AIR UNIVERSITY

DTIC
ELECTE
MAR 0 7 1994
S D
F

John Boyd and John Warden

Air Power's Quest for Strategic Paralysis

DAVID S. FADOK, Major, USAF

School of Advanced Airpower Studies

This document has been approved for public release and sale; its distribution is unlimited.

DTIC QUALITY INSPECTED 4

John Boyd and John Warden

Air Power's Quest for Strategic Paralysis

DAVID S. FADOK, Major, USAF
School of Advanced Airpower Studies

THESIS PRESENTED TO THE FACULTY OF THE SCHOOL OF ADVANCED AIRPOWER STUDIES, MAXWELL AIR FORCE BASE, ALABAMA, FOR COMPLETION OF GRADUATION REQUIREMENTS, ACADEMIC YEAR 1993–94

Accesion For
NTIS CRA&I ☑
DTIC TAB ☐
Unannounced ☐
Justification
By
Distribution /
Availability Codes
Dist | Avail and / or Special
A-1

Air University Press
Maxwell Air Force Base, Alabama

February 1995

19950228 043

Disclaimer

This publication was produced in the Department of Defense school environment in the interest of academic freedom and the advancement of national defense-related concepts. The views expressed in this publication are those of the author and do not reflect the official policy or position of the Department of Defense or the United States government.

This publication has been reviewed by security and policy review authorities and is cleared for public release.

Contents

Chapter		*Page*
	DISCLAIMER	*ii*
	ABSTRACT	*v*
	ABOUT THE AUTHOR	*vii*
1	INTRODUCTION	1
	Notes	4
2	THE NOTION OF STRATEGIC PARALYSIS	5
	Notes	10
3	BOYD'S THEORY OF STRATEGIC PARALYSIS	13
	Notes	20
4	WARDEN'S THEORY OF STRATEGIC PARALYSIS	23
	Notes	30
5	CLAUSEWITZ AND JOMINI REVISITED	33
	Notes	37
6	BOYD, WARDEN, AND THE EVOLUTION OF AIR POWER THEORY	39
	The Past—Paralysis by Economic Warfare and Industrial Targeting	39
	The Present—Paralysis by Control Warfare and Command Targeting	41
	The Future—Paralysis by Control Warfare and Informational Targeting	42
	Notes	44
7	CONCLUSION	47
	Notes	50
	BIBLIOGRAPHY	51

Illustrations

Figure		
1	Boyd's OODA Loop	16
2	Boyd's Theory of Conflict	17
3	Warden's Five Strategic Rings	25
4	Warden's Theory of Strategic Attack	27

Abstract

Throughout air power's inaugural century, theorists have posited numerous schemes to best exploit the air weapon's inherent flexibility and ubiquity. The evolution of air power theory has been fashioned along the way by harsh lessons of war, remarkable advances in technology, and the visionary concepts of a few select airmen.

Two modern-day theorists, Colonels John Boyd and John Warden, have significantly contributed to this evolution through their respective works on *strategic paralysis*. Although currently in vogue in the aftermath of Desert Storm, the notion of strategic paralysis has been around for quite some time. Its historical roots reach back to the writings of the Eastern philosopher of war, Sun Tzu, and the quest for paralysis underpins all theories of strategic conventional air power in one form or another. Characterized by its *nonlethal intent* and promise of force economization, strategic paralysis differs markedly from the more traditional strategies of annihilation and attrition.

Boyd's thoughts on strategic paralysis are *process*-oriented and aim at *psychological* incapacitation. He speaks of folding an opponent back inside himself by operating inside his observation-orientation-decision-action (OODA) loop. This severs the adversary's *external bonds* with his environment and thereby forces an *inward orientation* upon him. This inward focus *necessarily* creates mismatches between the real world and his perceptions of that world. Under the menacing environment of war, the initial confusion and disorder degenerate into a state of *internal dissolution* which collapses his will to resist. To counter this dissolution, Boyd offers the orientation process of "destruction and creation," a form of mental gymnastics designed to permit more rapid construction of more accurate strategies in the heat of battle. His theory of conflict is Clausewitzian in the sense that it is philosophical, emphasizes the mental and moral spheres of conflict, and considers it important to teach warriors how to think—that is, to teach the *genius of war*.

