-month-old administration of President Bill Clinton.[65] Even as Task Force Ranger arrived and combat operations such as raids were intensifying, the Administration endeavored to portray a small and decreasing commitment to the mission. After the administration denied military commanders' requests for armored vehicles; the lack of those capabilities increased both risk and uncertainty in operations. U.S. forces became reliant on allies, many of whom did not share U.S. priorities or sense of urgency and were not subordinate to American command.[66] Uncertainty in Somalia stemmed from politics in Washington as well as the confusing political situation within the country.

Strategic and operational uncertainties were amplified at the tactical level. Soldiers and marines operated in a populous, congested urban area in which almost everyone was armed; it was difficult to distinguish between friendly forces, neutrals, and those opposed to the humanitarian effort. For marines and soldiers, the complex social, political, and geographical environment blurred distinctions between peacekeeping operations and combat operations. Confiscation of weapons, for example, was often contested and could lead to firefights with clans unwilling to give up arms or even submit to inspections. Blurred distinctions between peacekeeping and combat operations led Major General Tom Montgomery to remark, "If this isn't combat, then I'm sure having a helluva nightmare."[67]

Convoluted command channels and disagreements between the participating nations added to the uncertainty of the situation. The Pakistanis, stung by the horrible ambushes of 5 June were reluctant to take unnecessary risks. Italians were generally sympathetic to General Aidid and were widely believed to be one of the General's intelligence sources. The resultant reluctance to share intelligence created greater uncertainty. Because it was a strategic asset, Task Force Ranger complicated matters further. Although the force was under "tactical control" of US Forces Somalia, it also remained under the "operational control" of U.S. Central Command, headquartered in Tampa, Florida. Its orders and reports flowed from and to Central Command without going through U.S. or UN headquarters in Somalia. A study of lessons learned in Somalia concluded that the complex command relationship "effectively created a condition that allowed no one to set clear unambiguous priorities."[68]

The inherent uncertainties of the Somalia operation were revealed and amplified on October 3, 1993 as U.S. Army Rangers began what they thought would be a mission of short duration to apprehend two of General Aidid's principal deputies. Despite initially confusing reports, intelligence sources located the "targets" near the Olympic Hotel in Mogadishu. Despite American technological superiority, a Somali warlord was able to achieve information superiority over Task Force Ranger during the raid. Spies working for Aidid were in all American troop locations. They provided intelligence and early warning to the rogue warlord and his deputies. They watched American forces conduct previous operations, identified patterns, and planned to attack vulnerabilities.[69] The result was tactical surprise over Task Force Ranger and a desperate fourteen-hour fight in a densely populated, hostile urban environment.

The interactions that occurred between Somali militia and the Rangers defied situational understanding: the shoot-down of two helicopters, heroic actions by isolated teams of American soldiers against armed mobs, repeated attacks by armed Somalis who used women and children as shields, application of tremendous firepower from American helicopters and the dispatch of wheeled convoys, multiple Somali ambushes against those convoys, and the commitment of an armored reaction force including Pakistani and Malay forces. It is difficult to imagine a more confusing fight from the vantage points both of the command post and the soldiers and leaders engaged in action.[70] As a close observer of urban combat noted, "the realities of urban warfare mean that the fog of war remains to a considerable degree impenetrable even to the latest technology." Although the soldiers of Task Force Ranger won a fight in which they were grossly outnumbered, the Battle of Mogadishu highlighted many of the inherent limits of technology and revealed the absurdity of basing military doctrine and organization on the assumption of information superiority.[71]

Growing confidence in technology as the answer to the problem of future war, however, overwhelmed the lessons of Somalia. Despite the inescapable conclusion that the technologies that were supposed to provide certainty in future war could not even influence the causes of uncertainty in Somalia, the growing effort to use the assumption of information superiority as the basis for conceptualizing future war continued. RMA advocates argued that it was unnecessary for theories to be grounded in current realities because even better technology was on the way.[72] A belief in insurmountable American military supremacy developed among senior military and civilian officials that manifested itself in the often-heard declaration that the United States would have "no peer competitor until [at least] 2020."[73] Because of American technological predominance, some assumed that America enjoyed a period of easy security during which emphasis ought to be placed on futuristic concepts and the development of "leap-

ahead" technologies. The absence of any perceived threat led many to argue that historical or recent experience was irrelevant and confining. Grounding change in reality would result in unimaginative solutions to the problem of future war. It was important, they argued, not to miss an opportunity to "skip a generation" to extend American dominance well into the twenty-first century. Those who saw revolutionary promise in new technologies seemed to regard the lack of evidence for their claims as an indicator of their powers of imagination rather than a deficiency.

Millenialism, may have reinforced this tendency. Some declared that the end of the millenium coincided with a "new epoch of conflict" with "no good old-fashioned wars in sight."[74] Although most qualified their description of this new epoch with statements that technology "can never eliminate completely the fog" of war, they assumed a level of certainty that redefined the nature of war. By 1996, the language of defense transformation began to exhibit a remarkable degree of confidence, promising "full spectrum dominance," essentially the capability to defeat decisively any adversary or control any situation.

Paradoxically, these declarations of American dominance grew as the readiness of America's military dropped. As the Department of Defense spoke of revolutionary technologies, shortages in repair parts, lack of training funds, turbulence associated with force reductions, and a dramatic increase in overseas deployments placed great strains on the military. Even a partial list of missions that the Department of Defense conducted during the eight years of the Clinton administration indicates how stretched forces were: operations in Somalia, air campaigns in Bosnia and Kosovo and against Serbia and Iraq, peacekeeping deployments to Bosnia, Haiti, Rwanda, and Kosovo, support for Haitian refugees in Guantanamo Bay, continuous operations in Iraq and deployments to Southwest Asia in response to Saddam Hussein's intransigence, and strikes in Afghanistan and Sudan.[75] The lack of a sound strategy to transition from a Cold War to a post-Cold War defense organization was taking its toll. Formal defense planning efforts such as the 1993 Bottom-Up Review and the 1997 Quadrennial Defense Review exhibited inconsistencies between strategy, force structure, and resources.[76] Critics characterized the 1990s as a period of "paralysis" in connection with Defense reform.[77]

While military and civilian leaders of the services and Department of Defense coped with the consequences of over-commitment and lack of direction, significant shifts in the intellectual basis for transformation occurred. Revolutionary concepts of future war might have provided a welcome escape from readiness crises and increasing demands on the force. An overworked officer corps contracted out many of the intellectual functions of the military. Based on a flawed understanding of victory in the Gulf war and bolstered by dreams of American technological

dominance of any opponent, the assumption of certainty in future war received official sanction in a document published by the Chairman of the Joint Chiefs of Staff in 1996.

General John Shalikashvili intended Joint Vision 2010 to serve as the "conceptual template for how America's Armed Forces will channel the vitality and innovation of our people and leverage technological opportunities to achieve new levels of effectiveness in warfighting."[78] Information technology and assumptions about how that technology would change war formed the basis for the concepts contained in JV2010.

> Improvements in information and systems integration technologies will also significantly impact future military operations by providing decision makers with accurate information in a timely manner. Information technology will improve the ability to see, prioritize, assign, and assess information. The fusion of all source intelligence with the fluid integration of sensors, platforms, command organizations, and logistic support centers will allow a greater number of operational tasks to be accomplished faster. Advances in computer processing, precise global positioning, and telecommunications will provide the capability to determine accurate locations of friendly and enemy forces, as well as to collect, process, and distribute relevant data to thousands of locations. Forces harnessing the capabilities potentially available from this system of systems will gain dominant battlespace awareness, an interactive "picture" which will yield much more accurate assessments of friendly and enemy operations within the area of interest.

JV2010 stated that technological advances would "not eliminate the fog of war," but asserted that dominant battlespace awareness would "make the battlespace considerably more transparent."[79]

Despite the qualifiers, the Department of Defense and each of the services embraced certainty as a condition of future war and the basis for transformation efforts. In his cover letter to the 1997 Quadrennial Defense Review Report to Congress, Secretary of Defense William Perry placed information superiority at "the heart" of defense transformation and identified the "key to success" in future war as "an integrated system of systems that would give [forces] superior battlespace awareness permitting them to dramatically reduce the fog of war."[80]

The assumption of near-certainty in future war exerted an immediate influence on the American armed forces. What was supposed to be a vision of the future became an organizing imperative for the current force. The Army, for example, accepted uncritically the promised reduction in the uncertainty of war. Based on that acceptance, the Army reorganized the division in a way that cut twenty-five percent of its heavy close combat formations, centralized logistical assets, and preserved command and staff overhead. In constructive computer simulation exercises designed to "validate" the new design, near perfect intelligence permitted centralized

targeting of large conventional forces such that long-range rocket artillery, Apache helicopters, and other fires compensated for the division's reduction in combat power. The new division was "smaller" yet "more lethal" because the assumption of dominant knowledge gave the unit "situational understanding."[81]

Acceptance of the assumption of certainty in future war was illogical because the claimed source of certainty – technology – was unable to remove or even reduce significantly principal sources of uncertainty in war. Indeed, the idea that future war would be near-certain failed to account for enemy actions, reduced the complexity of warfare to identifying and targeting things, and ignored the human and psychological dimensions of war. After it received official endorsement in JV2010, however, the assumption of near-certainty in future war continued to gain wide acceptance in the Department of Defense and within the services.

Ignorance of history, a misunderstanding of the Gulf War, and a failure to learn from even contemporary combat experiences such as the battle of Mogadishu permitted a fundamentally flawed assumption to become orthodoxy. While officers were reminded of the old quotation that the only thing harder than getting a new idea into the military mind is to get an old one out, the real problem was a lack of skepticism and critical inquiry.

Historian Williamson Murray found that the familiar contention that military institutions fail in war because they focus too closely on the last war is incorrect. In the often-cited case of German military triumph and French defeat in 1940, for example, the Germans benefited from a detailed study of World War I to determine what really happened and identify implications for future war. Meanwhile, the French studied their last war only superficially and used selective observations to justify existing organizations and doctrinal trends. The French avoided meaningful debate and designed wargames and exercises to ensure results that reinforced flawed assumptions. As historian Eugenia Kiesling observed, "hard truths were blurred both by optimistic language and by refusal to ask questions whose answers might have proved unsettling."[82] Because flawed assumptions escaped exposure, French military doctrine and institutional culture developed in a way that was incongruous with the conditions of war in 1940. When the Germans invaded, the French, who had assumed they would be able to conduct "methodical battle," maintain communications, prevent surprise, and control operations very closely were paralyzed and unable to contend with the actual conditions of war.[83]

Operation Iraqi Freedom and other recent conflicts represent opportunities to learn from contemporary experience, repair the intellectual foundation of defense transformation, and build a capable force for the future. Understanding how deeply flawed assumptions about the nature

of future war have penetrated the Department of Defense and each of the Services is a necessary first step in setting a new course.

THEORY OVER PRACTICE

> Theory cannot be accepted as conclusive when practice points the other way.
>
> —Charles E. Callwell

After the 1991 Gulf war, the Air Force embraced the concepts of information superiority and dominant battlespace knowledge enthusiastically. Certainty in war, when combined with increased accuracy of weapons would permit the Air Force finally to achieve decisive, fast, efficient, and low-cost victory in war through air power; it was a vision that airmen had pursued since 1918.[84] As the precision of weapons increased, target identification and target location remained limiting factors in the application of air power.[85] Precision weapons demand precision intelligence and thereby generate demands for even more accurate information. In late 1996, Air Force Chief of Staff General Ronald Fogleman, referring to the idea of dominant battlespace awareness in JV2010, declared that "in the first quarter of the twenty-first century, it will be possible to find, fix or track, and target anything that moves on the surface of the earth." He declared the Air Force "capable of dominating enemy operations in all dimensions of warfare: land, sea, air, and, in the future, space across a spectrum of time and conflict."[86] General Fogleman's assertions were consistent with the Air Force's faith in technology and confidence gained while operating in the most transparent of the "dimensions" he mentioned.

The pursuit of dominance from the air required more resources. As General Fogleman predicted dominant awareness in future war, the Air Force was in the midst of a budget battle over funding its new fighter aircraft, the F-22. In this context, the Air Force marketed a new concept called the "Halt Phase Strategy." The Halt concept assumed that "superior knowledge" was already attainable and would permit the Air Force to dominate future battlefields, especially early in a conflict. The Halt strategy, however, suffered from obvious limits in its applicability. The enemy it portrayed, a large invading mechanized ground force, was a mirror image of US heavy forces. The strategy failed to consider countermeasures to American technologies such as dispersion, concealment, deception, and intermingling with civilian populations.[87] The Halt strategy met skepticism because of the difficulty of identifying and targeting an enemy determined to foil American technological capabilities.[88]

In 2002, the Air Force Transformation Flight Plan announced a remedy for that difficulty: "decisive awareness." Close in meaning to the term dominant battlespace awareness, decisive awareness would permit the Air Force to achieve near-certainty in future war through: "Machine to machine interface of C4ISR [Command Control Communications Computers Information Surveillance Reconnaissance] systems through the horizontal integration of manned, unmanned, air, surface, information, and space systems to provide executable, decision-quality knowledge to the commander in near-real time from anywhere."

The degree of certainty the Air Force required included not only near-perfect knowledge of the current situation, but also knowledge of enemy intentions. When confronted with that limitation, the proponents of certainty assumed predictive abilities. "Predictive battlespace awareness" debuted as a component of decisive awareness; it would "anticipate our adversary's next move before he makes it" and "eliminate surprise." Predictive intelligence depended on automated decision aids to magnify the intellects of talented analysts who would have continuous access to near-perfect intelligence on the current situation. Those analysts would collaborate with one another on a network to identify trends and penetrate the minds of enemy commanders. They will also assess accurately other factors such as cultural predilections, morale, skill level and leaders' competence.[89]

Those fantastic claims allow the application of the logical test of *reductio ad absurdum* to the belief in certainty in future war. Under *reductio* reasoning a premise is taken to its logical conclusion and thereby reveals its fatal flaws. The Air Force clung to the assumption of certainty in war even as "dominant awareness" required clairvoyance under conditions of combat.

The Navy joined and might have even surpassed the Air Force in its advocacy of certainty in future war. Senior naval officers were among the most enthusiastic about the promise associated with information age technologies. Admiral Bill Owens, as Vice Chairman of the Joint Chiefs of Staff, helped develop the concept of "dominant battlespace knowledge." In his influential book, *Lifting the Fog of War*, the retired Admiral who is co-CEO of a satellite communications company, asserted that future commanders would "be able to see everything of military significance in the combat zone" and also gain a "deeper comprehension of the enemy's intentions, planned actions, and capabilities and limitations." Dominant battlespace knowledge would permit US commanders to launch strikes that "paralyze the enemy force."[90] With the publication of Sea Power XXI in September 2002, the Navy embraced Admiral Owens' ideas and made information superiority the basis for future naval operations.

Sea Power XXI organized the Navy's vision of future war around three concepts: Sea Strike, Sea Shield, and Sea Basing. Sea Strike is the ability to project precise and persistent

offensive power from the sea; Sea Shield extends defensive assurance throughout the world; and Sea Basing enhances operational independence and support for the joint force. All three concepts depended on ForceNet, the Navy's emerging system for command and control, intelligence, and communications.[91]

Officers charged with developing ForceNet were confident in the ability to deliver "superior knowledge." After years of concept development work, the Chief of Naval Operations' Strategic Studies Group in Newport, Rhode Island finalized the definition of ForceNet as: "the operational construct and architectural framework for naval warfare in the information age that integrates warriors, sensors, networks, command and control, platforms, and weapons into a networked, distributed combat force that is scalable across all levels of conflict from seabed to space and sea to land." ForceNet was designed to implement "the theory of network-centric warfare" and "draw on vast amounts of information and share the resultant understanding." Although the authors acknowledged the danger of information overload as volume of information increased and time to make decisions decreased, they were confident in ForceNet's ability to deliver "immediate and detailed information." ForceNet would "develop and deploy next-generation systems and analytical processes that provide broad situational awareness by harnessing the torrent of data flowing through military, interagency, and public channels." The result would be "expansive visibility and understanding, arming the joint force with knowledge dominance." The language of ForceNet revealed an engineering approach to war. The ForceNet concept was based on the belief that war would succumb to information age engineering just as nature succumbed to industrial age engineering. ForceNet appeared as the Hoover Dam and information as the wild waters of the Colorado River; the information age engineers of ForceNet would "harness" a "torrent of data" and "stream of information" to produce "power." That the human, psychological, and moral elements they sought to control might prove indomitable seemed not to dissuade them. Besides, the blueprints and work plans were finished and ground was already broken.

The architects of ForceNet do acknowledge that "military actions must be informed by political, economic, and cultural understanding" and that action in war can generate disproportionate reaction such that "a single shot can have global ramifications." It is assumed, however, that these sources of uncertainty will succumb to the power of "broadened knowledge" and shared "databases."

> Integral to this effort will be employment of knowledge enhancement centers within which intelligent computer agents help elite analysts search, filter, and classify information to produce a comprehensive understanding of the environment as quickly as possible…. Automated tools will be developed to

> continuously map and analyze critical variables in the operational environment, adversary forces, and friendly assets. Such tools will keep U.S. and allied commanders updated on the status of increasingly fluid operational environments. Our asymmetric advantages in information collection and processing technologies are ideally suited to such tasks, involving data-intensive functions for which computer capabilities vastly exceed those of human planners.

Sea Power XXI will create "decisive advantage conferred by superior information management and knowledge dominance."[92]

The enemy is generally absent from these descriptions of future war. When the enemy does appear, he is quickly overwhelmed by American strength and the interaction between forces is limited to the application of U.S. military power followed closely by enemy capitulation. Enemy countermeasures are not fully considered. Indeed, Sea Power XXI dismissed the enemy explicitly, extolling "strengths that are powerful and uniquely ours" such as "the expanding power of computing, systems integration, a thriving industrial base, and the extraordinary capabilities of our people…." The strengths of Sea Power 21 promise to make the enemy irrelevant to the outcome as "information technology will empower us to dominate timelines, foreclose adversary options, and deny enemy sanctuary." [93] Like the Air Force, the Navy plans to: "predict what will happen next, so that an adversary's actions can be preempted. By drawing on superior information and understanding, ForceNet will allow joint force commanders to foresee potential enemy actions days or weeks in advance. This will empower our commanders to decisively alter conditions and dominate opponents…."[94]
Linear thinking and the absence of the enemy ensure dominance, at least in theory.

In addition to the absence of the enemy, the orthodoxy of knowledge dominance survives because it is assumed that technological advantage at sea and in the air applies absolutely to operations on land. Since the end of the Cold War, the Navy's and the Air Force's uncontested mastery of sea and sky have bolstered claims of certainty in future war. It is easiest for the Air Force and Navy to assume certainty in future war because they operate in similar, relatively transparent media. After earning vast superiority over all potential adversaries in their domains, both services appropriately focused greater attention on the ability to influence operations on land, the only medium in which American power is currently contested. Innovations in tactics and capabilities have increased air-to-land and sea-to-land capabilities tremendously, but claims concerning what naval and air forces can achieve on land do not consider the fundamental differences between air, land, and sea environments.

Important efforts to enhance joint interoperability began to describe the air, ground, and sea environments as a "singular" or "unified" battlespace. While encouraging a holistic view and recognizing the need for improved integration of air, sea, and land operations was a positive development, those terms obscured critical differences. Joint concept developers operate at a high level of generality and base their efforts mainly on emerging technological capabilities and the operational level of war. They fail to consider tactical combat and most are not predisposed by either experience or education to recognize the unique complexity of operations on land.[95] Some military analysts tend to consider the media of air, sea, and land equivalent in complexity and transparency. Analysts Daniel Goure and Stephen Cambone asserted in 1997, for example, "air and space power provides the ability to see the entire theater/battlespace in three dimensions." They went on to argue that air forces could "use the information gained to develop an appreciation for how an adversary performs as a complex system." That knowledge would then permit air and space power alone "to achieve strategic results."[96]

As the American combat actions in Desert Storm, Somalia, Afghanistan and Operation Iraqi Freedom indicated, the factors that preserve uncertainty in war despite technological superiority are mainly land-based. Because people live there, land is where political, social and cultural, factors interact with complex geography to generate uncertainties that can alter the best-laid plans. As C. Kenneth Allard observed, the numbers of "targets" on land are far greater than on sea or in the air. He noted that "many of these potential targets resist that characterization by becoming extremely adept at using terrain, vegetation, and similar features of an environment that is far more "cluttered" and "dirty" that either the sea or aerospace- and therefore much less susceptible to electronic or other forms of penetration." Operations on land, he observed, provide challenges "for which technology at best provides only incomplete answers."[97]

The air and sea domains share many of the same characteristics and are transparent and uniform relative to land. Both are unforgiving environments. Air and sea forces reduce friction in very complex operations through centralized planning and control.[98] The speed of air and naval strikes make the contested portion of missions and the actual interaction with the land domain often-high risk, but short in duration. It is difficult for many who conduct or witness impressive strikes from sea and air to understand how superior technology and highly developed skills that earned dominance in those domains do not transfer directly to land. It is especially confounding given the tremendous destructive power that air and naval forces can now deliver precisely on target. That precision strikes might be ineffective or even counterproductive because of political factors, enemy strategy, or tactical countermeasures

requires them to transcend personal experience and balance enthusiasm for their technological capabilities with an appreciation of limitations.