Warden's theory of strategic attack is *form*-oriented and aims at *physical* paralysis. It advocates parallel, inside-out strikes against an enemy's five strategic rings, with unwavering emphasis on the leadership bullseye. Continual differentiation of these rings by air strategists will reveal those centers of gravity *within and between* rings which, when struck, will incapacitate the enemy system through the rapid imposition of either total or partial paralysis. Warden's theory is Jominian in the sense that it is practical, emphasizes the physical sphere of conflict, and considers it important to teach warriors how to act—that is, to teach the *principles of war*.

Boyd and Warden represent a major transition in the evolution of air power theory. Early air power theorists argued that one could defeat the enemy by

paralyzing his war-making and war-sustaining capabilities—a form of *economic warfare based upon industrial targeting*. In contrast, Boyd and Warden contend that one should target enemy command and control—that is, *control warfare based upon command targeting*.

However, the present Information Revolution will likely alter the focus of "control warfare." If current trends in the economic world suggest future changes in all bureaucracies to include the military, then decision making will be decentralized instead of centralized; organizational networks of semiautonomous agents (or agencies) will replace hierarchies; and lateral cooperation will be more vital to system operation than top-down command. As a result, control warfare in the future will be based on creating "non-cooperative centers of gravity" by targeting horizontal information channels instead of vertical command channels.

Thus, air power's brief history has witnessed a steady transformation in strategic paralysis theory from an early emphasis on war-supporting industry to a current emphasis on war-supporting command to a future emphasis on war-supporting information. John Boyd and John Warden have contributed significantly to this evolutionary process.

About the Author

Maj David S. Fadok (BS, United States Air Force Academy; MA, Oxford University) is a C-5 pilot. After graduating with honors from the US Air Force Academy in 1982, he attended Oxford University as a Rhodes Scholar. Following this, he spent a year at Williams AFB, Arizona, in undergraduate pilot training. His first operational flying tour was in the EC-130 at Davis-Monthan AFB, Arizona. In addition to upgrading to instructor pilot, he served as squadron mobility officer, assistant chief of plans and exercises, and pilot course manager. After planning and flying in Operation Just Cause, Major Fadok was reassigned to the C-5 at Travis AFB, California, during which time he participated extensively in Operations Desert Shield and Desert Storm. While upgrading to instructor pilot, he served as executive officer to the wing commander. As a senior pilot with 3,300 hours he was the 1988 recipient of the Secretary of the Air Force Leadership Award, one of Tactical Air Command Instructors of the Year in 1989, and a distinguished graduate from both Squadron Officer School and Air Command and Staff College. Upon graduation from the School of Advanced Airpower Studies, Maxwell AFB, Alabama, he will be reassigned to Headquarters, Air Mobility Command at Scott AFB, Illinois. Major Fadok is happily married to the former Faith Interrante and has two sons, Daniel and James.

Chapter 1

Introduction

A strategist should think in terms of paralysing, not of killing.

—B. H. Liddell Hart, *Strategy*

Since the advent of heavier-than-air flight in 1903, theorists have posited numerous schemes to best exploit the inherent ability of aircraft to rise above the fray of the battlefield and go straight to the heart of an enemy nation. From seeds sown by the Italian pioneers, Gianni Caproni and Giulio Douhet, strategic air power theory has steadily evolved throughout the twentieth century. Along the way it has been fashioned by harsh lessons of war, remarkable advances in technology, and the visionary concepts of a few, select airmen.