Air and sea are not without their own frictions, uncertainties, and challenges that draw into question the assumption of dominant knowledge even in fluid environments. Indeed, the professionalism and high degree of skill in American air and naval forces conceal the complexity and danger associated with them. Air forces' duel with air defense systems is a tactical and technological game of cat-and-mouse. Air space management for rotary wing, fixed wing, unmanned aerial vehicles, and air defense assets can create dangerous uncertainties even without enemy action. Long bombing missions push human endurance to the limit. The vulnerability of ships and aircraft increase as they approach land because proximity to land reduces warning time and maneuver space and subjects forces to the uncertainty that land harbors. The naval environment increases in complexity as ships enter shallow or confined waters. Submarines, mines, and land-based conventional threats such as missiles, underwater demolition teams, and high-speed boats blend into the clutter of inhabited areas and busy commercial shipping routes. The October 12, 2000 terrorist attack on the USS Cole demonstrated that vulnerabilities persist despite vast technological superiority.[99] Because gaining access to land from sea and air is a critical capability for US forces and because missiles that can target sea and air platforms continue to increase in range and capability, naval and air forces will continue to operate in uncertain, dangerous environments and dominance of the air and sea domains enjoyed in recent conflicts through Operation Iraqi freedom will not go unchallenged in the future.

The Marine Corps, a service that operates in the air, on the sea, and on land understands the unique complexity of the ground environment and has rejected the prevailing assumptions about future war. In its "capstone concept," the Marine Corps emphasized "timeless realities of human conflict" over technological change. It eschewed attempts "to redefine war on more humane or less risky terms." It defined the nature of war as Clausewitz did: "A violent struggle between hostile, independent, irreconcilable wills characterized by chaos, friction, and uncertainty – will remain unchanged as it transcends advancements in technology."[100] Other services might adopt the Marine Corps definition rather than impose onto land a vision of war consistent only with operations in the air or at sea under conditions of unchallenged technological supremacy.

Hubris is an ancient Greek term defined as extreme pride that leads to overconfidence and often results in misfortune. In Greek tragedies, the hero vainly attempts to transcend human limits and often ignores warnings that portend a disastrous fate. The idea of dominant

knowledge in war and the related overconfidence in so called 'shock and awe' precision strikes transcends the limits of the nature of war and, in particular, war's human dimension. Hubris permeates the language of defense transformation and is particularly evident in the reductive fallacies of information superiority, dominant battlespace knowledge, and their various companion terms. Warnings were ignored.

The experience in Somalia from 1992-1994 might have served as a corrective to overconfidence in American military technological superiority. Ironically, Somalia instead reinforced faith in technology as a solution to complex national security problems. Painful images of the aftermath of Task Force Ranger's fight in Mogadishu provided incentive to expect even more from sensors, missiles, and airplanes. President William Clinton resolved to substitute missiles and bombs for ground forces as a method for avoiding another Mogadishu. Engagement from a safe distance offered the comfort of action without risk of irreversible commitment.[101] The Balkans became a testing ground for a strategy based on American military technology.

In July 1995, the horror of Srebrenica, including the humiliating surrender of Dutch peacekeepers to the Bosnian Serb war criminal Ratko Mladic, and the subsequent murder of seven thousand Muslim men, finally overcame American and European reticence to use force against the Bosnian Serbs. To many, Mladic's Serbs had seemed a formidable opponent; estimates of the number of ground troops needed to intervene in Bosnia were high. Bosnian Serb brutality against defenseless civilians, however, masked weakness. In early August, Croat and Muslim forces that America trained and equipped attacked and began to rout the Bosnian Serbs. Finally, in response to a brutal and senseless mortar attack on the Sarajevo marketplace that killed thirty-eight people and wounded eighty-five others, NATO air power struck Serbian forces in Bosnia hard. During the first twenty-four hours of Operation Deliberate Force, 300 strike sorties attacked Serb forces. It was a sharp contrast with the previous two years of irresolute and ineffective air strikes that NATO carried out in Bosnia under Operation Deny Flight. Deliberate Force complimented the Croat and Muslim ground offensives. For example, as Croat forces advanced across the Krajna River, any Serb unit that concentrated to stop them was subjected to devastating attacks from the air. The eleven day, 3,515-sortie air campaign was a success. Deliberate Force contributed significantly to the signing of the Dayton Accord in November after which NATO troops occupied the war-stricken province to enforce the peace.[102]

Deliberate Force demonstrated air power's ability to achieve strategic effects as part of a broad strategy and in conjunction with a complementary ground offensive. In 1999, however,

when the Clinton administration confronted Serbian brutality in Kosovo the emphasis was on precision air power as the solution to that problem. Missile strikes and bombing, made increasingly effective by technological advances, appeared very attractive to an administration that wanted to use force, but also wanted to minimize risk and avoid public or congressional opposition. Between March 24 and June 7, 1999, the United States and its NATO allies conducted an air campaign against Yugoslavia to end human rights abuses against the ethnic Albanian, Muslim population in the province of Kosovo.

Operation Allied Force was planned as a five-day air campaign to coerce Yugoslavian President Slobodan Milosevic to "withdraw his forces and cease hostilities" against the ethnic Albanian population in the province of Kosovo.[103] There was a high degree of confidence at the outset of the war. Rump Yugoslavia was a weak state unable to threaten NATO bases of operation or lines of communication. American military technology had continued to improve since the Gulf War. It was less than three years since the publication of Joint Vision 2010, but information superiority seemed within grasp. Unmanned aerial vehicles would provide greater fidelity of the battlefield in real-time. Joint STARS radar systems had an improved ability to track ground targets. Precision munitions including laser-guided bombs, cruise missiles, the new Joint Direct Attack Munition (JDAM), and Stand Off Weapon (JSOW) were available in great quantities. As the campaign began, American Secretary of State Madeline Albright declared on national television, "I think this is achievable in a very short period of time."[104]

Confidence, however, did not equate to certainty, even at the outset of the war. Political factors both within the United States and between the United States and its allies generated ambiguities and tensions that complicated military planning. The adversary was a sovereign nation with historical, cultural, and religious ties to Russia and much of Europe. As a result, the resolve of NATO allies was uneven despite the record of Serbian brutality in Bosnia-Herzegovina and Kosovo.[105] Macedonia provided a base of operations, but the situation there was unstable; the majority of its populace was sympathetic to the Serbs and feared an uprising by their own ethnic Albanian population. Protests in Greece, a NATO member, threatened to shut down critical supply lines. The French and Italians were unenthusiastic about an intensive air campaign against Serbia and favored measured attacks to communicate resolve. Despite working on war plans from May of 1998 to March of 1999, differences among NATO members kept those plans in flux. As in Somalia, it proved difficult to operate as part of a broad coalition even under the rubric of the NATO Alliance.[106]

Ambiguities in US policy and strained relationships between top civilian and military officials created more uncertainty and friction. President Clinton kept his policy deliberately

ambiguous to forestall debate in the US Congress. The President's announcement that he had no intention of using ground forces removed an important capability and dimmed the prospect of coercing Milosevic. The administration was determined to minimize the risk of casualties even if achieving that goal placed the achievement of strategic objectives in jeopardy. "Force protection" became part of the mission. Emphasis on minimizing collateral damage and the desire to maintain consensus among allies led to disagreements between top civilian and military officers; military officers regarded constraints on the use of force excessive. Strained relationships between top military officials over these and other issues added even more friction and impeded effective communication.[107] Even before it began, Operation Allied Force demonstrated how political considerations are connected inexorably to the conduct of war and that intractable uncertainty in war derives, in part, from the interaction of military means with political ends and factors that impede congruence between them.[108]

Assumptions of near-certainty in war are both a product of and encouraged by linear thinking. Once the psychological dynamic of war was unleashed, the future course of events depended not only (or even primarily) on NATO's bombing plan. It depended also on Yugoslav reactions and initiatives that proved impossible to predict. Without the necessary force to impose NATO's will on Yugoslavia and having based initial actions on unrealistically sanguine assumptions about the coercive power of air strikes, Yugoslavia seized the initiative soon after the war began.

Despite considerable preparation time and a weak enemy, NATO failed to achieve information superiority. Much was known about the enemy, but intelligence was not detailed enough to keep track of the Serbian Army.[109] Poor weather, heavy cloud cover, and mountainous, forested terrain degraded satellites, UAVs, and radars. Serbian decisions surprised NATO despite numerous personal interactions with Yugoslavian leader Slobodan Milosevic over the previous four years and the opportunity to develop detailed intelligence estimates.

Milosevic anticipated NATO's actions and countered them. He moved troops to the border of Kosovo weeks prior to the initiation of air and missile attacks. When the campaign started, those forces threw the Albanian population into the street, stripped them of their identification, looted their possessions, burned their houses, and drove them like cattle toward the Macedonian and Albanian borders. NATO was surprised and unprepared. The air campaign had the unintended consequence of actually accelerating the brutal ethnic cleansing operations it was intended to stop. A few weeks after the start of Allied Force, three-fourths of the ethnic Albanian population were refugees. Eight hundred thousand people crammed into

camps outside Kosovo's borders. Five hundred thousand more hid in the hills inside the province. Milosevic was not as easy to coerce as had been assumed. What was supposed to be a five-day air campaign drug into weeks, then months. The British government estimated that Serbs murdered ten thousand ethnic Albanians during the course of Operation Allied Force.[110] The experience revealed the dangers of linear thinking and being unprepared for the interaction that occurs with one's enemy once war begins.

Interaction with the enemy created considerable friction, complicated the conduct of the air campaign, and generated uncertainty. On the air campaign's seventh day, General Wesley Clark observed that NATO was facing "an intelligent and capable adversary who is trying to offset all our strategies." Even though Serbian air defenses were antiquated, they forced NATO aircraft to altitudes above fifteen thousand feet which made target identification difficult. They also used innovative methods to keep their radars active, yet prevent them from being hit. The Serbs used low-technology tactics and improvisation to down an F-117 Stealth Fighter. Those tactics forced thirty-five percent of combat sorties to be allocated against air defense.[111]

The Serbians learned to deceive and manipulate American intelligence. Serb forces allowed reconnaissance aircraft to identify actual targets then replaced them with decoys. Approximately five hundred of the three thousand precision munitions used struck those decoys. The Serbs learned the times when JSTARS conducted reconnaissance flights and had their forces halt on the sides of the road so the system would not detect "moving target indicators." After NATO began employing successfully a forward air controller in an A-10, Yugoslav forces sought concealment immediately upon hearing the aircraft.[112]

The Serbs' ability to obtain considerable intelligence on allied operations despite their technological inferiority draws into question the denial component of "information superiority" against even a foe that has very basic capabilities. The Serbs evacuated certain targets soon after they appeared on target lists. It is likely that the Yugoslav government had access to plans through spies at NATO headquarters. Additionally, spies stationed outside Aviano Airbase provided early warning when aircraft departed on missions.[113]

Perhaps most important, the instruments of Milosevic's ethnic cleansing campaign, small mobile groups of paramilitary and police, were intermingled with the innocent civilian objects of their terror and were, therefore, unidentifiable and immune to NATO air power. Intelligence analysts often had clear pictures of Albanian refugees cowering in the hills, but could not locate the Serbs who were terrorizing them. Aircraft looked for targets in vain, sometimes refueling four times without dropping a bomb. Because aircraft could not land with bombs, millions of dollars of ordinance landed in the Adriatic Ocean or on the vacant countryside. Serbian Army tanks and

other vehicles dispersed and hid. Even when Serbian tanks and artillery pieces were located, bombing might have provided an emotional catharsis, but the activity was irrelevant to stopping the Serbian ethnic cleansing campaign. It was not until peacekeepers moved into Kosovo that NATO discovered the full extent of Serbian atrocities committed against Kosovar Albanians.[114]

Evidence that uncertainty remained the dominant feature of war was also found in the confusion over results of the bombing campaign. NATO greatly exaggerated losses inflicted on the Serbian military. Initial reports estimated that the bombing destroyed over 450 artillery pieces, 120 tanks and self-propelled artillery vehicles, and 220 armored personnel carriers. Nothing close to those numbers, however, were counted physically. The Allied Force Munitions Effectiveness Assessment Team later reported the following numbers of destroyed equipment: 14 tanks, 18 armored personnel carriers, and 20 artillery pieces. Those numbers suggested that less than five percent of the Serbian combat systems had been destroyed during the seventy-eight day campaign. NATO's effort to attack enemy ground units failed. The extent of that failure became apparent only after the air war was over.[115]

Because of ambiguities in target selection and identification, many targets were hit unintentionally. Mistakes occurred not because of a lack of information; the sheer volume of data and the difficulty in separating good from bad information presented difficulties. As Secretary of Defense William Cohen attested after the war, "our vast intelligence system can create such a haystack of data that finding the one needle that will pinpoint a target in the right time frame is difficult, indeed."[116] The best-known intelligence failure was the bombing of the Chinese Embassy in Belgrade. At the time of the bombing, planners were under pressure to find two thousand targets in Serbia because targets for the five-day air campaign were exhausted. Human errors, including the use of an old map and a failure to update a no-strike list caused the error.[117] There were at least twenty other incidents of "collateral damage" including bombs that fell in Bulgaria and struck trains, convoys, a school, and hospitals.[118] These mistakes occurred despite great discipline on the part of the pilots. After an incident in which eighty Albanian refugees were reported killed in what was mistaken for a military convoy, Brigadier General Leaf, commander of the unit who conducted that attack, observed that it was "a very complicated scenario and we will never be able to establish all the details."[119]

Collateral damage concerns and unrealistic expectations created additional friction and uncertainty as the air campaign continued; commanders and planners were determined to avoid another disastrous error that might unhinge already decreasing political support for the effort. Benjamin Lambeth, an expert on the air campaign, observed that: "Thanks to unrealistic efforts to treat the normal friction of war as avoidable human error, every occurrence of unintended

collateral damage became overinflated as front-page news and treated as a blemish on air power's presumed ability to be consistently precise."[120] Many targets hit in Serbia were selected due to distance from the civilian populace rather than for their military value and thus contributed little to the objective of coercing Milosevic. Even very careful targeting procedures, however, could not prevent inadvertent damage. After the two-week moratorium on bombing Belgrade that followed the Chinese embassy incident, the first night of renewed bombing damaged the residences of the Swedish, Spanish, and Norwegian ambassadors as well as the Libyan embassy and a hospital.[121]

The Kosovo experience demonstrated that even extreme technological superiority does not lead to information superiority or remove uncertainty and friction. The Serbs were no "peer competitor." NATO enjoyed air supremacy and faced antiquated, minimal air defenses. The Serbs had no ability to disrupt NATO communications or information systems. Kosovo demonstrated that the causes of uncertainty in the conduct of war lie mainly outside technology's reach: war's political nature, its human dimension, its complexity, and interaction with the enemy. Military organizations should, of course, take all possible action to minimize uncertainty and friction, but they must be prepared to win in an uncertain environment. In Kosovo, NATO has assumed certainty and was unprepared.

The assumption that the war in Kosovo would lie in the realm of certainty undermined NATO's ability to meet objectives and prevent suffering. Near-certainty combined with long range precision fires was supposed to vitiate the need for ground forces and a make possible a fast, low-cost, low-casualty war. The campaign was supposed to last five days; t lasted eleven weeks and ended after 40,000 aircraft sorties and the threat of a ground invasion. The way in which the war was conducted increased the suffering of both Kosovar Albanians and Serbian civilians and made air power much less effective than it would have been if it had been employed as part of air-land operations. NATO achieved dominance of the air, but that achievement did not translate into dominance on the ground. The absence of a ground force to compel the Serbs to desist from their campaign of terror and to render ineffective the countermeasures taken against air forces allowed Serbia to terrorize the ethnic Albanians and work to turn world public opinion against NATO. The mismatch between stated objectives and military strategy made it a war of paradoxes. It was a war waged with one sided casualties, but one that generated ambiguous results. It was also a war waged under the auspices of compassion, but conducted in a way that increased, or at least permitted the suffering of those on whose behalf it was initiated.[122]

Those who conducted Operation Allied Force deserve great credit for laboring under constraints and overcoming considerable uncertainty and friction. The failures of Operation Allied Force were not failures of air power; they were failures based on unrealistic expectations that elevated a military capability to the level of strategy. The U.S. experience during Operation Allied Force exposed the ideas of information superiority and dominant battlespace knowledge as fundamentally unsound. Once the effects of Operation Allied Force were combined with other elements such as increased diplomatic pressure (especially from Russia), a Kosovo Liberation Army offensive, and the threat of a NATO ground offensive, NATO succeeded and Milosevic acquiesced.[123]

Even if the war had been waged with technology anticipated in the year 2020, those capabilities would not have reduced significantly the uncertainty and friction. In 2020, enemy in forests and villages would have remained undetected and supply of Serbian forces could not have been interdicted because Serbs used small civilian trucks to get supplies to their units. Perhaps most important to the outcome in Kosovo, technology of the future will remain unable to distinguish the small forces that carried out the ethnic cleansing from innocent civilians.[124] Even if one assumes near-perfect information, that information is only relevant if it can be translated into near-perfect military operations in the context of a sound strategy that supports policy goals. Information, in other words, is not an end in and of itself. Kosovo, however, like Somalia, did not provide a corrective to flawed assumptions concerning future war.

As one book on the subject of Kosovo observes, NATO "won ugly," but won nevertheless and even a modest success can emasculate lessons. Senior administration officials declared Operation Allied Force "history's most successful air campaign."[125] The Defense Department's Kosovo After Action Report stated that Operation Allied Force "provided a real-world test of information superiority concepts outlined in Joint Vision 2010." The report noted that: "U.S. intelligence, surveillance, and reconnaissance capabilities provided unprecedented levels of support to NATO warfighters. The supporting intelligence architecture included a worldwide network of processing centers and high-speed data communications, all operating in direct support of combat operations in Kosovo. " Those observations were true, but they appeared without qualifications concerning the limitations of technologies.

The intelligence section of the report recognized that precision munitions require precision intelligence and cited obstacles intelligence collection such as "adverse weather, nighttime, concealment and deception techniques, or rapid movement," but suggested that these difficulties would succumb to the "modernization path." Defense procurement programs would generate an improved "sensor mix" that when combined with processes such as

"dynamic collection management, common battlespace awareness, and interoperable intelligence systems and architectures" would "improve precision intelligence capability." The Department decided to "focus on specific technical enhancements in response to Kosovo."[126] The engineering approach to war was actually strengthened by its failures.

As the Department of Defense released its report on Kosovo, the Joint Staff was working on Joint Vision 2020 (JV2020). The extension of the vision another ten years gave technology more time to deliver on the capabilities that Kosovo drew into question.[127] The experience of Kosovo did, however, generate caveats in JV2020. JV2020 warned that "we should not expect war in the future to be either easy or bloodless" and stated that "friction is inherent in military operations" and derives from the following factors:

- effects of danger and exertion
- existence of uncertainty, and chance
- unpredictable actions of other actors;
- frailties of machines and information
- humans

Additionally, JV2020 asked readers to "remember that information superiority neither equates to perfect information, nor does it mean the elimination of the fog of war." These cautions appeared disconnected with other portions of the document, however, that highlighted the "information revolution" and the "profound changes" that it would create in the conduct of military operations.[128] Although JV2020 attempted to administer a corrective to the assumption that near-certainty would be the dominant characteristic of future war, caveats could not overcome the momentum behind the belief that technology would lift the fog of war.[129]

As the Joint Staff prepared a revised Joint Vision document in July 2002, it based the effort on the following assumption: "Dramatic improvements in intelligence collection, analysis and dissemination capabilities will facilitate near-continuous surveillance of the battlespace. Analysis of this continuous information flow will produce the type of current and predictive intelligence that enables the US Armed Forces to achieve full spectrum dominance." The qualifiers and warnings of JV2020 disappeared. The words fog and friction were absent from the revision and the word uncertainty appeared only in connection with the future strategic environment.[130] Flawed assumptions about future war overcame the reality of Kosovo.

MAN'S NATURAL ELEMENT

> Ground is man's natural element, and an infinitely complex one. War on land differs in three fundamental respects from war and sea, in the air or in space. War in the fluid media is ultimately concerned with the possession or control of ground…On land man can choose his degree of dependence on machines; in the fluid media, he cannot live or move without them. The fluid media are either uniform, or have an unchanged gradation of properties, except where they adjoin land…
>
> —Richard E. Simpkin

While the Department of Defense called for more and better technologies in pursuit of dominant knowledge, the Army learned a different lesson from Kosovo. In 1999, a new Army Chief of Staff determined to reform Army organization based, in part, on the experience of Task Force Hawk, the only significant Army participation in Operation Allied Force. Task Force Hawk centered on twenty-four Apache Helicopters that were to conduct deep strikes against Serbian Army units in Kosovo. The task force grew from a planned deployment of 1,700 soldiers to approximately 6,000 soldiers including an infantry battalion task force of forty-two Bradley Fighting Vehicles and twelve M1A1 tanks, twenty-four Multiple Launch Rocket Systems, and a large headquarters of twenty-five expandable vans mounted on 5-ton trucks. It took five hundred fifteen C-17 sorties to transport the unit. To make matters worse, the force deployed into and operated from a small Albanian airfield surrounded by mud and standing water shared by twelve other NATO units and multi-national organizations. The Army brought in massive amounts of crushed rock and had to build helicopter-landing pads. Still, the airfield ramp became a clutter of munitions, repair parts, humanitarian supplies, vehicles and equipment. Although Task Force Hawk met its deployment schedule, it arrived later than many expected, including General Wesley Clark, the Supreme Allied Commander, Europe. The image of soldiers wading through the mud focused attention on Army organization and seemed a metaphor for what needed to change in the Army; it needed to be faster and lighter. When two Apache pilots died in a training accident, many believed that the unit was not prepared to operate at night in the demanding mountainous environment; any remaining interest in using Task Force Hawk waned and the unit was never employed.[131] It was a profound embarrassment for the Army.

The Army was behind in organizational change and suffering from a degradation in readiness and morale. General Shinseki resolved to make immediate and substantial changes. It had been clear to many officers for years that the heavy force was powerful and possessed operational mobility, but was difficult to deploy, and dependent on a large logistical

infrastructure. The Army's airborne and light infantry units possessed strategic mobility, but suffered from a lack of mobility, firepower, and protection once they arrived in a theater of operations. The Army discontinued its Force XXI program and shifted efforts to two initiatives: the Interim Brigade Combat Team (IBCT) and the Objective Force. The IBCT was to fill the short-term need for a strategically mobile force that possessed greater mobility and firepower than a light unit. The Objective Force had its roots in an earlier Army After Next initiative, a research and development effort to determine the optimal Army organization for 2020 and beyond. Between 1999 and 2003, General Shinseki defeated efforts to obstruct the formation of the IBCT, renamed the Stryker Brigade Combat Team (SBCT), and the Army began fielding the first three of six of these units in record time. In 2002, the Army moved up dramatically the target fielding date of the first Objective Force Unit of Action (UA) from 2015 to 2008, cancelled many programs, and shifted funds to research and development.[132]

Both the Stryker Brigade and Objective Force hold promise to enhance Army capabilities, but the Army's uncritical acceptance of the assumption of near-certainty in future war is undermining both initiatives. Army experimentation in the mid to late 1990's had convinced many that "information dominance" provided the solution to the problem of future war.[133] Similar to the Joint, Navy, and Air Force transformation efforts, the belief that technology will lift the fog of war has corrupted the doctrinal basis for the Stryker Brigade's employment and the Objective Force's development. Unless the Army abandons its flawed vision of future combat, that vision could result in the employment of the Stryker Brigade in combat situations for which it is ill suited and create severe vulnerabilities in the Objective Force such that it is unable to fight successfully except under optimal conditions.

The Stryker Brigade's tactical doctrine is based on the assumption that the brigade's "integrated suite of intelligence reconnaissance and surveillance capabilities and digitized battle command systems" will permit the force to achieve "situational understanding and information superiority." The brigade will thus be able to "avoid surprise, develop rapid decisions, control the time and place for combat, conduct precision maneuver, shape the battlespace with precision fires and effects, and achieve decisive outcomes." Adopting the assumption of near-certainty in future war permitted the Stryker Brigade to achieve greater lightness while assuming virtually the same fighting capability of the mechanized force. In theory, information would compensate for limitations such as: light armor protection, no stabilized weapons to fire while moving, no fire control system tied to thermal sights to shoot weapons accurately at night, and a main armament of machine guns and grenade launchers instead of more powerful weapons like the 25 millimeter chain gun.[134]

Despite the clear limitations of the technologies that are supposed to deliver it, the assumption of near certainty in future war has migrated to the present and has shaped current Army tactical doctrine. In the past, the Army anticipated having to fight for information because much of the situation remains uncertain until first contact due to enemy efforts to avoid detection and the human dimension of war. The Serbians employed countermeasures such as deception, camouflage, concealment, and intermingling with the civilian population. Important elements of information lie squarely in the human and psychological dimensions and are impossible to know until a ground maneuver formation closes with the enemy include: How will the enemy react? Will he use chemical munitions? How will he employ his reserve? What were the effects of bombing and artillery? Will he retreat or mount a resolute defense? How skilled is he? The first unit to fight always benefited from intelligence before contact with the enemy, but soldiers and commanders expected the unexpected. The Army relied on reconnaissance units that were prepared to fight to gain the part of the intelligence picture that remained concealed because of the limits of surveillance technology, enemy countermeasures, and the moral dimension of war. To fortify units for these encounter actions, the Army provided them with firepower, armor protection, and mobility. The Army also decentralized combined arms (e.g. engineers, infantry, armor, artillery, and aviation) capabilities to these units so they were capable of taking independent action. The all arms capability forced the enemy to deal with multiple threats simultaneously and allowed U.S. commanders to exploit opportunities and protect against dangers. Because battles of attrition tend to cause high casualties on both sides, emphasis was on maneuver and bold action to seize and retain the initiative. The Army sought temporal and psychological as well as physical advantages over the enemy.[135]

According to the Army's capstone doctrinal manual, soldiers and units will now have near-perfect intelligence prior to contact with the enemy:

> The Army must also gain information superiority. This means the operational advantage derived from the ability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an enemy's capability to do the same…. Unmanned systems with artificial intelligence will augment human action and decision making through improved situational understanding…. The extensive information available to Army leaders will also allow unprecedented awareness of every aspect of future operations. Precise knowledge of the enemy and friendly situations will facilitate exact tailoring of units for mission requirements; tactical employment of precision fires; exploitative, decisive maneuver at extended ranges; and responsive, flexible support of those forces. Although knowledge will never be perfect, improved command and control systems will enable leaders to know far more than ever before about the nature of activities in their battlespace. They will have access to highly accurate information regarding enemy and friendly locations, the civil

> population, terrain, and weather…. The common operational picture provided through integration of real-time intelligence and accurate targeting reduces the need to fill space with forces and direct fire weapons. Agile forces can also improve the capacity of commanders to employ combat power with precision to achieve a desired outcome. The goal of future Army operations will be to simultaneously attack critical targets throughout the area of operations by rapid maneuver and precision fires to break the adversary's will and compel him to surrender. The cumulative effect of simultaneous shaping operations and nearly simultaneous decisive operations will be to reduce an adversary's ability to synchronize his effort and will establish the military conditions for friendly victory—decisive victory.[136]

The assumption of near perfect intelligence allows the army to declare the Stryker Brigade to be considered "optimized for combat in complex and urban terrain" even though these types of terrain are most resistant to sensors and provide the enemy with the best opportunities for concealment, deception, and surprise. The Army assumes, however, that the SBCT will be able to "understand the situation" such that it will encounter the enemy only at the times and places of its own choosing.[137]

The Army is also designing the Objective Force based on the assumption of near certainty delivered by the "Global Information Grid" and a large number of unmanned air and ground sensors. The Objective Force's combat formation, the Unit of Action (UA), is intended to be a "system of systems" that is "empowered by dominant situational understanding resident in a vibrant knowledge network." In contrast to the Army's former emphasis on reconnaissance units capable of fighting, a "hallmark" of UA operations "will be the significant ability to develop situations out of contact." The UA will then "maneuver to positions of advantage with speed and agility, engage enemy beyond the range of their weapons systems, destroying them with enhanced fires, and assaulting ***at times and places of our choosing***." The Objective Force assumes that the technology will be available to deliver this high degree of clarity and that it will maintain that high fidelity of information throughout a campaign. It also assumes that joint fires, such as those applied against Serbian forces in Kosovo for seventy-eight days, will be successful "prior to forces being joined." Indeed, small UA units will be able to operate widely separated because these same fires will "shield" them from significant enemy threats. The UA organizational design is based on the assumption that it "will have situational understanding through all phases of the battle from alert to redeployment." A mathematical formula serves as the basis for organizational design: the sum of maneuver plus firepower plus protection multiplied by leadership, then raised to the power of information.[138] Power is dependent on near-perfect information. The Objective Force will be ineffective under conditions of uncertainty.

The Unit of Action offers a doctrinal remedy for its organizational weaknesses. That doctrine, however, based as it is on the same assumption of near-certainty in future war, is also fundamentally flawed. The Unit of Action will fight "unlike any other tactical force" because it will fight only when it chooses and only when the enemy is "most vulnerable." Certainty in combat will allow the Objective Force to achieve a so-called "Quality of Firsts" such that the UA will "see first, understand first, act first, and finish decisively." The UA offers a clean break with even the most recent experiences in land warfare in Afghanistan and Operation Iraqi Freedom:

> Historically, uncertainty about enemy and friendly conditions on the battlefield often dictated cautious movements to contact….UA capabilities break this paradigm permitting future commanders to develop the situation before making contact, maneuver to positions of advantage largely out of contact, and, when ready initiate decisive action by destroying enemy systems beyond the range of their weapons to set conditions for decisive assault.

If a unit is capable of tactical overmatch, movements to contact need not be cautious, because the force is confident operating under conditions of certainty. The UA, however, must exercise caution to survive as it is designed only to operate when the situation is clear. Indeed, the Unit of Action doctrine acknowledges that it will only engage in what it knows in advance to be "profitable fights" in which it has "the best tactical advantage." The "empowerment" of "information dominance" is supposed to make land combat efficient, less dangerous, and certain in outcome.[139] It will also make it more cautious, deliberate, and highly selective.

Because many believe that certainty will be the dominant condition of future war, "knowledge" is overtaking fighting as the primary basis for Army doctrine and organization. A section of the Army Transformation Roadmap entitled "Leveraging Information Technology and Innovative Concepts to Develop an Interoperable, Joint C4ISR Architecture and Capability that Includes a Tailorable Joint Operational Picture," announces that in combat, no maxim is truer than "knowledge is power." The anticipated knowledge will come mainly from "a seamlessly interoperable Joint C4ISR architecture, with the necessary space-based and terrestrial infrastructure."[140] Because knowledge is power, it simplifies war and eliminates traditional tradeoffs between combat power and strategic mobility. Because units no longer have to hedge against uncertainty, "harnessing the power of information will enable the Objective Force units to increase their lethality, precision, and survivability even while dramatically reducing their mass and footprint."[141]

The primary difficulty with the Army's SBCT and Objective Force initiatives is that they are both advancing based on wishful thinking rather than analysis. There is no evidence that

land forces will achieve anything like the level of knowledge assumed in the "Quality of Firsts." A recent RAND study that assumed perfect functioning of all emerging technologies in the year 2020 concluded that it would "be difficult if not impossible" to detect army forces that used "cover concealment, deception, intermingling, and dispersion." The study also found that the UA's air and ground sensors would only achieve dominant knowledge against an enemy in the open and that the precision fires on which the Objective Force depends would "provide attrition" but be insufficient to accomplish typical tactical missions.[142]

It is as if the Army forgot that it operated on land and adopted wholesale the Air Force's and Navy's visions of future war. As Williamson Murray and Richard Sinnreich observed, "war on land is imbedded in and to a large extent driven by the ground itself, an extraordinarily disorderly environment in which the obstacles to knowledge, movement, and communications multiply friction, and in which, therefore, progress is slow, direction and momentum are difficult to sustain, the risk of surprise is omnipresent, and command and control are inherently fragile."[143] Aside from fictional accounts of one-sided Unit of Action victories, interaction with the enemy and the unique challenges of the land environment are absent from the doctrine as the UA "acts first" then "finishes decisively by controlling the tempo of operations, denying the enemy freedom of action, and destroying the enemy's ability to fight."[144]

The assumption of near certainty in future war is depraving the Objective Force of its good intentions and undermining the effort. It is true that information, surveillance, and communications technology will help to produce invaluable awareness about the disposition and actions of ones own force, achieve a higher speed of action, integrate the efforts of Army units with the Joint Force, and generate valuable, albeit incomplete information about the enemy. The expectation that the enemy situation will be clear prior to contact and the associated unpreparedness to fight for the complete picture, however, will prevent the force from taking full advantage of vast improvements in command and control as well as joint interoperability. The enhanced strategic, operational, and tactical mobility of the force could prove irrelevant if the force lacks firepower and protection to defeat an enemy in complex terrain under uncertain conditions such as those encountered most recently in urban terrain in Iraq. The promising concept of distributed operations (under which Army formations arrive at various points in a theater of operations to conduct fast, simultaneous attacks) could generate multiple "Little Big Horns" if forces are unable to overmatch determined enemy attacks after the UA's arrival. Appropriate emphasis on teaching Objective Force leaders to be bold, aggressive and seize the initiative through surprise and speed will be for naught as leaders are compelled to wait for near-perfect intelligence as a pre-condition for operations. Decentralized combined arms

capabilities provide tremendous potential to increase unit effectiveness, but weaknesses built into the force based on the assumption of near-perfect intelligence limit even those possibilities. Those limitations include inadequate protection to close aggressively with the enemy and a lack of integrated engineers to provide mobility support if mines and other obstacles go undetected. A reliance on long range fires at higher levels of command contradicts the doctrinal emphasis on decentralization, makes the force dependent on support from remote headquarters, and limits the force's freedom of action. Finally, the baseless assumption of certainty in future war risks the creation of an unrealistic picture of American "dominance" in efficient, relatively bloodless campaigns. When the actual experience of battle appears in stark contrast with that idealized vision of combat, it could generate fear and even paralysis. It is fortunate that soldiers today still train under conditions that aim to replicate the uncertainty of ground combat because the fighting in Afghanistan from 2001-2003 and in Iraq in March-April 2003 bore little resemblance to the battleground of the future on which the Objective Force is being designed to fight.

Until analysts began to assess the evidence concerning military operations during Operation Enduring Freedom, many observers viewed combat in Afghanistan as a demonstration of an American "way of war" that these observers had envisioned since the end of the 1991 Gulf War. The RMA technologies of sensors and precision munitions seemed decisive.[145] Some ignored completely the role that a large Northern Alliance army played in the fight to defeat the Taliban. Others acknowledged the role of the Northern Alliance and suggested the possibility of applying an "Afghan Model" to future war; the United States would provide air and sea-based firepower to indigenous forces. Some suggested that the "Afghan model" applied to Iraq could win that war cheaply and quickly. The course of Iraqi Freedom once again revealed the tremendous capability associated with Special Operations Forces and precision strike assets. It also exposed the folly of relying on that capability to deliver cheap, rapid victory without a balanced joint force.

Dr. Stephen Biddle, who had ten years earlier warned about learning the wrong lessons from the Gulf War, corrected simplistic explanations for victory in Afghanistan. It is difficult to improve on his analysis:

> The Afghan campaign was actually far less different or unusual than most now suppose: it was a surprisingly orthodox air-ground theater campaign in which heavy fire support decided a contest between two land forces. Of course, some elements were quite new: the fire support came almost exclusively from the air; the air strikes were directed mostly by commandos whose methods, equipment, and centrality to the outcome were unprecedented; and the ground armies were mostly not countrymen of the

> commandos and air forces who provided the firepower. In an important sense, though, the differences were less salient than the continuities: the key to success in Afghanistan as in traditional joint warfare was the close interaction of fire and maneuver, neither of which was sufficient alone and neither of which could succeed without significant ground forces trained and equipped at least as well as their opponents.[146]

Northern Alliance battles as well as those fought later with mainly American ground forces provided opportunities to evaluate the degree of certainty achieved in combat.

Biddle's study revealed that the outcome of these battles depended on factors beyond the influence of sensors and precision munitions. Geography was a critical factor in that the complexity of the terrain as well as the intermingling of Al Qaeda forces with civilians foiled attempts to kill or capture the enemy. Surveillance of the difficult terrain at Tora Bora, for example, could not compensate for the lack of ground forces to cover exfilteration routes. After a sixteen-day battle, many Al Qaeda forces, probably including Osama bin Laden, escaped across the Pakistan border. Deception might have contributed as well; Bin Laden's bodyguards used his cell phone transmissions to misdirect the manhunt aimed at capturing the Al Qaeda leader.[147]

Advantages in the human dimension of war proved more important than American military technology in generating tactical victories against the Taliban. Despite descriptions of U.S. Special Forces as "sensors," personal relationships between U.S. soldiers and faction leaders were more important than hitting targets with precision munitions.[148] It was Special Forces soldiers' interaction with leaders such as Rashid Dostrum and Hamad Karzai that proved most critical to success. The Special Forces and the firepower they accessed bolstered confidence in Northern Alliance leaders and galvanized into action forces that were otherwise predisposed toward inaction or retreat. When the tide turned it was due more to political and psychological effects than the physical impact of precision bombs. Overhead imagery was critical, especially during engagements, but the most valuable information came from human intelligence. Captain Jason Amerine who led the team assigned to Karzai's forces recalled that "the biggest tool in [Ahmed Karzai's] intelligence network was the [satellite] telephone…. He was able to get word right away of anything going on...."[149]

Even with intelligence from satellites and cellphones, tactical actions between the Special Forces-supported Northern Alliance militia and forces sympathetic to the Taliban remained profoundly uncertain; the outcome of battles often hinged on psychological factors impossible to predict. Special Forces teams sometimes recognized clear opportunities for victory only to see those opportunities slip away because Northern Alliance fighters perceived

imminent defeat. Uncertainty spiked when the pro-Taliban occupied towns. CPT Amerine recalled one particular action: "I don't know how many guys were in the town. I don't. We'll just say somewhere between 30 and 50 guys were in town. They're opening up on my guys, and my guys start to withdraw. It was pretty withering fire. I had aircraft overhead the whole time, but I didn't want to bomb the town."

The friction inherent in combat also added difficulty and unpredictability, an example of which was the submission of faulty coordinates that resulted in the delivery of a 500 pound bomb on a friendly position, killing and wounding Americans and allied fighters.[150]

The "interaction" with the enemy increased the degree of uncertainty as the enemy adapted to U.S. capabilities. It was clear to those fighting in Afghanistan that Taliban forces were learning how to defeat American surveillance capabilities. Early Taliban positions were exposed and often silhouetted. By December 2001 the enemy began to employ extensive camouflage, concealment, and deception. Counterattacking forces used terrain to close within two hundred meters of Northern Alliance forces before they were detected. Enemy hid in culverts and burned out vehicles. They began to recognize the advantages of hiding among the civilian populace. On December 2-4 at Sayed Slim Kalay, enemy positions were not identified until Northern Alliance forces came under small arms fire.[151]

Even when enemy concentrations were identified, complex terrain and the cover of fortified positions frustrated attempts to predict the effects of bombing and made ground attack the only option to defeat the enemy. At Keshendeh-ye Pa'in, for example, two days of bombing was not enough to prevent the enemy from halting a ground advance. At the Qala-i-Gangi fortress, despite air attacks involving multiple AC-130 ammunition loads and seventy-two thousand-pound GPS-guided bombs, the defenders survived and resisted. From an American perspective, continued resistance was surprising. It took fighting the enemy in the close fight to determine his skill as well as determination to continue resisting. US forces learned that native Afghan Taliban had low morale, were oftentimes not resolute in defense, and tended to quit the field of battle when faced with significant air and ground combat power. Foreign al Qaeda fighters proved very determined and many threatened to kill Afghan Taliban who refused to fight. Discovering that qualitative difference as well as disparities in enemy training level and skill was only possible when engaged in close combat.[152]

Perhaps the most direct test of technology's ability to lift the fog of war would come during Operation Anaconda in March 2002. US intelligence detected another concentration of Taliban forces in the Shah-i-Kot valley. US commanders deliberately planned an attack that

would include two American infantry battalions reinforced with Aghan and other allied troops. It would be the largest combat operation of the war in Afghanistan.

Intelligence preparation for the operation spanned two weeks. The US focused every available surveillance and target acquisition capability including satellite imagery, unmanned aerial vehicles, and communications and signal intelligence assets on the ten by ten-kilometer box that defined the battleground. Every landing zone for the aerial insertions received the attention of four unmanned aerial vehicle overflights.

Enemy countermeasures to US sensors were effective and the fight during Operation Anaconda was characterized by a very high degree of uncertainty. On March 2, infantry air assaulted almost directly on top of undetected enemy positions. Soldiers came under immediate fire from small arms, mortars, rocket propelled grenades, and machineguns as their helicopters landed. Battalion and brigade command posts were pinned down and commanders fought alongside their men. Apache helicopters responding to provide direct fire support were hit and rendered inoperable. The planned second lift of soldiers had to be cancelled. Some units were pinned down by enemy fire during the first night of the battle and through the next day; they, including many of the wounded, could not be extracted until the following night. The unit had deployed with no artillery under the assumption that surveillance combined with precision fires from the air would be adequate. Even the most precise bombs proved ineffective against small, elusive groups of enemy infantry so soldiers relied heavily on small mortars. As the fight developed over the next ten days, it became apparent that over half of the enemy positions and at least three hundred fifty al Qaeda fighters had gone undetected. The enemy's reaction to the attack was also unexpected. American commanders had expected al Qaeda forces to withdraw upon contact with the superior allied force rather than defend as they did from fortified positions. As Sergeant Major Frank Grippe observed with a considerable degree of understatement, "The picture the intel painted was just a little bit different than the actual events happening on the ground by numbers of al Qaeda and the type of position they had set up and so forth."[153]

A combination of small unit skill, soldier initiative, and determined leadership permitted American forces to shake off the effects of tactical surprise, defeat al Qaeda attacks on the landing zones, then mount an offensive. Their ability to reduce the enemy positions depended heavily on Special-Forces directed precision air power, but especially the integration of air power with ground maneuver. The battle that ensued demonstrated clearly the tremendous capability of precision strikes, but also revealed some of its limitations. American aircraft heavily

bombed al Qaeda positions on Objective Ginger for over one week, but the enemy was still able to fire on infantry as the Americans closed on their positions.[154]

The experience of Operation Anaconda revealed that geography, when combined with an enemy's determination to avoid detection creates a high degree of uncertainty in battle. Al Qaeda applied countermeasures to surveillance and precision munitions capabilities learned during previous engagements. As Stephen Biddle concluded:

> How could such things happen in an era of persistent reconnaissance drones, airborne radars, satellite surveillance, thermal imaging, and hypersensitive electronic eavesdropping equipment? The answer is that the earth 's surface remains an extremely complex environment with an abundance of natural and manmade cover and concealment available for those militaries capable of exploiting it.

The experience of Operation Anaconda revealed the dangers of failing to take into account the "interaction" with the enemy and considering potential countermeasures to American technological capabilities. The course of the battle also demonstrated how friction encountered after initial contact with the enemy generated even greater uncertainty. The cancellation of subsequent lifts and other decisions such as the forced withdrawal of attack helicopters reveal that the future course of events depends not only on what one side plans to do, but upon enemy reactions and initiatives that are impossible to predict at the outset. Anaconda exposed the Army's "Doctrine of Firsts" as unrealistic. Despite the experience of Anaconda, the belief in the certainty of future war persisted even as America's military prepared for an attack into Iraq under conditions of profound uncertainty.[155]

FIRST THE VERDICT, THEN THE TRIAL!

> For after all allowances have been made for historical differences, wars still resemble each other more than they resemble any other human activity.
>
> —Sir Michael Howard

War is the final auditor of military institutions. In theory, contemporary conflicts such as those in Afghanistan and Iraq provide opportunities for military innovation because of a high sense of urgency and opportunity for feedback based on actual experience.[156] Analysis of the present combined with an understanding of history should permit a grounded projection into the near future and allow the strategist to meet what Sir Michael Howard identified as the challenge to: "steer between the danger of repeating the errors of the past because he is ignorant that

they have been made, and the danger of remaining bound by theories deduced from past history although changes in conditions have rendered these theories obsolete."[157] The record of recent years is not encouraging, however, as a flawed vision of future war developed and grew despite contemporary experiences that ran directly counter to that vision.

An element of classical hubris is man's belief that he has broken free from history. Many advocates of certainty in war disregard history because they believe that technology has generated unprecedented change; others misuse history to support their conception of change in warfare as linear and spurred almost exclusively by technology.[158] What is particularly surprising, however, is the neglect of recent wartime experience. Answers to questions that bore directly on the development of military plans and strategy for Operation Iraqi Freedom lay well outside the reach of sensors and computers. Those questions included: Will Iraq use biological or chemical weapons? Will military leaders obey Saddam if he orders them to employ those weapons? What will be the effects of those weapons? Will Iraq target civilians or strike Israel or Kuwait? Will Iraqi forces blow the bridges over the Euphrates River? How resolutely will the Iraqi Army defend? What are the combat potentials of different Iraqi units? Will the people of Baghdad welcome attacking U.S. forces? Will Saddam's Army defend forward or organize a defense nearer the center of Baghdad? How capable will our units be in urban operations? Will they set oil wells on fire as part of a larger scorched earth strategy? Will Saddam create a refugee crisis? Will Iraqi factions fight each other? How will each of the Kurdish factions react in the north? What will be Iran's reaction and what will be the actions of the Iranian-supported forces that had already entered eastern Iraq? Questions concerning a transition to military government and constabulary duty in post-conflict Iraq were fraught with even greater uncertainty. The best sensors or information technologies could not answer those questions and each bore directly on the conduct of operations. The United States and its allies devised a strategy for and fought under conditions of profound uncertainty, modifying the plan dramatically from the very beginning of hostilities.

Two factors obstruct the abandonment of the assumption of near-certainty in future war. First, some consider business, finance, and economic analogies more relevant to understanding future war than war itself. Second, there is a tendency to place unwarranted confidence in the fidelity of computer simulations that fail to replicate the conditions of war. Faulty analogies and flawed experiments are mutually reinforcing; the experiments promote the assumption of near-certainty in war and that assumption makes war appear comparable to business practices and the economy.

The military and business routinely share ideas and lessons in the areas of management and leadership. The military has clearly benefited from that relationship. Large portions of the military resemble business and require management efforts similar or identical to those in business. Specific military functions that benefit clearly from proven and emerging business management techniques include finance, budget, comptroller and accounting functions; transportation and supply management; and information management. More general lessons also apply such as WalMart's methods for assessing competition and remaining adaptive to the market. Lockheed-Martin's effort to forge a unifying culture and achieve efficiencies among its many sub-entities seems particularly relevant to joint integration. The military has applied and sometimes misapplied the latest management techniques such as Total Quality Management to improve operations.[159] Problems arise when managerial practices and business principles influence military strategy, operations, or organization without sensitivity to the unique features and demands of war.

Uncertainty in war makes business and war incompatible and limits the utility of analogies between military conflict and the economy. Whereas military organizations must cope with inherent unpredictability, businesses rely on control and efficiency. Business fears the unpredictable and management emphasizes objective and quantifiable considerations rather than an embrace of the subjective and unpredictable.[160]

The uncertainties of war (such as the unanswered questions prior to Operation Iraqi Freedom) make precise calculation and control impossible. Interactions with the enemy and uncertainties associated with those interactions are fundamentally different from business interactions with either markets or competitors. Moreover, war cannot be prosecuted to business standards of efficiency because barely winning in war is an ugly proposition. In war one seeks to overwhelm the enemy such that he is unable to take effective action; the business principle of maximum payoff for minimum investment does not apply. Business relies on projections to gauge demand, control production, and manage supply chains. The human and psychological dimensions of war often make projecting demand for needs such as fire support or logistical supplies impossible to make with any degree of specificity. Consider, for example, an attack during which an enemy who was expected to offer stiff resistance collapses suddenly. If the means to exploit that transitory advantage, such as fuel, are not immediately at hand, forces may miss a fleeting opportunity. Unanticipated enemy actions, such as the interdiction of air or ground supply lines and weather, such as sandstorms that limit air and ground resupply operations, militate for decentralization of assets even if such an organization seems inefficient in peacetime. Business practices such as centralization of logistical assets and concepts such

as just-in-time delivery, velocity management, and supply chain management are potentially disastrous if applied to the military without consideration of war's unique nature. In general, the complexity and uncertainty of war requires decentralization and a certain degree of redundancy, concepts that cut against business' emphasis on control and efficiency. The assumption that future war will lie mainly in the realm of certainty obscures differences between business and war fosters the belief that the influence of information technology on business and the economy is directly transferable to war.

In the late 1990s, a new concept called network-centric warfare formalized analogies between war and business. In a 1998 book that advanced the concept, David Alberts, John Gartska, and Frederick Stein indicated that network-centric warfare depended on a high performance information grid that "translates information into combat power by effectively linking knowledgeable entities in the battlespace."[161] In an article that appeared in The Naval Institute's *Proceedings* during that same year, Vice Admiral Cebrowski and Mr. Gartska asserted that:" Network centric operations deliver to the US military the same powerful dynamics as they produced in American business. At the strategic level the critical element for both is a detailed understanding of the appropriate competitive space – all elements of the battlespace and battletime."[162]

While the authors of *Network Centric Warfare* stated that they saw the "lessons learned in the commercial sector not as gospel to be blindly followed, but as inputs to our concepts, development, and experimentation processes," they asserted that "the basic dynamics of the value-creation process are domain independent." They went on to apply their analogies without consideration for the unique dynamics of war.[163] For example, the authors suggested a direct application of Metcalf's Law – the idea that as the number of nodes in a network increases linearly, the effectiveness of that network "increases exponentially as the square number of nodes in the network." Based on that "law," the network promised to deliver a "superior information position." The authors argued that the military and business shared interest in gaining access to an "information grid". As a "sensor grid" generates "competitive space awareness" for business, it would generate "battlespace awareness" for the military. As network centric businesses use "transaction grids" to translate high levels of awareness into specific actions such as shipping orders, increasing production, and ordering parts, the network centric military would use "engagement grids" to target and strike enemy assets.[164] They assumed that an increase in access to relevant, accurate, and timely information would have the same effect on war as it did on business. The military could become more efficient, smaller and faster.

Network-centric advocates also believed that changes in the economy of the mid-to-late 1990s permitted similar changes in warfare – changes that could be engineered with information technology. Under the old economy, they argued, growth and profits were limited by competition with companies who produced comparable goods and services. Businesses, therefore, could not "lock in" market share and efforts to do so resulted in decreasing returns on investment. With information superiority, however, companies could generate extraordinary wealth and increasing returns on investment. Information permitted companies to "lock in" success and eliminate the constraints of market share equilibrium and competition. With information superiority in war and investment in the right technologies, it was argued that the U.S. military would achieve speed and precision to "lock out" enemy strategies and "lock in" success.[165] To some, the information revolution in business provided nothing less than the answer to future war.

The concept of "lock out" assumed near-perfect intelligence. By connecting its information, sensor, and transaction grids, the military would achieve the same degree of visibility on the enemy that WalMart enjoyed on inventories and sales.[166] Speed of action coupled with certain knowledge was the guarantor of victory. Admiral Cebrowski and Mr. Garstka depicted "old" warfare as attrition based; network-centric warfare would be cleaner, more humanitarian, and bring rapid victory. Under the old style of warfare, "reversals are possible, and frequently the outcome is in doubt," but network centric warfare appeared as "analogous to the new economic model, with potentially increasing returns on investment."[167] The rapid growth of the information technology sector of the economy added arrogance to ignorance as an impediment to correcting the increasingly flawed vision of future war.

The economic bubble of the late 1990s increased enthusiasm for the concept of network-centric warfare. Futurists Alvin and Heidi Toffler argued that changes in warfare would parallel changes in the "information age" economy. Some of the Tofflers' ideas have proven generally correct such as the ability to use intelligence to strike targets with greater precision and less destructive power; the ability to employ smaller organizations over wider areas than in the past, and the integration of systems to achieve increased efficiency and speed of action.[168] Advocates of network-centric warfare, however, emboldened by the booming economy, displayed irrational exuberance in connection with the degree of certainty that information technology could provide in war. The authors of *Network Centric Warfare* and others took inspiration from "profound changes in the nature of our world" including the possibility for dot-com executives to "become billionaires in periods measured in months."[169] They built upon the Tofflers' ideas and suggested that the prosperity of the late 1990s signaled the advances that

were possible in the conduct of war. It was against this backdrop in 1998, that the Secretary of Defense gave Joint Forces Command the mission to develop and test concepts for future war based on Joint Vision 2010. Joint Forces Command turned over a large portion of that work over to contractors.

A team comprised mainly of contractors used JV2010 as the basis for their efforts. They viewed the possibilities associated with information technology as the basis for new operational concepts. That vision of future war took shape under two complementary concepts: Rapid Decisive Operations (RDO) and Effects-Based Operations (EBO). Their names were inherently persuasive; criticism might be misconstrued as advocacy for "Ponderous Indecisive Operations" or "Randomly Generated Violence." Even beyond the names, the concepts had much to recommend them. The time it took to deploy forces to Southwest Asia and prepare for the 2003 invasion of Iraq supported RDO's call for forces capable of moving across strategic distances and transitioning immediately into combat. The need for concurrent, geographically dispersed actions at the outset of the war to secure the Kurdish population in Northern Iraq, control bridges across the Euphrates River, occupy oil fields in Northern and Southern Iraq, open ports in Southern Iraq, and prevent Iraq from firing missiles from the Western desert demonstrated the need for forces capable of conducting the simultaneous and distributed operations, called for in RDO. Concepts concerning speed of action and decision relative to the enemy (tempo and decision superiority) and improvements in interagency coordination to ensure mutually reinforcing efforts (an element of EBO) are also promising.[170] The persistent belief in near-certainty in future war, however, elevated anticipated capabilities of information technologies to the level of strategy, encouraged linear thinking, and undermined the positive features of the new concepts.

The concept of effects-based operations assumed near certainty in future war; it treated the enemy as a "system" that could be fully understood through a process called "operational net assessment (ONA)." Because ONA would produce "a comprehensive system-of-systems understanding of the enemy and the environment," operations could achieve a high degree of speed as well as precision in operational effects. The enemy would be unable to keep pace with the "high rates of change" imposed on him. Similar to WalMart's use of information technology, the military's knowledge would lock out opponents' courses of action. Because ONA permits commanders to understand even second and third order effects, military operations (essentially precision attacks against enemy "nodes") progress linearly and rapidly toward victory. The enemy is unable to respond effectively and falls victim to "cumulative and

cascading effects."[171] It is assumed that because of near-perfect intelligence and knowledge of the enemy's reactions, actions necessary to achieve desired effects can be calculated with a great deal of precision and the application of force, therefore, can become very efficient and controlled. Under the concept of distributed operations, for example, it is assumed that commanders will have enough "knowledge" to "give distributed combat groups enough combat power to accomplish the required ends and survive the encounter."[172] Effects-based operations promise to influence enemy intentions and coerce the enemy before destructive power (or a large commitment of land forces) is necessary. Effects-based operations promise to bring "network-centric power to bear" with "coordinated sets of actions directed at shaping the behavior of friends, foes, and neutrals in peace, crisis, and war." EBO would seek to prevent wars or, if war became unavoidable, convince an adversary to desist from behavior contrary to United States interests. As Admiral Cebrowski and his assistant Dr. Thomas Barnett wrote in January 2003, "When 50% of something important to the enemy is destroyed at the outset, so is his strategy. That stops wars – which is what network centric warfare is all about."[173] It was this thinking that led some to believe that the "shock and awe" phase of Iraqi Freedom would lead to the regime's capitulation. During Operation Iraqi Freedom, however, coercive power seemed to come at least as much from ground forces advancing on the Iraqi capital as it did on the "shock and awe" strikes. Factors such as the desire to limit collateral damage and the hope of cajoling the Iraqis into surrendering complicated theoretical "calculations" of how much force to apply.

Confidence in predictability and rapid victory in war has generated interest in two other strategic concepts, "pressure" and "discriminate force." These concepts call for employing military force at low levels against critical nodes. While these ideas have met resistance, some within the Department of Defense and academia continue to argue for their adoption. In a November 2002 article, former U.S. Deputy Assistant Secretary of Defense Elizabeth Sherwood-Randall and former Israeli Deputy National Security Advisor Ariel Levite set forth perhaps the most comprehensive argument to appear for "discriminate force." The authors argued that a high degree of discrimination and control was now possible in war because of a "knowledge base that will enable aiming attacks at high-leverage targets, while avoiding irrelevant, politically sensitive, incorrectly identified, or illegitimate sites." The authors suggested that future military operations would emphasize "stand-off firepower over physical movement, software over hardware, and extensive deployment of light infantry as well as special forces over armored or mechanized forces."[174] Some commentators suggested that the opening actions of Iraqi Freedom were consistent with "discriminate force"[175] The strategy for the war, however, included forces to impose the coalition's will on the enemy and the Iraqis, as in 1991,

were incapable of challenging the initiative of U.S. and British joint forces. As the air war in Kosovo demonstrated in 1999, coercion could work if one's strategy includes the ability and the will to compel the enemy if coercion fails. As Operation Iraqi Freedom demonstrated in 2003, imposing one's will on the enemy requires a balanced joint force capable of operating under conditions of uncertainty and a strategy more sophisticated than a target list designed to achieve "shock and awe."

Simplistic strategic approaches to war that terms like discriminate force and pressure represent describe war as fast, efficient, controllable, and cost-effective. The approach was not really new. Those theories are not new. The belief in certainty in future war, in addition to influencing the intellectual foundation for defense transformation, had resurrected an old, failed strategy cloaked in a new lexicon.

Faith in American technological superiority, particularly in the information domain, has resurrected a belief, largely discredited during the Vietnam War, that military action can be calibrated and controlled with a great deal of precision to achieve strategic objectives. That belief combines faith in information technologies with old strategic bombing theories and the American tendency to view war as an engineering or business management problem that will succumb to systems analysis, reasoned judgment, and the application of superior technology. Elements of RDO, EBO and discriminate force replicate Secretary of Defense Robert McNamara's Vietnam strategy of graduated pressure as applied in Vietnam. Sherwood-Randall and Levite called for "capabilities and options for the highly discriminate, calibrated, and nuanced application of conventional military power" to effect the "cost/benefit calculations" of the enemy. With improvements in "intelligence and other situational awareness tools," war would become the application of "cutting edge air power." Because near-perfect intelligence would reduce the complexity and unpredictability of war, "organic armed formations" that possess "their own core components" would be "modified to meet the requirements of discriminate force."[176] Because discriminate force closely parallels features in the emerging Department of Defense orthodoxy concerning future war, the authors provided a glimpse of how the flawed intellectual foundation of Defense Transformation could create vulnerabilities in force structure and organization. Some advocates are unaware of past failures associated with this approach and believe that they have invented a new strategic concept. Others acknowledge previous failures, but do not recognize the reductionism of their vision; they blame previous failures only on immature technology.[177]

The emerging strategic concept for future war is nearly identical to the concept of "graduated pressure" that Secretary of Defense Robert McNamara and his principal

subordinates developed during the Vietnam War. McNamara believed that fundamental changes in the nature of war made traditional military advice based on the need to impose one's will on the enemy irrelevant and even dangerous to national security. Similar to aspects of "effects based operations" McNamara developed a strategy that would use military force not to destroy, but to signal resolve and intentions to the enemy. Measured application of power using mainly bombing against carefully-selected targets but also small commando raids were designed to effect Vietnamese Communist "calculation of interests" and convince them to desist from their support for the insurgency in South Vietnam. Because the United States was so much more powerful – "full spectrum dominant" in today's language –Vietnamese communist leaders would desist from supporting the insurgency in South Vietnam. Emphasis was on control to send precisely the right message and produce the desired effects. In March of 1964, McNamara predicted that his strategy would "turn the tide" in Vietnam in four to six months. As in Kosovo, there seemed to be reason for confidence. Like Serbia in 1999, North Vietnam in 1964 was no "peer competitor."

Fundamental flaws in the Vietnam War strategy of graduated pressure are replicated in emerging doctrinal concepts. McNamara and his principal assistants were oblivious to the human and psychological dimensions of war. From the U.S. perspective bombing and limited raids might have appeared as coercion and communication short of war. From the perspective of the enemy, however, those were acts of war. War unleashes a dynamic that defies systems analysis quantification; McNamara and the architects of graduated pressure greatly underestimated the resolve of the North Vietnamese leadership and the ability of Vietnamese communist forces to suffer losses and continue fighting. The linear thinking of McNamara and his advisors kept them from recognizing that the future course of events depended not only on U.S. action, but also on enemy reactions and initiatives that were difficult to predict. Ho Chi Minh's response, the infiltration of North Vietnamese Army divisions into South Vietnam impelled the commitment of U.S. troops, precisely the action that graduated pressure was designed to avoid.

The situation in Vietnam was too complex a problem for bombing to solve. The source of Vietnamese communist strength was political as well as military; The enemy strategy to avoid American and South Vietnamese strength and attack weakness combined with the geography of South Vietnam and the mainly agrarian economy of North Vietnam to render America's preferred method of fighting, the application of air power, unable to force a decision.[178]

A September 1964 Pentagon war game, SIGMA II, exposed the flaws in the concept of graduated pressure. The games tested the thesis that: "By applying limited, graduated military

actions, reinforced by political and economic pressures, against a nation providing external support for an insurgency, we could cause that nation to decide to reduce greatly, or eliminate altogether, its support for the insurgency. The objective of the attacks and pressures is not to destroy the nation's ability to provide support, but rather to affect its calculation of interests." The game was eerily prophetic. The hope that air power would be decisive was dashed as insurgents' low demand for supplies and the agrarian nature of North Vietnam's economy made the enemy resistant to bombing as a solution. Control of the situation passed to the enemy as the United States reacted to Vietnamese Communist initiatives and was forced to introduce large numbers of ground troops. Because of enemy resilience, measured and calculated application of force gave way to the destruction of all North Vietnamese targets and the mining of Haiphong Harbor.[179]

The SIGMA II war game had no effect on American policy or strategy in Vietnam. Growing momentum behind the concept of graduated pressure prevented learning from the war game. Even planners who were personally convinced that graduated pressure could only lead to defeat suppressed their opinions because their bosses did not want to hear those opinions. Others went along because it was expedient to do so; they believed that, over time, they could erode barriers to more resolute military action. Similarly, the growing orthodoxy of near-certainty in future war overwhelmed practical experience that exposed it as fallacy. For example, Dr. David Alberts of the Department of Defense, a computer scientist and businessman-turned-strategist who has authored and co-authored much of the burgeoning literature on network-centric and information age warfare stated that "NCW proofs of concept are beginning to accumulate and convince even some of the diehard skeptics…. Experiences in Bosnia, Kosovo, and Afghanistan have proved real-world laboratories where important learning and proofs of concept have occurred."[180] Imprecision in language compounds the misreading of contemporary experience. It is unclear, for example, what Dr. Alberts' meant by "network-centric proofs of concept."

In contrast to the SIGMA II test, joint experimentation failed to challenge the assumptions on which flawed concepts are based. Rather than expose flawed assumptions, joint experimentation has imparted those assumptions with false credibility derived from an appearance of impartiality associated with computer simulations. It is in this area of simulation that the military might learn a valuable lesson from business. The experience with joint experimentation is similar to the experiences of some companies during the information technology economic boom and the subsequent stock market crash of 2001.

Before the economic bubble of the late 1990s burst in 2001, there were indicators that businesses' expectations for continued growth were greatly inflated. The case of, CISCO, a computer network company, is particularly instructive. CISCO projected current growth linearly into the future similar to projections of America's military technological advantages into the future. CISCO persisted in those projections even as the market changed and every other company recognized the market slowdown. CISCO's faith in its network-centric method, however, blinded the company to market realities. Indeed, CISCO's "virtual close" software was designed to prevent earnings surprises. As one analyst concluded after CISCO's collapse: "I've come to realize how the use of computers – computer models to be precise – combined with hubris can lead to disaster…. While computers are wonderful tools for gathering and analyzing data, they cannot consistently and accurately predict the future of extremely complex systems…. This requires and, dare I say, always will require human judgment."[181] Like CISCO, the Department of Defense is ignoring the equivalent of the market – actual combat experience – in favor of computer simulations that reinforce flawed assumptions about the nature of future war.

Once Joint Vision 2010 identified information superiority as the foundation for defense transformation, the assumption of near-certainty in future war underpinned all concept development and experimentation efforts.[182] Because that assumption had the official sanction of the JCS Chairman and the Secretary of Defense, there was pressure to "validate" rather than scrutinize it. A close observer of joint experimentation remarked that the process reminded him of the Queen's declaration in *Alice in Wonderland*: "First the verdict, then the trial!"

Conflicts of interest present additional obstacles to effective experimentation. For example, J9 of Joint Forces Command has responsibility both for developing and testing future war concepts.[183] That conflict of interest appears similar to accounting firms such as Arthur Anderson having management consulting and auditing responsibilities. The continuous assertion of near-certainty in future war seems as obvious as false accounting at Worldcom and other companies, yet joint experimentation has failed to expose faults in visions of future war. Nine months after soldiers fought against undetected enemy in hot landing zones during Operation Anaconda, Joint Forces Command reported to Congress that recent experiments had affirmed that future joint operations would be "knowledge centric" and U.S. forces would achieve "situational awareness superiority."[184]

In December 2002, Joint Forces Command reported that recent experiments demonstrated the "opportunity to replace the inefficient application of mass that was based on uncertainty with a more precise application of national power based on knowledge."[185]

Experiments determined that near-perfect intelligence became "knowledge through Operational Net Assessment (ONA), Common Relevant Operational Picture (CROP), and Joint Intelligence, Surveillance, and Reconnaissance (JISR)." Under the concept of Rapid Decisive Operations, experimentation demonstrated that knowledge about "the adversary, the operational environment, and ourselves" would permit American forces to win the next war:

> with less risk of unintended consequences, and more efficient expenditure of national resources. Knowledge becomes a hedge against uncertainty, allowing deployment of more precisely tailored capabilities and enabling speed and degree of decisiveness of action. Knowledge-centric operations postulates that future operations will move beyond information superiority to decision superiority through a comprehensive, system-of-systems understanding of the enemy and the environment, as well as a shared integrated awareness of the friendly situation. Decision superiority is the ability of the commander, based upon information superiority and situational understanding to make effective decisions more rapidly than the adversary, thereby allowing a dramatic increase in the pace, coherence and effectiveness of operations. Advanced decision-support tools, knowledge-fusion, and horizontal and vertical integration of situational awareness will improve dissemination to decision –makers in an understandable and actionable format.[186]

The report indicated that experimentation "validated" the process of "Operational Net Assessment" and its ability to provide "knowledge in sufficient detail to apply integrated diplomatic, information, military, and economic (DIME) friendly actions decisively against an adversary's political, military, economic, social, information, infrastructure (PMESH) systems." ONA and the knowledge it generated created "decisive effects."[187]

While those charged with the development and testing of concepts clearly have the best intentions, many are contracted from large defense manufacturing companies such as Lockheed Martin, TRW, and General Dynamics. In addition to the incentive to develop sound concepts for future war, other influences such as the renewal of the consulting contract or the benefits to the parent company of developing concepts that demand that company's weaponry or communications equipment have potential to cloud judgment. The inherent limitations of computer simulations in replicating the complexity of war place a particularly high premium on independent, critical evaluation of concepts.

Joint experiments like Millenium Challenge 2002, described as "the largest most complex military experiment in history" fail to replicate the uncertainty of war because they are largely scripted. As the enemy conforms to the intelligence estimate, concepts like dominant battlespace knowledge and predictive intelligence are "validated." Retired Marine Corps Lieutenant General Paul Van Riper became so frustrated with constraints on enemy actions that

he quit his role as opposing forces commander in Millennium Challenge. While all exercises contain a mix of scripting and free-play, the excessive restrictions placed on General Van Riper were designed primarily to protect the flawed assumption of information superiority. Another senior officer observed after the experiment, "it was in actuality an exercise that was almost entirely scripted to ensure a Blue win." It was important to preserve conditions of near-certainty because the military is already trading traditional sources of combat power, such as firepower and protection, for information dominance. The conflict of interest in Joint Forces Command was also apparent as the exercise director, who also had responsibility for supervising concept writers, changed Van Riper's scheme for employing the opposing force. Because of flaws in the experiment, Joint Forces Command failed to expose the limitations of "knowledge" in war and "validated" the concepts of Rapid Decisive Operations and Effects Based Operations – concepts that Van Riper criticized as representing little more than slogans.[188]

Joint experiments also preserve the assumption of near-certainty in future war because they end before the adversary has the opportunity to adapt to U.S. strengths. Because near-perfect intelligence combined with precision weapons is supposed to deliver quick victory, experiments such as the Air Force's Global Engagement VI and the Army's Vigilant Warrior war games ended before strategic objectives were achieved. Because the war games assumed that a good beginning equated to a rapid decision and end of the war, they oversimplified the problem. Intelligence estimates are best at the outset of the campaign because they can be prepared deliberately before interaction with the enemy. Indeed, much of the uncertainty in war stems from that interaction under conditions that require rapid decisions based on imperfect information. As a retired senior officer who observed many joint and service experiments observed, the war games end when victory seems inevitable to the U.S. side, but not to the enemy.[189]

Clausewitz observed that "war is a special activity, different and separate from any other pursued by man."[190] He also observed that friction is what separates real war from war on paper; today we might add that friction also separates real war from war in computers. Because experiments that are supposed to test assumptions of future war are biased toward validating concepts and because primary causes of uncertainty in war are absent from those experiments, joint and service experimentation actually advance a flawed intellectual foundation for Defense Transformation. Many of the advocates of near-certainty in future war have assumed that their experience and education as systems analysts, economists, computer scientists, engineers and business managers gives them not only valuable insight into, but a holistic understanding of war. They overlook, however, war's human and psychological dimensions, the interactions with

the enemy, the political nature of war, and other sources of uncertainty that make counterproductive their well-intentioned efforts to contribute to national defense.

The Army's Objective Force initiative is under review. There is much that the Army will want to retain such as decentralization of combined arms capabilities to lower levels and the ability to achieve improvements in mobility while reducing logistical requirements. What the Army has achieved in the area of command and control and sensor technologies will benefit the force of the future. The root cause of the Objective Force's difficulties, however, the assumption of near-certainty in future war, must be expunged along with its distortions in organization and doctrine. The Army might use the opportunity also to correct inflated claims about the SBCT's capability to fight in operations that will remain dominated by uncertainty.

Other efforts in the Department of Defense, hold promise for improving joint experimentation. Historian Williamson Murray has completed a study of past successes and failures in war gaming and experimentation. Although he noted that effective "red teaming" to test prevailing visions of future war rarely occurred, he identified the principal causes of those failures: organizational cultures that did not encourage debate and intellectual effort, arrogance, overconfidence in a simplistic solutions to future war, and a failure to understand the enemy.[191] Although the same problems plague the development of concepts for future war and the conduct of joint experimentation, identifying them might serve as the first step in changing course. The Joint Staff has established a new process to subject concepts to greater scrutiny before they go to experimentation including panels of more junior officers not vested in concept development. Correcting the fundamental flaw in the vision of future war, however, does not require elaborate experimentation. The orthodoxies of knowledge centric warfare and near-certainty in future war are illogical and have been thoroughly discredited by recent experience.

IMPLICATIONS FOR DEFENSE TRANSFORMATION

> "We must learn to live with a measure of uncertainty, paradox, and ambiguity. We must acknowledge that vital pieces of information may always be missing. That is the price we pay for entering into the lives of the cosmos, for becoming participators in nature instead of mere observers."
>
> -—F. David Peat

Operation Iraqi Freedom demonstrated the enduring uncertainty of war and thoroughly discredited portions of service and joint visions based on the assumption of near-certainty. It

was clear before the war began that RMA technologies had neither lifted the fog of war nor provided the capability to achieve quick, cheap and decisive victory in Iraq. The key to victory in Iraqi Freedom was the joint capability that the coalition employed to impose its will on the enemy. In contrast to descriptions of war found in concepts such as Rapid Decisive Operations and Effects-Based Operations, the course of events in Iraqi Freedom depended very much on enemy and even allied reactions that proved difficult to predict. As reporters continuously asked officials if circumstances had forced military operations "off plan," they seemed not to understand that, in war, successful plans are not deterministic and are adaptable to a wide range of possibilities. Leaders adapted military plans and operations to changing circumstances, such as the denial of overland movement through Turkey. Because the force was capable of operating under conditions of profound uncertainty, the Coalition continued to make progress toward political goals and objectives.

An obvious observation emerged from early operations in Iraq: The best means of dealing with uncertainty was the flexible employment of joint and all-arms capabilities. Diverse means – including air, land, special operations, and naval forces as well as space-based assets – permitted innovations to retain the initiative. Coalition adaptability was clear, for example, in connection with operations in urban terrain and efforts to prevent injury to innocent civilians. When the enemy blended into the civilian population to force a protracted fight and escape Coalition air power, land forces closed with the enemy to identify and defeat them. When enemy forces, in turn, concentrated to defend against ground attacks, they became vulnerable to fires from artillery and aircraft. Uncertainty put a premium on flexibility rather than the detailed planning associated with concepts such as Effects-Based Operations. Uncertainty also demanded flexibility in operations conducted at sea and in the air. The plan for the air campaign, developed deliberately for months, did not survive the first moments of the war.

The enemy employed deception at sea; the Iraqis attempted to mine their own harbors with commercial boats. Coalition naval forces boarded and searched those boats and discovered many mines. Dynamic tasking of aircraft in which pilots received target instructions after take off greatly enhanced the ability of air forces to respond to real-time intelligence and support land forces. The uncertainty of the war and the adaptability it demanded revealed the strengths of the American military; it also revealed flaws in the deterministic aspects of concepts such as Effects-Based Operations and Rapid Decisive Operations.

In addition to freeing the Iraqi people from a brutal regime and removing the threat of weapons of mass destruction in the hands of Saddam, Operation Iraqi Freedom presents a tremendous opportunity to learn from that conflict and base visions of future war in reality rather

than wishful thinking. If America fails to repair the intellectual foundation of defense transformation, future national security will be at risk. The fallacy of near-certainty in war will generate vulnerabilities in the force that future adversaries could exploit. These include flaws in strategic and operational concepts, an inability to capitalize on technological advances, confused priorities that result in wasted resources, diminished combat readiness, an impairment of joint interoperability, imbalances in force structure, and a military culture out of step with the realities of war.

The illusion of information dominance creates unrealistic expectations that long-range precision weapons systems can deliver quick, efficient, cheap, and decisive victory. Enthusiasm for impressive new technologies connected by the network into a "system of systems" led many to conclude prior to Operation Iraqi Freedom that those capabilities represented a "silver bullet" solution to the complex problem of war. Strategic and operational thinking suffers from that simplistic conception because of a tendency to mirror image the enemy and assume that the enemy will behave rationally.

The assumption that the use of force in war is susceptible to rational calculation and tight control is particularly dangerous. The illusion of control in war portrays the use of force innocuously and blurs distinctions between war and diplomacy. War, however, involving as it does killing and the prospect of death, unleashes a psychological dynamic that defies control. "Discriminate force" from the adversary's perspective is still an act of war, not a signal of resolve. If the adversary chooses to escalate, he is likely to gain the initiative over a country employing "deliberate force." When the enemy does not behave as planned, withdraw or the commitment to a level of effort not considered at the outset become the only options.

Unless the belief in near-certainty is rejected, future enemies will have greater opportunities to achieve surprise over U.S. forces. Faith that information technology combined with systematic methodology can "prevent surprise" encourages a tendency to discount factors that are not quantifiable such as cultural and historical influences on behavior. The vast literature on strategic and operational surprise reveals that a lack of information or the absence of systematic analysis rarely make principal contributions to so-called intelligence failures. The "noise" of conflicting information and the sheer volume of data often prevent warning of enemy action. Over time, false alarms generate a "cry wolf" syndrome that desensitizes commanders and staffs to actual warnings. Bureaucratic barriers and compartmentalized intelligence, often designed to preserve secrecy of sources, can prevent fusion of intelligence indicators. Other obstacles reside in the cognitive domain. Prejudices and a human tendency to pay attention mainly to information that reinforces current expectations often prevent the identification of

specific threats and enemy actions that appear, in retrospect, to have been obvious. Even assuming that intelligence warnings are recognized, additional barriers exist between the perception of a specific danger and the translation of that perception into defensive or preemptive action.[192] This is not to suggest a defeatist attitude in connection with intelligence analysis, but declarations that the RMA has solved the complex problem of surprise in war could prevent real improvements in an area that has become especially critical given the terrorist threat and the proliferation of weapons of mass destruction. Initiatives such as the creation of a "collaborative information environment" and the process of "operational net assessment" should be pursued with vigor, but with also with realistic expectations.

A less deterministic approach will improve intelligence analysis at the operational and tactical levels as well. Operating with an appreciation for the uncertainty of war permits commanders to understand a range of possibilities and contingencies. Commanders will be better prepared to make decisions under the actual conditions of war; precise predictions are often precisely wrong. The recognition that war remains fundamentally uncertain will permit commanders to focus intelligence collection and combat reconnaissance efforts on what they cannot learn in advance and recognize the importance of initiative, adaptability, and bold action.

The orthodoxy of near-perfect intelligence inflates the importance of the headquarters and threatens to have a stultifying effect on high-level command. Terms like information dominance and decision dominance impart the idea that making near-perfect decisions based on near-perfect intelligence is the essence of command. To many, commanders are managers who mainly use tools such as the methodology in Operational Net Assessment. Command responsibility, however, is far more diverse. Commanders must be capable of conceptual thought and be able to communicate a vision of how the force will achieve its objectives. Their concepts of operation must harmonize the efforts of disparate entities and direct the force in a way that permits initiative and achieves synergy. As Martin van Creveld warned in *Command in War*, "communications and information processing technology merely constitutes one part of the general environment in which command operates. To allow that part to dictate the structure and functioning of command systems, as is sometimes done, is not merely to become the slave of technology, but also to lose sight of what command is all about."[193]

The assumption of near-certainty also threatens to undermine forces' ability to fight. If commanders assume near-perfect intelligence, emphasis is likely to shift from mission-oriented orders and flexible execution of those orders toward the development of near-perfect plans based on deductive processes. Because those plans are regarded as near-perfect, commanders will be inclined to demand execution of specific tasks on time and within

constraints of calculated resource allocations. The belief in near-perfect intelligence leads to an emphasis on firepower delivered from remote weapon systems under the control of higher headquarters. The illusion that war can be precisely managed and controlled leads to a preoccupation with efficiency, centralization, and control. Information displaces organic firepower and armor protection. This trend is already apparent. Displacement of fighting capability by perceived access to information was the foundation of the Army's division redesign in the late 1990s. Claims of what the SBCT can achieve in battle and the design of the Objective Force are also based on the same illusion. Computer simulations create a false impression that these organizations are capable. For example, analysts at RAND Corporation who are conducting computer simulation-based tests of the Objective Force are instructed not to let the unit get in close contact with the enemy.

Because information dominance and precision weapons permit efficiencies in force design, the weakness of future ground forces will demand that they avoid close battle. The force will be vulnerable under uncertain conditions. If the force loses communications, it will be isolated and even more vulnerable because it depends on remote fires. Michael Andrews, Army Deputy Assistant Secretary for Research and Technology observed that, "Everything relies on a reliable and secure network. Without it, our vulnerability is exposed." A widely circulated draft of an Objective Force white paper states clearly that the "Objective Force in 2015 requires knowledge dominance to succeed."[194] Even if the force is able to prevent tactical surprises, operations are certain to be slow and deliberate because any degree of ambiguity will necessitate a reallocation of sensors and an analysis effort to avoid risks associated with encountering the enemy. Abandoning the assumption of knowledge dominance will help reverse the trend toward designing vulnerable units that are dependent on centralized resources and unable to overmatch the enemy in close combat.

The belief in near-certainty also undermines military culture, especially in connection with expectations of junior leaders. If leaders are not conditioned to cope with uncertainty, they are likely to experience paralysis and wait for orders when they confront chaotic circumstances. While much of the transformation literature stresses adaptability and initiative, the force's inability to overmatch the enemy in a close fight, a bias toward deductive reasoning, and the belief in dominant knowledge discourage risk taking. Leaders will be predisposed to wait for information rather than take resolute action. Indeed, they will have to act cautiously to ensure their force's survival. Ironically, a force that was designed to be fast and agile will operate ponderously.

Because belief in certainty or uncertainty as the dominant condition in war is relative, so are the consequences of that belief. Unique circumstances in combat will shift experiences, capabilities needed, and methods along a continuum between extremes of certainty and uncertainty. Assuming near-certainty, however, generates a series of derivative assumptions and predilections that are likely to lead to difficulties when that base assumption is proven false.

CERTAINTY	UNCERTAINTY
DEDUCTIVE REASONING AND PROCESSES	**INDUCTIVE REASONING AND INTUITION**
Detailed Planning, Targeting, Control	Mission Orders and Flexible Execution
Precision Firepower	Joint Integration; Fire and Maneuver
Centralization	Decentralization
Synchronization	Initiative
Deliberate execution	Speed of action

Forces prepared to fight under conditions of near-certainty in future war will be at a severe disadvantage relative to forces that embrace uncertainty and seek to turn it to their advantage.

The belief in near certainty has both derived from and reinforced American technological *hubris*, so much in evidence in the language of defense transformation. Phrases like Full Spectrum Dominance, Shock and Awe, Information Dominance, and Rapid Decisive Operations present a danger to our own efforts, embolden our adversaries, and offend our allies. As Colin Gray has observed, "When a capability appears almost too good to be true, especially when it pertains to an activity as complex, uncertain, and risky as war, the odds are that, indeed, it is too good to be true."[195] The name of a concept should avoid presenting the object of difficult endeavors as a *fait accompli*. Potential hazards involve an underestimation of the challenges associated with military operations and false confidence that could lead to complacency or insensitivity to the limits of military technological advantages. Additionally, America's powerful military and economic strength relative to other nations has inspired considerable jealousy and suspicion; the immodesty associated with these terms serves only to cause further alienation.

Potential adversaries believe that the names of those concepts give expression to flaws in American thinking about future war; they are determined to capitalize on those flaws. For example, a recent study by two People's Liberation Army officers of the American vision of future war noted the belief in near-certainty and countered with the observation that while information technology "has made great strides, war still remains an unbroken mustang." The study went on to recommend to commanders that, "what is needed to grasp the ever-changing

battlefield situation is greater use of intuition rather than mathematical deduction." In a passage that appears very close to Clausewitz's observation that uncertainty derives, in part, from an "interaction of opposites," the authors suggested that overconfidence in technology is America's principal vulnerability.

> They believe that as long as the Edisons of today do not sink into sleep, the gate to victory will always be open to Americans. Self-confidence such as this has made them forget one simple fact – it is not so much that war follows the fixed racecourse of rivalry of technology and weaponry, as it is a game field with continually changing direction and many irregular factors…. It appears that Americans, however, do not pay attention to this. They drew the benefit of the Gulf War's technological victory and obviously have resolutely spared no cost to safeguard their leading position in high technology.[196]

Other militaries have also recognized the enduring uncertainty of war. If the U.S. military continues along the wrong path of defense transformation, others will learn from America's mistakes and plan to take advantage of vulnerabilities.

Potential adversaries view the importance that the American military has placed on network-centric concepts as a weakness and are developing technological countermeasures to attack components of emerging capabilities. News concerning the development of electro-magnetic bombs or the sale of GPS jammers to Iraq highlight the danger of assuming linear progression toward greater clarity and precision on the battlefield. Historically, countermeasures have limited the effects of all "dominant" weapons on the battlefield. A cursory examination of twentieth century conventional weapons development reveals technological interactions that limited the effects of new technology. On land, the machine gun seemed decisive until the introduction of mobile protected firepower; the tank seemed decisive until the introduction of tank-killing systems. In the air, the development of radar limited the effectiveness of the bomber. The submarine may have dominated the seas were it not for the invention of sonar and battleships controlled the ocean's surface until the advent of naval aviation. Although Nazi Germany's strategic communications seemed invulnerable, the Allies had access to transmissions after capturing an Enigma machine and breaking the codes. Advocates of decisive weapons or technological capabilities have a history of ignoring countermeasures. Today, potential adversaries are closely monitoring American military operations and defense transformation initiatives to develop countermeasures to US capabilities. As Secretary of Defense Donald Rumsfeld observed, "In a networked environment, information assurance is critical." He warned that "No nation relies more on space for its national security than the United States. Yet elements of the U.S. space architecture—ground stations, launch assets and satellites in orbit—are threatened by capabilities that are

increasingly available."[197] The U.S. must avoid the tendency to think linearly about technological countermeasures, especially when many capabilities and countermeasures can be purchased off-the-shelf.

Technological *hubris* and the associated neglect of countermeasures has led some to conclude that national defense should rely on a combination of small, light ground forces and preponderant air and naval power. This is one of the paradoxes of the RMA orthodoxy. American technological advantages have pushed adversaries out of the air and sea domains, yet RMA advocates suggest further investment in forces that are already dominant and reductions in the only forces that are capable of contending with potential adversaries' responses – a shifting of the venue of conflict to complex and urban terrain. Such an imbalance of forces would create vulnerabilities and thereby undermine America's ability to deter conflict or win wars if deterrence fails. As operations in Afghanistan demonstrated, the best results are achieved with synergistic joint capabilities. As the 1999 air war in Kosovo demonstrated, the absence of one of the components leads to extreme difficulties and results inconsistent with objectives. As Operation Iraqi Freedom demonstrated, the joint force must be able to fight under conditions of uncertainty on land, close with and defeat enemies employing countermeasures to joint fires, control terrain, and impose order. Iraqi Freedom demonstrated that, fighting together, joint forces are able to overcome challenges and uncertainties associated with complex geography (especially urban areas), political and humanitarian constraints on the use of firepower, and enemy actions such as deception, dispersion, concealment, and intermingling with the civilian population. As land, sea, and air forces were amassing to invade Iraq, however, Admiral Cebrowski and his assistant in the Office of Force Transformation wrote that future wars would be fought with air and sea-based precision munitions and small, "elite" special operations forces. They stated that a new "American Way of War moves the military toward an embrace of a more sharply focused global cop role: we increasingly specialize in neutralizing bad people who do bad things."[198] Admiral Cebrowski seemed to overlook the fact that "bad people" are sometimes positioned at the head of bad armed forces that are determined to fight and might be savvy enough to evade long-range detection and precision munitions. The need to change the geopolitical landscape in Iraq demanded the presence of land forces to establish security and dismantle the Baath Party apparatus. It was important to defeat Iraqi Army units and it was equally important to separate physically the population from the Fedayeen militia. The belief in certainty, rooted as it is in technological hubris, masks the human dimension of war and creates the illusion that sensors and long-range fires can solve

complex military and political problems. Only balanced joint forces will represent an effective deterrent or be able to win future wars.

While defense transformation has been distracted by the unrealistic objective of achieving near-certainty, organizational changes that could deliver immediate improvements in the ability to fight have not received focused attention. Indeed, the flawed assumption of near-certainty has led to changes in the wrong direction. Organizational reform would permit the joint force to take full advantage of the capabilities associated with communications, sensor, and information technologies. While some positive organizational initiatives are underway (such as the establishment of Joint Task Force Headquarters), changes made under the assumption of near-certainty, are generally unsound. To fight effectively under conditions of uncertainty and complexity, organizations must be flexible and agile. Flatter, or less hierarchical organizations are, in general, more capable of operating in uncertain environments than hierarchical organizations. Diverse capabilities at lower levels of command, to include all-service and all arms, will increase the effectiveness, albeit not the efficiency of the force.[199] The assumption of near certainty, however, has resulted in a centralization of capabilities and the preservation of hierarchical organizations.

The flawed vision of future war impedes service cooperation; its abandonment will foster more effective integration of service capabilities. If the intellectual foundation of joint transformation acknowledges the complexity and uncertainty of war and the associated need for balanced forces, all services will have a greater incentive to work together. Understanding the limits of technology will bolster efforts to solve complex operational problems as a joint team through doctrine, organizational reform, training, tactics, and education.

In addition to creating an imbalance of forces and impeding joint integration, the irrational faith in certainty threatens to waste resources and create an imbalance between readiness and acquisition. It is easy to understand how precision strike technologies contribute to military operations. It is harder to understand the qualitative factors and skill level necessary to make that strike happen. It is perhaps even more difficult to understand the elements of combat power in land formations. Like air and sea forces, Army and Marine Corps units generate power from weapons, equipment and individual skill, but the main source lies in the collective psychology of the organization. In battle, strength comes from resistance to fear and disintegration that fear can impel. Imponderables such as confidence in one another and in one's leaders are most important in that connection. That confidence derives, in part, from bonds of mutual trust and respect that develop during tough, realistic training. Because it is easier to understand the sources of an F-22's capabilities, for example, than understand the

source of an infantry platoon's combat power, those who make resource decisions must understand how investments in manning, forming, and training ground units are vital to maintaining a balanced joint capability. That training should occur in a joint environment whenever possible. If the bonds of trust and mutual understanding that exist within ground, air, and sea units could be transferred to joint organizations, the results would be powerful.

The consequences of the assumption of near certainty are wide ranging and potentially damaging to American national security. The belief in near-certainty has misdirected and undermined defense transformation efforts. Unless it is abandoned, the consequences will be negative and potentially severe.

CONCLUSION

> In armed conflict no success is possible – or even conceivable – which is not grounded in an ability to tolerate uncertainty, cope with it, and make use of it."
> —Martin Van Creveld

The abandonment of the assumption of near-certainty in war will accelerate defense transformation. Unrealistic assumptions about the nature of future war polarize the debate and obstruct change. The promise of omniscience in the future discredits and dilutes the transformation effort by deferring changes until an ambiguous future capability becomes available; it encourages recidivism and resistance to changes that are long overdue. The potential effects of the orthodoxy of near-certainty in future war reveal that bad ideas have bad consequences. Indeed, the migration to the present of what were considered theoretical features of future war is already damaging national defense capabilities. Repairing the intellectual foundation of defense transformation will repair the damage done and permit real progress in building the force of the future. The following are recommendations for improving the joint force's ability to fight and win under conditions of complexity and uncertainty:

- Denounce the orthodoxy of near-certainty in future war and make an explicit statement that future war will remain in the realm of uncertainty.
- Develop joint and service operational concepts or idealized visions of future war that are consistent with the uncertainty and complexity of war. Make these concepts "fighting-centric" rather than "knowledge-centric." Build these concepts on an understanding of battle at the tactical level as well as operational and strategic considerations. Identify continuities

as well as changes in warfare. Discard the concepts of Rapid Decisive Operations and Effects-Based Operations after salvaging their positive features.

- Reform joint and service organizations. Retain interoperability as a top priority for reform. Establish a balance between air, sea, and land capabilities. Push all arms and joint capabilities to lower levels of command. Decentralize assets and create the highest degree of autonomy possible while flattening the overall organization. Retain necessary redundancies, but eliminate overhead that does not contribute to effectiveness. Use effectiveness rather than efficiency as the principal criterion for evaluating organizations. Emphasize mobility and adaptability to achieve speed of action without compromising overmatch in the aerospace, sea, and land domains.
- Eliminate service parochialism, but preserve positive aspects of service culture that derive from unique characteristics of operations in their domains. Forge a common understanding of service interdependence. Emphasize the mutual effort necessary to achieve objectives in complex environments. Encourage officers to expand their scope of identity and gain an appreciation for the capabilities and contributions of other services as well as for the complexity of war. Reinforce reforms in joint education with practical joint training at lower levels of command.
- Abandon the idea that lightness, ease of deployment, and reduced logistical infrastructure are virtues in and of themselves. Invest in air and sealift to improve strategic deployment capabilities. Develop technologies to reduce the demands on strategic lift and logistical support, but do not assume that information eliminates tradeoffs between combat power, deployability, and sustainability. The Army, for example, must fundamentally redesign the Objective Force. It should retain the SBCT, but acknowledge its limitations as well as its capabilities.
- Maintain the emphasis on improving joint training and education. Adopt tiered readiness that aligns each of the services for both training and deployment.
- Eliminate the ambiguous language of defense transformation. Be skeptical of concepts and presentations that rely on superlatives, theoretical models, flashy graphics, and futuristic videos.
- Declare a moratorium on joint experimentation and concept development. Study Operation Iraqi Freedom in context of military operations since 1991. Reform the organization for joint concept development and experimentation. Increase free-play in experimentation and remove conflicts of interest. Recognize that fundamentally flawed ideas can be discarded without elaborate experimentation. Eliminate the practice of contracting out the intellectual

responsibilities of military professionals and civilian defense leaders. Whenever possible, include live deployments and tactical operations in joint experimentation and recognize that iterations in constructive or virtual simulations can neither replicate the fog and friction of war nor substitute for thought and analysis.

- Continue to pursue initiatives to lessen the degree of uncertainty and friction in war and consolidate gains already made. However, recognize limitations as well as possibilities. Pay particular attention to countermeasures and anticipate them by hardening the network and creating redundant capabilities. Pursue network-centric warfare as a vital capability, not a strategy.
- Declare that the revolution in sensor, communication, information, and precision engagement technologies has occurred. Study these advances in the context of recent conflicts and focus on integration of what is available (or what will become available shortly) and abandon the idea of "skipping a generation" of technology. Make appropriate changes now.

These measures would help the Department of Defense, Joint Staff, and each of the services reverse the damage to defense transformation incurred from unrealistic assumptions about the nature of war, advance American national security, and secure progress already made in defense reform.

What is certain about the future is that even the best efforts to predict the conditions of future war will prove erroneous. What is important, however, is to not be so far off the mark that visions of the future run counter to the very nature of war and render American forces unable to adapt to unforeseen challenges. An embrace of the uncertainty of war, balanced Joint Forces, effective joint integration, and adaptive leaders will permit the flexibility that is key to future victories.

WORD COUNT: 29,690

ENDNOTES

[1] The block quotation is from William A. Owens, "Introduction," in Stuart E. Johnson and Martin C. Libicki, eds., *Dominant Battlespace Knowledge*, (Washington, D.C.: National Defense University Press, 1996), p. 4. Other definitions are from Joint Vision 2020, The DOD Dictionary of Military Terms, and Joint Publication 1-02. See the Joint Electronic Library on the worldwide web at http://www.dtic.mil/doctrine (3 November 2002).

[2]The discussion of "predictive intelligence" as a component of "robust intelligence" is from The Joint Staff, "Joint Operations Concept: Full Spectrum Dominance Through Joint Integration," Predecisional Draft Version 4.8, 10 February 2003, , pp. 33-35. A subsequent draft removed the definition, but retained the term robust intelligence.

[3] Those studies included the 1989-1990 Base Force, 1993 Bottom-Up Review, and 1997 Quadrennial Defense Review. See Eric V. Larson, David T. Orletsky, and Kristin Leuschner, *Defense Planning in a Decade of Change: Lessons from the Base Force, Bottom-Up Review*, and *Quadrennial Defense Review* (Washington, D.C.: RAND, 2001). See also, Andrew Krepinevich, "Why No Transformation?" *National Interest*, 4 February 1999. <http//www.csbaonline.org> (3 October 2002).

[4] George W. Bush, Speech delivered to Citadel Cadets, 11 December 2001. http://www.whitehouse.gov/news/releases/2001/12/20011211-6.html (15 January 2003).

[5] Donald Rumsfeld, Memorandum from Secretary of Defense to Secretaries of the Military Departments, Chairman of the Joint Chiefs of Staff, Undersecretaries of Defense, et. al., "Legislative Priorities of Fiscal Year 2004," 17 September 2002.

[6] Department of Defense, "Quadrennial Defense Review Report," 30 September 2001, pp. 29-31. http://www.defenselink.mil/pubs/qdr2001.pdf (15 December 2002). Hereafter cited as 2001 QDR Report.

[7] There has been no shortage of activity within the services. The Air Force is working toward the establishment of ten air expeditionary forces capable of organizing into strike packages based on the mission. The Navy has organized its efforts around the areas of sea basing, sea strike, and sea shield and is establishing a communications infrastructure called "NetForce." The Army is integrating digital communications and command and control systems into existing organizations, considering radical changes in personnel management that would permit unit rather than individual replacement, fielding a new organization designed to increase strategic mobility, and continuing work on Objective Force organizations, doctrine, and technology. For summaries and analyses of service and joint transformation, see Hans Binnendijk, ed., *Transforming America's Military* (Washington, D.C.: NDU Press, 2002).

[8] Under Secretary of Defense for Acquisition, "Evolutionary Acquisition and Spiral Development," 12 April 2002, as quoted in John Hanley, "Rapid Spiral Transformation," *Transformation Trends*, 3 February 2003, p. 3. http://www.oft.osd.mil/library/transformation_trends/trends.cfm#past (15 March 2003). "Efforts Underway to Promote Jointness," *DOD Update*, 4 February 2003, pp. 6-7. http://www.dfi-intl.com/shared/updates/dod/2003-02-04DoDUpdate.pdf (15 February 2003)

[9] For example, the Office of Force Transformation reviewed service "Transformation Roadmaps" and recommended changes to make them consistent with DOD plans.

[10] Speech, President George W. Bush, Norfolk Naval Air Station, February 13, 2001. http://frwebgate6.access.gpo.gov See also 2001 QDR Report, p. 13.

[11] Memorandum from Secretary Donald Rumsfeld to General Myers, Subject: Concept of Operations, 12 August 2002.

[12] The Joint Staff, "Joint Operations Concepts," Final Draft, 20 February 2003, p. 3. Hereafter cited as "Joint Operations Concepts Final Draft." See also Kim Berger, "US DoD Presses for Joint Operations Concept," *Jane's Defense Weekly*, 25 September 2002. < http://jdw.janes.com/> (7 December 2002). "Pace Asserts JROC's Importance in Developing CONOPS," *Defense Daily*, 24 January 2003. www.defensedaily.com (9 December 2002). "JROC Takes More Active Role in Acquisition Process," *Aerospace Daily*, 24 January 2003. http://aviationnow.com/aviationnow/aerospacedaily (15 January 2002). Separately, Secretary Of Defense Rumsfeld affirmed his intention to use the concept to "test proposals from the various services" as quoted in "Services, Joint Staff Forming Joint Operational Concepts," *Inside the Navy*, 24 November 2002, p.4. Admiral Cebrowski, the head of the Office of Force Transformation has developed "information age metrics" to assist the Department in making resource decisions. Arthur K. Cebrowski, "New Rules for a New Era," *Transformation Trends,* 21 October 2002. http://www.oft.osd.mil/library/transformation_trends/past (18 March 2003).

[13] On importance of the concept see Paul K. Davis, "Integrating Transformation Programs," in Binnendijk, ed, *Transforming America's Military*, pp. 193-219. Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military,* (Ithaca, NY: Cornell University Press, 1991), p. 20. The FYO4 budget, for example, cancelled 24 Army programs and 50 Navy programs and shifted those funds to "transformation initiatives." See "President's FY04 Budget Released," *DOD Update*, 4 February 2003, pp. 1-5. http://www.dfi-intl.com/shared/updates/dod/2003-02-04DoDUpdate.pdf (20 February 2003). See also "Rumsfeld's Budget Favors Weaponry of Tomorrow," *Washington Times*, 4 February 2003, p. 8. Colonel David Fastabend suggested that an operational concept has four fundamental characteristics. It should provide an idealized vision of war, it should reflect the strategic environment, it should connect theory, strategic context and doctrine, it should present a clear choice concerning the technique for success in war, and it should be regarded as a "component of conflict" between potential adversaries rather than an inflexible construct. David Fastabend, "That Elusive Operational Concept," *Army*, June 2001. <http://www.ausa.org/www/armymag.nsf> (10 January 2003).

[14] "Efforts Underway to Promote Jointness," *DOD Update*, 4 February 2003, pp. 6-7.

[15] 2001 QDR Report, p. 29.

[16] For discussions of strategic and operational environments, see Joint Vision 2020, the 2001 QDR Report, and the Joint Operations Concepts Final Draft.

[17] William A. Owens, *Lifting the Fog of War* (Baltimore: Johns Hopkins, 2001), p. 96. Peter Reddy, "Joint Interoperability: Fog or Lens for Joint Vision 2010?," Research Report Number 97-0137, (Maxwell Air Force Base, Alabama: Air Command and Staff College, March 1997).

[18] "Joint Operations Concepts Final Draft," pp. 14-15, 20.

[19] The paper lists "increasing political, economic, ethnic and religious divisions, globalization, the diffusion of power to hostile non-state actors, population growth, urbanization , a scarcity of natural resources, and the proliferation of dangerous technologies and weaponry" as some of the factors that make war "dynamic, uncertain, and complex." Joint Operations Concepts, p. 7.

[20]"Joint Operations Concepts Final Draft," pp. 7-9.

[21] "Joint Operations Concepts Final Draft," pp. 9, 20-21.

[22] Interviews with officers and civilians in J7 and J8, the Joint Staff, conducted in December 2002. For the concepts of robust intelligence and predictive intelligence, see "Joint Operations Concept: Full Spectrum Dominance Through Joint Integration," Predecisional Draft Version 4.8, 10 February 2003, , pp. 33-35.

[23] The literature that questions the idea of dominant knowledge in future war continues to grow. For a sample, see: Stephen Biddle, "Victory Misunderstood: What the Gulf War Tells Us About the Future of Conflict," *International Security*, Vol. 21, No. 2 (Fall 1996) http://www.comw.org/rma/fulltext/victory.html (10 September 2002). Michael O'Hanlon, *Technology and Future War,* esp. pp. 106-142. Richard J. Harknett, "The Risks of a Networked Military," *Orbis*, Winter 2000. John A. Gentry, "Doomed to Fail: America's Blind Faith in Military Technology, *Parameters*, Winter 2002-2003, pp. 88-103. Mark Helprin, "Revolution or Dissolution?" *Forbes*, 23 February 1998, vol. 161, no 4. Franklin Spinney, "What Revolution in Military Affairs?" *Defense Week*, 23 April 2001 vol. 222, issue 17, p. 2. For an excellent critique of RMA claims in connection with the certainty of war, see Christopher Kolenda, "Transforming How We Fight: A Conceptual Approach," *Naval War College Review*, (Spring 2003, Vol. LVI, No. 2) http://www.nwc.navy.mil/press/Review/2003/Spring/art6-sp3.htm (28 March 2003). For a bibliography of articles concerning "second thoughts on the RMA," see The RMA Debate website at http://www.comw.org/rma/fulltext/second.html.

[24] Consider the following excerpt from a definition of the "knowledge centric" characteristic of Rapid Decisive Operations, an overarching concept billed as "the solution" to future joint operations. "Advanced decision support tools, knowledge fusion, accurate compression, and horizontal and vertical integration of situational awareness will improve dissemination to decision-makers in an understandable and actionable format. Future operations will move beyond information superiority to decision superiority—better decisions faster—based on knowledge developed through a comprehensive, system-of-systems understanding of the enemy and the environment, and a shared integrated awareness of the friendly situation. This will reduce operational risk, and dramatically increase the pace, coherence, and effectiveness of operations. A knowledge-centric joint force will enable a better balance of effectiveness and efficiency; it will ensure increased rapidity of our operations." US Joint Forces Command, J9 Joint Futures Lab, "Toward a Joint Warfighting Concept: Rapid Decisive Operations," RDO Whitepaper 2.0, 18 July 2002, pp. 6-7.

[25] An example is the Army's determination to retain the division structure despite compelling arguments that alternative organizations were more appropriate for the post-Cold War era. See Douglas A. Macgregor, *Breaking the Phalanx: A New Design for Landpower in the 21st Century* (Westport, CT: Praeger, 1997).

[26] "An Interview with the Director," *Fateful Lightning*, A Newsletter of The Information Technology Association of America," October 2002, p. 2. http://www.afei.org/transformation/pdf/Cebrowski_ITAA_interview.pdf (15 December 2002).

[27] "U.S. Programs Future May Turn on C4ISR, *Defense News*, 25 November 2002, p. 18. See also Arthur Cebrowski, "New Rules for a New Era," Transformation Trends, 21 October 2002. http://www.afei.org/transformation/pdf/TransTrends_02_10_21.pdf (15 December 2002).

[28] See, for example, Lawrence Kaplan, "The Coming Anarchy," *The Atlantic* (February 2004). http://www.theatlantic.com/politics/foreign/anarchy.htm (10 October 2002). Samuel P. Huntington, "The Clash of Civilizations," *Foreign Affairs*, (Summer 1993, vol. 72, no. 3) http://www.foreignaffairs.org/1993/3.html (15 September 2002). Benjamin Barber, *Jihad vs. McWorld*, (New York: Times Books, 1995).

[29] Andrew F. Krepinevich, "Cavalry to Computer: The Pattern of Military Revolutions," *The National Interest*, 37, (1994), 30. The idea of a contemporary revolution in military affairs actually had its origin with Russian military thinkers in the 1960s who predicted that America's combination of precision munitions with computer technologies and sensors had introduced a "military-technical revolution." See Notra Trulock III, Kerry Hines, Ann Herr, *Soviet Military Thought in Transition: Implications for the Long-Term Military Competition* (Arlington: Pacific-Sierra Research Corp., May 1988). This idea gained wide acceptance in America, however, only after the 1991 Gulf War.
, pp. 2, 28, 31. For a superb study of military revolutions, see Macgregor Knox and Williamson Murray, eds., *The Dynamics of Military Revolution 1300-2050*, (New York: Cambridge University Press, 2001).

[30] Harlan K. Ullman, James P. Wade, L.A. "Bud" Edney, et. al., *Shock & Awe: Achieving Rapid Dominance* (Washington, D.C.: NDU Press, Dec. 1996), esp. chapters 1 and 2. Quotation is from chapter 2. www.ndu.edu/inss (10 January 2003).
[31] John Warden, "Employing Air Power in the Twenty-first Century," in Richard H. Shultz, Jr. and Robert L. Pfaltzgraff, Jr., eds., *The Future of Air Power in the Aftermath of the Gulf War* (Maxwell Air Force Base, Alabama: Air University Press, 1992), pp. 78-81.

[32] See, for example, George and Meredith Friedman, *The Future of War: Power, Technology, and American World Dominance in the Twenty-First Century* (New York: St. Martin's Griffin, 1996), pp. 278-281. Alvin and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (New York: Little, Brown, and Company, 1993), pp. 64-80. For a balanced summary of the issue, see Elliot Cohen and Keaney, *Revolution in Warfare?: Air Power in the Persian Gulf* (Annapolis, Maryland: US Naval Institute Press, 1995), pp. 188-212.

[33] See Biddle, "Victory Misunderstood." For critiques, see: Daryl G. Press, "Lessons from Ground Combat in the Gulf: The Impact of Training and Technology," *International Security*, Vol. 21, No. 2 (Fall 1997), pp. 137-146. Thomas Keaney, "The Linkage of Coalition Air and Ground Power in the Future of Conflict," *International Security*, Vol. 21, No. 2 (Fall 1997), pp. 147-150. Thomas G. Mahnken and Barry D. Watts, "What the Gulf War Can (and Cannot) Tell Us about the Future of Conflict," *International Security*, Vol. 21, No. 2 (Fall 1997), pp. 151-162. For Biddle's summary of the discussion and counterarguments, see Stephen Biddle, "The Gulf Debate Redux: Why Skill and Technology Are the Right Answer," *International Security*, Vol. 21, No. 2 (Fall 1997), pp. 163-174. See also, Stephen Biddle, "Commentary on Victory

Misunderstood," paper published by the Institute for Defense Analysis, September 1997. <http://www.ida.org/DIVISIONS/sfrd/crp/d-2014_Full_Paper.pdf> (10 January 2003).

[34] Barry D. Watts, *Clausewitzian Friction and Future War*, McNair Paper 52, October 1996, Institute For National Strategic Studies, pp. 37-53.

[35] Richard M. Swain, *Lucky War: Third Army in Desert Storm* (Fort Leavenworth Kansas: US Army Command and General Staff College Press, 1994), pp. 250-255, 333-335.

[36] Watts, *Clausewitzian Friction and Future War*, pp. 37-53. David R. Mets, "The Long Search for Surgical Strike: Precision Munitions and the Revolution in Military Affairs," Cadre Paper No. 12, October 2001, Air University, Maxwell Air Force Base, Alabama, p. 37.

[37] Michael Gordon and Bernard Trainor, *The Generals' War: The Inside Story of the Conflict in the Gulf* (New York: Little Brown, 1994), pp. 400-432.

[38] *Conduct of the Persian Gulf War Final Report to Congress*, (Washington: Government Printing Office, April 1992), p.140. Barry D. Watts and Thomas A. Keaney, *The Gulf War Air Power Study: Effects and Effectiveness* (Washington: Government Printing Office, 1993), .pp. 360-363. Hereafter cited as GWAPS. Daryl G. Press, "The Myth of Air Power in the Persian Gulf War and the Future of Warfare," *International Security*, Vol. 26, No. 2 (Fall 2001), pp. 29-38.

[39] Daryl G. Press, "The Myth of Air Power in the Persian Gulf War and the Future of Warfare,", pp. 44. Mets, "The Long Search for Surgical Strike: Precision Munitions and the Revolution in Military Affairs," pp. 48-50.

[40] Martin van Creveld et al, *Air Power and Maneuver Warfare*, p. 219. For another perspective on the ineptitude of the Iraqis, see "The Perfect Enemy: Assessing the Gulf War," *Security Studies*, Vol. 5, No. 1 (Autumn 1995), p.101. See also Swain, *Lucky War*, p. 343.

[41] GWAPS, vol. II, pp. 360-363.

[42] GWAPS, vol. II pp. 360-361.

[43] Daryl Press, "The Myth of Air Power in the Persian Gulf War and the Future of Warfare," *International Security*, Vol. 26, No. 2 (Fall 2001), pp. 5-44.

[44] General Norman Schwartzkopf briefed reporters concerning the success of the "Great SCUD Hunt." Instead of SCUDs, however, the video showed a strike on fuel trucks. Iraqi deception and "shoot and scoot" tactics were very successful and, despite pilot reports of mobile launchers being destroyed, it seems certain that none of the mobile launchers and only fourteen of the twenty-eight fixed launchers were hit. "Counter-Force in Desert Storm," available on the worldwide web at http://www.cdiss.org/scudnt6.htm. See also, Gordon and Trainor, *The Generals' War*, pp. 227-248. On Khafji, see Earl Tilford, "Halt Phase Strategy: A New Wine in Old Skins…With PowerPoint," Strategic Studies Institute Monograph, Carlisle Barracks, PA, 23 July 1998, pp. 7-9. http://www.fas.org/man/dod-101/usaf/docs/halt.pdf (August 2002). For an example of a persistent views despite the evidence, see Daniel Goure and Stephen Cambone, "The Coming Age of Air and Space Power," in Daniel Goure and Christopher Szara, eds., *Air*

and Space Power in the New Millenium (Washington, D.C.: Center for Strategic and International Studies, 1997), pp. 8-11.

[45] GWAPS, vol. II, p. 361.

[46] Williamson Murray, "Clausewitz Out, Computers In: Military Culture and Technological Hubris," *The National Interest*, 1 June 1997. http://www.clausewitz.com/CWZHOME/Clause&Computers.html (August 20, 2002).

[47] To review what Clausewitz identifies as the various causes of uncertainty in war, see Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), pp. 80-90, 101, 113-114, 117-118, 119-121, 136-140, 148-150, 161, 184-191,198-203, 577-578, 585, 605-610.

[48] The idea of "war as an extension of politics" included far more than the connection between military strategy and national policy. Clausewitz was particularly sensitive to the emotions and social forces unleashed by the French Revolution. For an analysis of Clausewitz's views of *Politik* and war, see Antulio J. Echevarria II, "War Politics, and the RMA – The Legacy of Clausewitz," *Joint Force Quarterly*, Winter 1995-96, pp. 76-80.

[49] Clausewitz, *On War*, pp. 86, 101.

[50] John Keegan, *The Face of Battle: A Study of Agincourt, Waterloo, and The Somme* (New York: Penguin Books, 1976), p. 303.

[51] Clausewitz,, *On War*, pp. 113-114.

[52] Clausewitz,, *On War*, pp. 572-573.

[53] Clausewitz, *On War*, pp.139, 149.

[54] Alan D. Beyerchen, "Clausewitz, Nonlinearity and the Unpredictability of War, *International Security*, vol. 17, no. 3 (Winter 1992), pp. 59-90. See also Stephen J. Cimbala, *Clausewitz and Chaos: Friction in War and Military Policy* (Westport, CT: Praeger, 2000). Katherine L. Herbig, "Chance, and Uncertainty in *On War*," in *Clausewitz and Modern Strategy*, ed., Michael I. Handel (London: Frank Cass, 1986), pp. 95-116.

[55] Clausewitz, *On War*, p. 101.

[56] Clausewitz, *On War*, p. 101.

[57] Admiral William Owens as quoted in Williamson Murray, "Clausewitz Out Computers In," p. 62.

[58] The tendency to claim that technological solutions can create certain solutions to complex problems is not limited to defense transformation. A new counter-terrorism system plans to use information technology to identify and defeat terrorist plans prior to attacks. The Total Information Awareness (TIA) system would use data retrieval, biometric identification and other technologies to analyzed information in databases to lift the fog of homeland security. Shane Harris, "Critics Say 'Total Information Awareness' Impractical," GovExec.com, 12

December 2002.< http://www.govexec.com/dailyfed/1102/112002ti.htm> (1 December 2002). On Americans' tendency to view war as an engineering problem, see Richard Sinnreich and Williamson Murray , "Joint Warfighting in the 21st Century," unpublished paper prepared for the Office of Net Assessment, Department of Defense, 2002.

[59] Clifford J. Rogers, "Clausewitz, Genius, and the Rules," *Journal of Military History*, October 2002. < http://www.clausewitz.com/CWZHOME/RogersRules.html> (10 January 2003).

[60] Clauswitz, *On War*, p. 136.

[61] See Clausewitz, *On War*, pp, 75-89.

[62] Admiral William Owens as quoted in Williamson Murray, "Clausewitz Out Computers In," p. 62.

[63] Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *International Security*, vol 17: no. 3 (Winter, 1992), pp. 59-90.

[64] General Anthony Zinni, interview, "Ambush in Mogadishu," http://www.pbs.org/wgbh/pages/frontline/shows/ambush/interviews/. (5 February 2003). On the same point, see Kenneth Allard, *Somalia Operations: Lessons Learned* (Washington DC, National Defense University Press, 1995), p. 74.

[65] David Halberstam, *War in a Time of Peace: Bush, Clinton, and the Generals* (New York: Scribner, 2001), p. 258.

[66] The Pakistanis, for example, were reluctant to enter into a combat situation after the 5 June incident without receiving permission from their government. Because TF Ranger operations were classified, the multi-national reaction force was not privy to the plan and, therefore, was not well prepared to respond.

[67] Kenneth Allard, *Somalia Operations*, pp. 55-66.

[68] Allard, pp. 55-61

[69] Captain Haad (sector commander in General Aidid's militia), interview, http://www.pbs.org/wgbh/pages/frontline/shows/ambush/interviews/ (5 February 2003). See also, Charles J. Dunlop, Jr., "21st Century Land Warfare: Four Dangerous Myths." *Parameters*, 27 (Autumn 1997), pp. 27-37.

[70] For a description of the action as well as the perspective of the command group, see Mark Bowden, *Blackhawk Down: A Story of Modern War* (New York: Atlantic Monthly Press, 1999). Many of the confusing circumstances were not limited to the desperate fight of 3-4 October. The Somalis used civilian shields, for example, as a routine tactic. "Throngs of women and children crowded around UN peacekeepers, allowing armed Somalis to get close enough to wipe out the UN troops with automatic weapons. While a risky tactic, the Somalis knew it had a good chance of success. If the opponents are bloody-minded enough, they will always exploit the humanitarian attitudes of their adversaries." James F. Dunnigan, *Digital Soldiers: The Evolution of High-Tech Weaponry and Tomorrow's Brave New Battlefield* (New York: St. Martin's Press, 1996), p. 219.

[71] Anatol Lieven, “Hubris and Nemesis: Kosovo and the Pattern of Western Military Ascendancy and Defeat,” in Cohen and Bacevich, eds., *War Over Kosovo: Politics and Strategy in a Global Age* (New York: Columbia University Press, 2001), p. 113.

[72] Owens, *Lifting the Fog of War*, p. 96.

[73] An example of the belief in American dominance is found in Harlan K. Ullman, James P. Wade, L.A. "Bud" Edney, et. al., *Shock & Awe: Achieving Rapid Dominance* (Washington, D.C.: NDU Press, Dec. 1996). The book is available on-line at <http://www.dodccrp.org/shockIndex.html>. The authors state that “The military posture and capability of the United States of America are, today, dominant. Simply put, there is no external adversary in the world that can successfully challenge the extraordinary power of the American military in either regional conflict or in "conventional" war as we know it once the United States makes the commitment to take whatever action may be needed.” See the following on the 1990s as the ideal time for experimentation and the lack of a “peer competitor.” James R. Blaker, "The American RMA Force: An Alternative to the QDR," *Strategic Review*, vol. 25, no. 3 (Summer 1997), pp. 21-30; See also Richard K. Betts, *Military Readiness: Concepts, Choices, Consequences* (Washington, D.C.: Brookings, 1995), pp. 35-84. John Arquilla, "The `Velvet' Revolution in Military Affairs," *World Policy Journal* (Winter 1997/98), p. 42.

[74] John Arquilla and David Ronfeldt, “A New Epoch—and Spectrum—Of conflict,” in John Arquilla and David Ronfeldt, eds., *In Athena’s Camp: Preparing for Conflict in the Information Age,* (Washington, D.C.: RAND, 1997), pp. 1-2.

[75] Still other matters demanded the attention of the Department of Defense and the Joint Staff including the 1994 nuclear crisis in Korea and efforts to dismantle the nuclear arsenals in former Soviet Republics.

[76] Various reviews including the 1989-1990 Base Force, 1993 Bottom-Up Review, and 1997 Quadrennial Defense Review resulted in little fundamental change. See Eric V. Larson, David T. Orletsky, and Kristin Leuschner, *Defense Planning in a Decade of Change: Lessons from the Base Force, Bottom-Up Review*, and *Quadrennial Defense Review* (Washginton, D.C.: RAND, 2001).

[77] On the issue of the fractious nature of and paralysis in defense reform during the 1990’s, see Owens, *Lifting the Fog of War*, pp. 32-41, 207-230. See also, Richard H. Kohn, “The Erosion of Civil Control of the Military in the United States Today,” *Naval War College Review* (Summer 202, Volume LV, Number 3), pp. 12-14. Lawrence Korb, interview by PBS Frontline, at www.pbs.org/wgbh/pages/frontline/shows/future.

[78] The Joint Staff, Joint Vision 2010, p. 1. < http://www.dtic.mil/jv2010/jvpub.htm> (2 September 2002). Hereafter cited as JV2010.

[79] JV2010, p. 13.

[80] JV2010, pp. 13, 32. William S. Cohen, *Report of the Quadrennial Defense Review*, May 1997, pp. vi, see also p. 39. <http://www.defenselink.mil/pubs/qdr/> (15 January 2003).

[81] For an uncritical summary of the Army’s division redesign, see Billy J. Jordan and Mark J. Reardon, “Restructuring the Division: An Operational and Organizational Approach,

Military Review, May-June 1998. http://www.fas.org/man/dod-101/army/unit/docs/mr-98may-june-jor.htm (12 January 2003).

[82] Eugenia C. Kiesling, *Arming Against Hitler: France and the Limits of Military Planning* (Lawrence Kansas: University Press of Kansas, 1996), pp.136-143, 175-181. Quotation is from page 180.

[83] Robert Doughty, *The Breaking Point: Sedan and the Fall of France, 1940* (Hamden, Conn.: Archon Books, 1990), esp. 27-32.

[84] Conrad Crane, *Bombs, Cities and Civilians: American Airpower Strategy in World War II* (Lawrence, Kansas: University Press of Kansas, 1993), p. 158. Tami Biddle, *Rhetoric and Reality in Air Warfare:The Evolution of British and American Ideas About Strategic Bombing, 1914-1945* (Princeton, NJ: Princeton University Press, 2002), p. 300. See also Michael Sherry, *The Rise of American Airpower: The Creation of Armageddon* (New Haven: Yale University Press, 1987), esp. pp. 22-46. For pronouncements of air power's decisiveness prior to World War II, see William Mitchell, *Winged Defense* (New York: GP Putnam's Sons, 1925) and Alexander P. DeSeversky, *Victory Though Airpower* (New York: Simon and Schuster, 1942). Air power enthusiasts' claims of decisiveness after a conflict despite evidence to the contrary has been a pattern. See, for example, the position of the Air Force historian that air power was decisive in both Korea and Vietnam in "Why American Needs to Maintain Its Air Superiority," *Washington Times*, 6 July 1998, p. 13. At the end of the 1991 Gulf War, the Air Force Chief of Staff announced that Desert Storm was "the first time in history" that an enemy Army was "defeated by Air Power." "Transcript of McPeak Briefing on Air Force Air Power in the Iraqi War," *Inside the Air Force*, 22 March 1991, p. 18.

[85] Most observers date the dawn of the new age of precision weapons to the USAF's destruction of the Thanwa Bridge in Vietnam in 1972. See Mark Clodfelter, *The Limits of American Airpower: The American Bombing of North Vietnam* (New York: Free Press, 1986).

[86] Ronald Fogleman, "Strategic Vision and Core Competencies: Global Reach – Global Power," *Vital Speeches*, 1 December 1996, vol. 63, no. 4, pp. 98-100.

[87] Tilford, "Halt Phase Strategy: Old Wine In New Skins…. With PowerPoint," pp. 16-19, 21-25. A RAND study took a "quantitative approach" to estimate the "ability of U.S. forces to damage and halt an invading mechanized ground force" of over twelve heavy armored divisions. The study concluded that "in theaters that do not feature heavily foliated or urbanized terrain" long range weapons systems "will be able to rapidly halt armored invasions short of their objectives" if "sufficient investments are made in the emerging information and firepower systems." See David A. Ochmanek, Edward R Harshberger, David E. Thaler, and Glesnn A. Kent, *To Find and Not to Yield: How Advances in Information and Firepower Can Transform Theater Warfare* (Santa Monica, CA: RAND, 1998). The assumptions and limitations of the study did not prevent air power advocates from recommending that the Army convert heavy forces to the National Guard so the nation could afford more aircraft to carry out the strategy. Rebecca Grant, *Airpower and the Total Force: A Gift of Time,* Arlington, VA, IRIS Independent Research, 1998.

[88] Daryl Press, "The Myth of Air Power in the Persian Gulf War and the Future of Warfare," pp. 33-34.

[89] Department of the Air Force, "The USAF Transformation Flight Plan, FY03-07," HQUSAF/XPXT, Transformation Division, 2002, quotations are from pages viii, 3, and 40.

[90] Owens, *Lifting the Fog of War*, pp. 136-138. See pages 100-112 for the argument that dominant battlespace knowledge will lead to near-perfect mission assignment. Owens' use of history to support his assertions was striking for lack of depth and reasoned argument. Owens contrasted costly land battles such as the Battle of Gettysburg with the initial air strikes in Desert Storm to suggest that technology would make the "inefficient, costly, and bloody" features of war "obsolete." He compares casualties during the landings at Normandy in WWII to the casualties suffered during Desert Storm and asserts technology as the principal cause in the vast difference, failing even to mention geography or the qualitative differences between the German and Iraqi forces. Owens' book has many strengths, however, and the author makes a compelling case and sound suggestions for improvements in joint interoperability.

[91] Admiral Vern Clark, "Sea Power 21: Projecting Decisive Joint Capabilities," *Proceedings*, October 2002, www.usni.org/PROCEEDINGS/ARTICLES02/PROCNO10.HTM (15 November 2002). In the early to mid 1990s, the Navy, in the midst of the dramatic reductions of force that attended the end of the Cold War, shifted emphasis from deep-ocean operations and nuclear deterrence to power projection in regional conflicts. In two documents, "…From the Sea," published in 1992 and "Forward…From the Sea" published in 1994, the Navy focused on expeditionary warfare. In the meantime, naval officers were among those who embraced the revolution in military affairs and the belief that emerging technologies would reduce greatly the degree of uncertainty in future war.

[92] All quotations are from Vice Admiral Richard W. Mayo and Vice Admiral John Nathman, "ForceNet: Turning Information into Power," *Proceedings*, February 2003. Article is available on the worldwide web at www.usni.org/PROCEEDINGS/Articles03/PROmayo02.htm

[93] Admiral Vern Clark, "Sea Power 21: Projecting Decisive Joint Capabilities," *Proceedings*, October 2002, Available on the internet at www.usni.org/PROCEEDINGS/ARTICLES02/PROCNO10.HTM.

[94] Vice Admiral Richard W. Mayo and Vice Admiral John Nathman, "ForceNet: Turning Information into Power," *Proceedings*, February 2003. <http//www.usni.org/PROCEEDINGS/Articles03/PROmayo02.htm> (15 March 2003).

[95] One contracted concept developer identified "posited advances in genetic algorithms/intelligent agents and general acceptance of a new paradigm for maneuver warfare in the twenty-first century" as the assumptions on which he based his efforts. He observed that any consideration of combat on land was too specific for his level of interest. E-mail to author, October 2002.

[96] Daniel Goure and Stephen Cambone, "The Coming Age of Air and Space Power," in Daniel Goure and Christopher Szara, eds., *Air and Space Power in the New Millenium*," (Washington, D.C.: Center for Strategic and International Studies, 1997) pp. 8-11. The authors used anti-Scud missile launcher operations in Desert Storm to make the point that the United States had the ability to acquire information from half-way around the world, then "communicate the knowledge so gained in a useful form anywhere in the world. Moreover it demonstrated that we can act on that information." They failed to mention that, based on enemy countermeasures such as frequent movement, concealment, and deception, not one mobile Scud missile launcher was destroyed during these operations.

[97] C. Kenneth Allard, "Information Warfare: The Burden of History and the Risk of Hubris," in Stuart J.D. Schwartzstein, ed., *The Information Revolution and National Security: Dimensions and Directions* (Washington, D.C.: Center For Strategic and International Studies, 1996).

[98] Naval operations are also characterized by a strong tradition of decentralization of authority to the captains of ships whom must be prepared to make quick decisions on which the fate of his ship, crew and mission rest.

[99]Terrorists used an explosive laden civilian craft to ram the ship and blow a hole in her side, almost sinking her. An investigation concluded that is was very unlikely that the attack could have been identified and prevented. Roberto Suro, "Pentagon Avoids Individual Punishment in Cole Attack," *Washington Post*, January 20, 2001; Page A01.

[100] Headquarters United States Marine Corps, "Expeditionary Maneuver Warfare: Marine Corps Capstone Concept," undated, <http//www.doctrine.usmc.mil/emw.htm> (5 January 2003). These views are consistent with an earlier document, "Operational Maneuver From the Sea," available on the worldwide web at http://www.dtic.mil/jv2010/usmc/omfts.pdf (5 January 2003).

[101] Halberstam, *War in a Time of Peace*, p. 56.

[102] Halberstam, *War in a Time of Peace*, pp. 309-357. Benjamin S. Lambeth, *The Transformation of American Airpower* (Ithaca, NY: Cornell University Press, 2000), pp. 173-180.

[103] Department of Defense, Report to Congress, "Kosovo/Operation Allied Force After Action Report," 30 January 2000, pp. 2, A7.

[104] Madeline Albright as quoted in Earl Tilford, "Operation Allied Force and the Role of Air Power," *Parameters,* Winter 1999-2000, pp. 24-38.

[105] Greece and France were the primary nations who opposed more resolute military action against Milosevic's forces and in Serbia.

[106] Halberstam, *War in a Time of Peace*, pp. 444-453. See also Michael Ignatieff, "The Virtual Commander: How NATO Invented a New Kind of War," *New Yorker*, 2 August 1999, pp. 33-35.

[107] Andrew J. Bacevich, "Neglected Trinity: Kosovo and the Crisis in Civil-Military Relations," in Cohen and Bacevich, eds., *War Over Kosovo*, pp. 155-157. See also Halberstam, *War in a Time of Peace*, pp. 420-435. See also Michael Ignatieff, *Virtual War: Kosovo and Beyond*, (London: Random House, 2000), pp. 176-179.

[108] Benjamin Lambeth, *NATO's Air War for Kosovo: A Strategic and Operational Assessment* (RAND: Santa Monica, CA, 2001), pp. 199-204.

[109] Philip A. Haun, "Air Power versus a Fielded Army: A Construct for Air Power in the 21st Century," Research Project, Air University, Maxwell Air Force Base, Alabama. April 2001,

pp. 17-18. https://research.maxwell.af.mil/papers/student/ay2001/acsc/01-054.pdf (15 January 2003).

[110] Lambeth, *NATO's Air War for Kosovo,* pp. 32-33.

[111] Lambeth, *NATO's Air War for Kosovo,* pp. 21-22, 26, 64, 117-118.

[112] For a summary of the impediments to target identification and other factors that limited military operations, see Phillip M. Haun, "Air Power versus a Fielded Army," pp. 13-23.

[113] Michael Ignatieff, *Virtual War,* p. 97.

[114] Earl Tilford, "Operation Allied Force and the Role of Air Power," *Parameters,* Winter 1999-2000, pp. 24-38. Lambeth, *NATO's Air War for Kosovo: A Strategic and Operational Assessment*, pp. 24-25, 28-29, 60.

[115] Earl Tilford, "Operation Allied Force and the Role of Air Power," *Parameters,* Winter 1999-2000, pp. 24-38. Benjamin Lambeth, *NATO's Air War for Kosovo,* pp. 128-133. See also, Richard J. Newman, "The Bombs that Failed in Kosovo," *U.S. News and World Report*, 20 September 1999, p. 29.

[116] William Cohen as quoted in Thomas, "Kosovo and the Current Myth…", *Parameters.*

[117] Lambeth, *NATO's Air War for Kosovo*, pp. 144-147.

[118] Thomas, "Kosovo and the Current Myth of Information Superiority," *Parameters*,

[119] Lambeth, *NATO's Air War for Kosovo*, pp. 136-139.

[120] Lambeth, *NATO's Air War for Kosovo,* pp. 138-139.

[121] Lambeth, *NATO's Air War for Kosovo,* pp. 136-147.

[122] Lambeth, *NATO's Air War for Kosovo*, pp. 242-248.

[123] Lambeth, *NATO's Air War for Kosovo*, pp. 56-59, 68-86. See also Ivo H. Daalder and Michael E. O'Hanlon, *Winning Ugly: NATO's War to Save Kosovo* (Washington, D.C.: Brookings Institution, 2000), pp. 3-5, 199, 203-205.

[124] O'Hanlon, *Technology and Future War*, pp. 132-133, 194. The most significant new sensor capability in Kosovo was the UAV. As a comprehensive study on emerging technologies concluded, "UAVs have a limited ability to deal with ambiguity….UAVs should be able to deal with ambiguity, but this ability exceeds the existing technological capabilities of sensors and computers." David B. Glade II, "Unmanned Aerial Vehicles," in William C. Martel, ed., *The Technological Arsenal: Emerging Defense Capabilities*, p. 192. John Matsumura et. al., *Exploring Advanced Technologies for the Future Combat Systems Program*, (Santa Monica, CA: RAND, 2002), esp. pp. 11-19, 59.

[125] Benjamin Lambeth, *NATO's Air War for Kosovo,* p. 179.

[126]Department of Defense, Report to Congress, "Kosovo/Operation Allied Force After-Action Report," 31 January 2000, pp. xxii, 52, 55,59,132.

[127] An author of JV2020 indicated that the purpose of the document was to expand the vision another ten years based on "the advancement of information technologies" and how those technologies "changed the modern battlefield." Dan Caterinicia, "Pentagon Revamping 2020 Vision," *Federal Computer Week*, 24 May 2002.

[128] The Joint Staff, *Joint Vision 2020*, Washington, D.C., June 2000, pp. 1, 8-13, 28-29. http://www.dtic.mil/jointvision/jvpub2.htm (8 August 2002). Hereafter cited as JV2020.

[129] In addition to the Department of Defense Report to Congress cited above, see "DARPA Tackles Kosovo Problems, " *Aviation Week and Space Technology*," 2 August 199, p. 55.

[130] Department of Defense, The Joint Staff, "Joint Vision Revision Final Draft," July 2002, p. 10. Near certainty is an assumed precondition for success in war and the basis for Defense Transformation. The following is from pages 26-27. "…C4ISR is the catalyst for transformational change and provides the foundation to help achieve a 'decision superior' joint force. This capability will provide a fused, secure, tailored presentation of the battlespace that enables enhanced awareness and understanding, integrates real and near-real time information with historical data, and supports the joint commander's ability to plan future actions, make and communicate decisions, and assess consequences. This increased ability to generate and share information provides commanders with enhanced C2 capabilities that integrate and fuse both data and information to facilitate decision superiority…. The joint C4ISR infrastructure will create an information synergy that assists decision superiority at all levels. Networked communications and automated processing, exploitation and dissemination of collected intelligence, surveillance, and reconnaissance (ISR) data and information have dramatically increased the quality and timeliness of intelligence available to commanders. The next step will provide more predictive intelligence assessments as part of a common relevant operational picture produced through secure virtual collaboration among geographically dispersed analysts and integrated with operations data. Additionally, technological advances in long-dwell collection assets - such as unmanned aerial vehicles, distributed undersea and unattended ground sensors and space-based collection platforms - combined with ever-improving process capabilities have initiated a revolutionary paradigm shift. Persistent surveillance over large portions of the battlespace will become increasingly possible and improve our ability to anticipate adversary actions, and enhance rapid decision-making. The products of long-dwell assets, coupled with improved human intelligence, highly trained reconnaissance personnel, and enhanced organic sensor and ISR platforms, will enable future joint forces to better maneuver and apply precision fires, while countering an adversary's use of camouflage, concealment and deception."

[131] For a detailed analysis of Task Force Hawk, see Bruce R. Nardulli, Walter L. Perry, Bruce Pirnie, *et. al*., *Disjointed War: Military Operations in Kosovo, 1999,* (Washington, D.C.: RAND, 2002), pp. 57-97. For a detailed list of lessons the Army identified in Kosovo, see United States General Accounting Office, "Kosovo Air Operations: Army Resolving Lessons Learned Regarding the Apache Helicopter," March 2001.

[132] For a summary of Army Transformation Efforts in the 1990s, see Bruce R. Nardulli and Thomas L. McNaugher, "The Army: Toward the Objective Force," in Hans Binnendijk, ed., *Transforming America's Military*, pp. 101-128. On funding shifts, see "Objective Force Funds Boosted At The Expense Of Legacy Efforts," *Inside The Army,* February 3, 2003 , p. 14.

[133] In 1996, for example, training and doctrine command commander General William Hartzog wrote, "The information age is upon us…The very nature of warfare is changing…The view of the future we see envisions a new battlefield; one where we gather, process, and use information differently than ever before. This information will then empower us as we field and fight the most lethal land force in the world." U.S. Army Training and Doctrine Command, *Land Combat in the 21st Century*, 1996, page 1

[134] On the original tactics for the Interim Brigade Combat Team and assumptions concerning "situational understanding," see Center for Army Lessons Learned Newsletter No. 118, "Army Transformation Taking Shape…Interim Brigade Combat Team Tactics, Techniques, and Procedures," July 2001, U.S. Army Center for Army Lessons Learned, Fort Leavenworth, Kansas. For a summary of the origins and initial progress of the Objective Force and Interim Brigade Combat Team initiatives, see Bruce R. Nardulli and Thomas L. McNaugher, "The Army: Toward the Objective Force," in Hans Binnendijk, ed., Transforming America's Military (Washington, D.C.: National Defense University Press, 2002), pp. 101-128.

[135] See, for example, Department of the Army, FM3-90, *Tactics*, (Washington, D.C.: Government Printing Office, 2001), pp. 1-5—1-9, 1-11—1-15, 6-10—6-14, 9-2, 13-13—13-19.

[136] FM1 *The Army*, Headquarters, Department of the Army, Washington, DC, 14 June 2001. < http://www.army.mil/features/FMI+FM2/FMIFM2.htm> (15 January 2003).

[137] This view pervades most Army documents written since 2001. Honorable Thomas E. White and General Eric K. Shinseki, *A Statement on the Posture of the United States Army 2003*, 11 February 2003, p. 32. Department of the Army, *Army Transformation Roadmap, 2002*. http//www.army.mil/vision/Transformation_Roadmap.pdf (1 March 2003).

[138] Department of the Army, Unit of Action Maneuver Battle Lab, "Change 1 to TRADOC Pamphlet 525-3-90 O&O: The United States Army Objective Force Operational and Organizational Plan Unit of Action," US Army Armor Center, Fort Knox, KY, 22 November 2002, pp. 1-4—1-11, 3-1. Emphasis in quotation is in the original.

[139] Department of the Army, Unit of Action Maneuver Battle Lab, "Change 1 to TRADOC Pamphlet 525-3-90 O&O: The United States Army Objective Force Operational and Organizational Plan Unit of Action," US Army Armor Center, Fort Knox, KY, 22 November 2002, pp. 4-1—4-5. See also, Department of the Army, *Army Transformation Roadmap*, 2002, p. 7.

[140] Department of the Army, *Army Transformation Roadmap*, 2002, p. F1.

[141] Department of the Army, *Army Transformation Roadmap*, 2002, p. 7, p. G-3.

[142] John Matsumura et. al., Exploring Advanced Technologies for the Future Combat Systems Program, (Santa Monica, CA: RAND, 2002), esp. p. 59.

[143] Williamson Murray and Richard Sinnreich, "Joint Warfighting in the Twenty-first Century," unpublished paper, p. 23. See also Richard Simpkin, *Race to the Swift: Thoughts on Twenty-First Century Warfare* (London: Brassey's, 1985), pp 57-77.

[144] Department of the Army, Unit of Action Maneuver Battle Lab, Change 1 to TRADOC Pamphlet 525-3-90 O&O: *The United States Army Objective Force Operational and*

Organizational Plan Unit of Action, US Army Armor Center, Fort Knox, KY, 22 November 2002, pp. 4-4—4-5.

[145] For a list of these article and statements, see Stephen Biddle, "Afghanistan and the Future of Warfare: Implications for Army and Defense Policy," Strategic Studies Institute, Carlisle Barracks, PA, November 2002, pp. 1-3.

[146] Biddle, "Afghanistan and the Future of Warfare," p. 6.

[147] Biddle, "Afghanistan and the Future of Warfare," p.11. On bin Laden's deception, see Peter Fin, "Bin Laden Used Ruse to Flee," *Washington Post,* 21 January 2003, Page A01

[148] Admiral Arthur Cebrowski as quoted in "An Interview with the Director," *Fateful Lightning*, October 2002. Available on the worldwide web at http://e-reservist.net/SPRAG/TransformationInterview.

[149] Jason Amerine as quoted in an interview on PBS *Frontline*. www.pbs.org/wgbh/pages/frontline/shows/campaign/interviews/amerine (1 March 2003).

[150] *Ibid.*

[151]On the enemy's ability to adapt, see Biddle, "Afghanistan and the Future of Warfare" and Robert Andrews, "Al Qaeda's Troops Have Adapted. Have Ours?" *Washington Post*, 22 September 2002, p. B2.

[152] Biddle, *Afghanistan and the Future of Warfare*, pp. 15-19.

[153] Dodge Billingsley, "Ice, Snow And Bullets," March 8, 2002, www.cbsnews.com (15 March 2003).

[154]Except as otherwise noted, the above account of Operation Anaconda is summarized from Biddle, "Afghanistan and the Future of Warfare," pp. 28-38. See also pages 43-45.

[155] Joint Experiments scheduled for May 2003 and beyond were to test concepts that were "knowledge centric" and assumed "anticipatory understanding." US Joint Forces Command J9, "Pinnacle Series Game Overview: 'A Wargame and a Discovery Experiment,'" undated briefing. US Joint Forces Command J9, "Campaign Plan 2003-2009 Information Briefing," 14 March 2003. Knowledge centric operations are assumed to replace mass and "produce desired effects with the right amount of force." They also permit commanders to "avoid unfavorable engagements" and "create cascading efficiencies while employing limited resources."

[156] Rosen, *Winning the Next War*, pp. 109-110.

[157] Michael Howard, "The Use and Abuse of Military History, in Michael Howard, ed., *The Causes of War and Other Essays*, (Cambridge, Mass.: Harvard University Press, 1983), p. 195.

[158]Williamson Murray, "Thinking About Innovation," *Naval War College Review* Spring 2001, Vol. LIV, No. 2, pp. 126-127. Colin Gray, *Modern Strategy* (New York: Oxford University Press, 1999), p. 201. For an example of a linear, simplistic interpretation of the influence of technology on war, see David Alberts, John Gartska, and Frederick Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority* (Washington, D.C.: Command and Control Research Program, 1999), p. 27.

[159] Earl Tilford, "The Revolution in Military Affairs: Prospects and Cautions," 23 June 1995, Strategic Studies Institute, Carlisle Barracks, Pennsylvania, pp. 10-13. http://www.carlisle.army.mil/ssi/pubs/1995/rmapros/rmapros.pdf (3 February 2003).

[160] This point if from Tilford, "The Revolution in Military Affairs," pp. 11-12

[161] David Gompert and Irving Lachow, "Transforming U.S. Forces: Lessons from the Wider Revolution,", RAND Issue Paper, 2000, p. 2. <www.rand.org/publications> (15 November 2002). On the general assumption that IT would have an effect on war similar to its effect on business and the economy, see Alberts, Gartska, and Stein, *Network Centric Warfare*, pp. 25-85. For a summary and critique of this viewpoint see Earl Tilford, "The Revolution in Military Affairs."

[162] Arthur K. Cebrowski and John J. Gartska, "Network Centric Warfare: Its Origin and Future," *Proceedings*, January 1998, p. 32.

[163] Alberts, et. al. *Network Centric Warfare*, p. 26.

[164] Ibid. p. 36, pp. 245-265.

[165] Cebrowski and Garstka, "Network Centric Warfare: Its Origin and Future." See also, Alberts, Garstka, and Stein, *Network Centric Warfare,* pp. 15-85.

[166] Cebrowski and Garstka, "Network Centric Warfare: Its Origin and Future."

[167] Ibid.

[168] Alvin and Heidi Toffler, *War and Anti War*, pp. 38, 57-80.

[169] ,Alberts, Garstka, and Stein, *Network Centric Warfare*, pp. 22-23.

[170] The most succinct description that blends all of these concepts in a way that appears sound and cogent relative to much of the literature can be found in the draft Joint Operations Concept. "Major Combat Operations are conducted in a campaign consisting of sequential, parallel, and simultaneous actions distributed throughout the physical, information, and cognitive domains of the global battlespace Operations will attempt to sustain an increased tempo, placing continuous pressure on the adversary, and will harmonize military action with the application of other instruments of national power. The campaign is designed to dismantle an adversary's system of offense and defense. It will preempt their freedom of action, destroy critical capabilities, and as rapidly as possible, isolate enemy forces and deny them sanctuary, the ability to maneuver and reconstitute, thereby allowing their defeat or destruction through the integrated application of air, ground, maritime, space, and information capabilities." The Joint Staff, Joint Operations Concept, "Full Spectrum Dominance Through Joint Integration," Joint Staff Working Draft Version 4.8, 10 February 2003, p. 28.

[171] This is summarized from multiple sources that discuss Rapid Decisive Operations and Effects-Based Operations. Joint Capstone Concept, version 4.8, pp. 14-19. J9 Concepts Department, US Joint Forces Command, "A Concept Framework for Joint Experimentation: Effects-based Operations," 20 July 2001. See J9 Joint Futures Lab, U.S. Joint Forces Command, "Toward a Joint Warfighting Concept: Rapid Decisive Operations," RDO

Whitepaper Version 2.0, 18 July 2002, esp. pp. 6-17. Quotations are from p. 7. In his recent book on Effects-based Operations, Edward Smith stated that effects would be "cumulative over time." Edward Smith, *Effects Based Operations: Applying Network-Centric Warfare in Peace, Crisis, and War.* (Washington D.C.: CCRP), November 2002, p. xv.

[172] US Joint Forces Command, Notes from Distributed Operations Workshop 3-4, December 2002. Concept developers identified "knowledge" as the critical enabler of distributed operations and also identified the risks associated with conducting distributed operations without information superiority.

[173] Arthur K. Cebrowski and Thomas P.M. Barnett, "The American Way of War," *Proceedings*, January 2003, pp. 42-43. Others have even higher hopes for Effects Based Operations. Air Force Major General David Deptula suggested the following: "I want to see a set of integrated physical and cognitive effects models that could help this nation achieve its national security objectives without the adversary even knowing that he's been influenced." Major General David Deptula, USAF, A Dialogue on Analyzing Effects Based Operations (EBO), an interview by Dr. Jacqueline Henningsen, Director, Air Force Studies & Analyses Agency, www.mors.org/publications/phalanx/mar02/Lead2.htm (3 January 2003).

[174] Ariel E. Levite and Elizabeth Sherwood-Randall, "The Case for Discriminate Force," *Survival*, vol. 44, no. 4, Winter 2002-2003, pp. 81-98.

[175] Thomas Picks, "Calibrated War Makes Comeback" The Washington Post, 21 March 2003 page A1.

[176] Levite and Sherwood-Randall, "The Case for Discriminate Force," pp. 81-98.

[177] See, for example, Cebrowski, "New Rules for a New Era."

[178] H.R. McMaster, *Dereliction of Duty: Lyndon Johnson, Robert McNamara, The Joint Chiefs of Staff and the Lies that Led to Vietnam* (New York: HarperCollins, 1997), pp. 72-85, 182-189, 217-221. On the fundamental problems with using air power for coercion, see Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, NY: Cornell University Press, 1996), esp. pp. 314-331.

[179] McMaster, *Dereliction of Duty*, 155-158

[180] David S. Alberts, *Information Age Transformation: Getting to a 21st Century Military*, 2d. ed., (Washington, DC: CCRP, 2002), pp. 13-14.

[181] Whitney Tilson, "Cisco's Hubris," *The Motley Fool*, 14 August 2001, available on the internet at www.fool.com

[182] The JV2010 concepts of Dominant Maneuver, Precision Engagement, Focused Logistics, and Full-Dimensional Protection are all based on "improved command, control, and intelligence, which can be assured by information superiority." Dominant Maneuver assumed a "full picture of the battlefield." Precision Engagement was based on "near real-time information about the target" and a "common awareness of the battlespace." Full Dimension Protection required "a joint architecture built upon information superiority." Focused logisitics also

depended on highly accurate information to track logistical status and predict demands. Joint Vision 2010, esp. p. 19.

[183] Government Accounting Office, "Military Transformation: Actions Needed to Better Manage DOD's Joint Experimentation Program," August 2002, pp. 5-6.

[184] See, for example, United States Joint Forces Command, "2002 Joint Experimentation Annual Report to Congress, 1 December 2002. Hereafter cited as "2002 Joint Experimentation Annual Report."

[185] "2002 Joint Experimentation Annual Report," p. 8, 11.

[186]"2002 Joint Experimentation Annual Report," p. 5.

[187] "2002 Joint Experimentation Annual Report," p. 17.

[188] The account of Millenium Challenge 2002 is summarized from the following sources. Quotation is from Richard Hart Sinnreich, "Cooking the Books Won't Help the Military Transform," *Lawton Constitution,* 18 August 2002, p. 4. See also"Get the Facts:Was it a Test or a PR Exercise?" *Fayetteville Observer*, 20 August 2002. Sean Naylor, "War Games Rigged? General Says Millenium Challenge 02 was Almost Entirely Scripted," *Army Times*, 16 August 2002. Mackubin Thomas Owens, "War Games are Still Just Games," *Wall Street Journal*, 29 August 2002.

[189] Huba Wass de Czega, "02 Wargaming Insights," unpublished paper, December 2002, esp. pp. 1-3.

[190] Carl, von Clausewitz, *On War*, p. 187.

[191] Williamson Murray, "Red Teaming: Its Contribution to Past Military Effectiveness," unpublished paper, Department of Defense, Joint Advanced Warfighting Project, 2002.

[192] The following books examine causes of surprise and failures to act on warnings. Michael I. Handel, ed., *Strategic and Operational Deception in the Second World War* (London: Frank Cass, 1987). Donald C. Daniel and Katherine L. Herbig, eds., *Strategic Military Deception* (New York: Pergamon, 1982). Roberta Wohlstetter, *Pearl Harbor: Warning and Decision* (Stanford: Stanford University Press, 1962).

[193] Martin van Creveld, *Command in War* (Cambridge, Massachusetts: Harvard University Press, 1985), p. 275.

[194] Michael Andrews as quoted in Dylan Machan, "A Few Good Toys," *Forbes*, Dec. 9, 2002. Department of the Army, "The Objective Force," Objective Force Task Force White Paper, 8 December 2002, p. 18. Comment on RAND analysts is based on conversations with people involved in the tests.

[195] Colin S. Gray, "Defining and Achieving Decisive Victory," Strategic Studies Institute, Carlisle Bks, PA, April 2002, p. 25.

[196] Qiao Liang and Wang Xiangsui, *Unrestricted Warfare*, trans. FBIS (Beijing: Peoples Liberation Army Literature and Arts Publishing House, February 1999), pp. 215, 221.

[197] For Secretary Rumsfeld's comments, see Molly Peterson, "Defense Chief Outlines Challenges of Information Warfare," Government Executive Magazine, 16 August 2002. Available on the worldwide web at www.govexec.com. For countermeasures under development that threaten American communications and "network-centric" capabilities, see: O'Hanlon, *Technology and Modern War*, pp. 58-61, 195-196. The Chinese are pursuing electo-magnetic pulse weapons and other countermeasures. Mark A. Stokes, "Chinese Ballistic Missile Forces in the Age of Global Missile Defense: Challenges and Responses," in Andrew Scobell and Larry Wortzel, eds., *China's Growing Military Power: Perspectives on Security, Ballistic Missiles, and Conventional Capabilities*, (Carlisle Barracks, PA: Strategic Studies Institute, 2002), pp. 135-136. See also, Susan Pushka, "Rough But Ready Force Projection: An Assessment of Recent PLA Training," in the same volume, pp. 240-241. See also essays in Steven Lambakis, James Kiras, and Kristin Kolet, eds., *Understanding "Asymmetric" Threats to the United States*, (Washington D.C.: National Institute for Public Policy, 2002). Marie Squeo, "US Military's GPS Reliance Makes a Cheap, Easy Target," *Wall Street Journal*, 24 September 2002.

[198] Arthur Cebrowski and Thomas P.M. Barnett, "The American Way of War," *Transformation Trends*, 13 January 2003. http://www.oft.osd.mil/ (20 March 2003).

[199] In addition to the numerous examples already provided, diversification of capabilities and the formation of smaller, autonomous units is consistent with general methods for coping with uncertainty and complexity. See F. David Peat, *From Certainty to Uncertainty: The Story of Science and Ideas in the Twentieth Century* (Washington, D.C.: Joseph Henry Press, 2002), esp. pp. 143-144.

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