Two modern-day theorists, Colonels John Boyd and John Warden, have significantly contributed to this evolutionary process. While Boyd does not offer an air power theory per se, his thoughts on conflict have significant implications for the employment of air power at all levels of war. In contrast, Warden has developed an air power theory, but primarily focuses on the strategic application of the air weapon. This paper summarizes and critiques each man's thoughts as they pertain to strategic conventional air power.[1] It identifies and explains the theoretical linkages and disconnects between the two, and highlights their contributions to the evolution of air power theory.

Specifically, I contend that: (1) Boyd's theory of conflict and Warden's theory of strategic attack share a theme common to most, if not all, theories of conventional air power—the goal of defeating one's adversary by *strategic paralysis*; (2) their divergent thoughts on strategic paralysis represent two distinct traditions regarding the nature and purpose of theory; and (3) together, the paralysis theories of Boyd and Warden represent a fundamental shift in the evolution of strategic air power thought from an emphasis on economic warfare to an emphasis on control warfare.[2]

To demonstrate these assertions, I have subdivided this paper into seven chapters. This first chapter introduces the essay's major themes and outlines the arguments for each by describing the past, present, and future context framing the research.

Chapter 2 examines the idea of paralyzing, or incapacitating, one's opponent in greater detail. Although currently in vogue among civilian and military analysts of the 1991 Persian Gulf War, the notion of strategic paralysis has been around for quite some time. I trace its historical roots to

the ancient writings of the Chinese philosopher of war, Sun Tzu, and demonstrate that, in one form or another, the quest for paralysis underpins all theories of strategic conventional air power. I then produce a working definition of strategic paralysis by examining this concept in light of the theoretical works of British strategist J. F. C. Fuller and German historian Hans Delbruck. This analysis reveals what strategic paralysis is and what it is not.

Chapters 3 and 4 summarizes and critique the theories of strategic paralysis offered by John Boyd and John Warden. In his theory of conflict, Boyd highlights the psychological and temporal aspects of war and argues that one can paralyze an enemy by operating inside his observation-orientation-decision-action (OODA) loop. This can be accomplished by "tightening" friendly OODA loops and/or "loosening" enemy OODA loops. Thus, the key to winning in conflict lies in establishing a *relative advantage* over one's enemy in terms of both OODA loop speed and accuracy. Ultimately, this edge allows one to penetrate the opponent's "moral-mental-physical being" to negate his capability and will to resist through moral alienation, mental disorientation, and physical deprivation.

Warden defines the enemy as a system of five strategic rings and advocates paralysis through aerial attack upon these rings. Listed in descending importance to the proper functioning of the enemy system, these "rings" are leadership, organic essentials, infrastructure, population, and fielded military forces. The innermost ring, leadership, represents the most lucrative target set by which to incapacitate an opponent because it commands and controls all system operations. Consequently, strategic attack should predominantly focus on the enemy's center ring. If a direct strike against this "bullseye" is not politically, morally, or practically feasible, then one can induce system paralysis through attack upon the outer rings (the degree of paralysis varying with the level of objective intent). In any event, the ultimate *target* of all strategic attacks must always be the mind of the *enemy command*. According to Warden, air power is uniquely suited to induce strategic paralysis since it alone can incapacitate all five rings, simultaneously or selectively from the inside out.

Chapter 5 explores the convergence and divergence of both theories. Using a construct developed by political scientist Robert Pape,[3] I demonstrate notable overlap between the ideas of Boyd and Warden. Both men target the enemy command to achieve the desired political ends. They also agree on the mechanism by which attacks upon the designated target produce the desired result; that being, *strategic paralysis*. However, the approach each man takes in developing his respective theory provides an interesting contrast.

Boyd's work reflects the philosophical, or Clausewitzian tradition regarding the nature and purpose of theory; Warden's work reflects the practical, or Jominian, tradition. Whereas Boyd mainly addresses the mental and moral dimensions of conflict, Warden focuses on the physical. Whereas Boyd offers a general "mind-set," or way of thinking, for the airman who seeks to paralyze his opponent, Warden offers a specific "target set," or way of acting. Yet,

although these two airmen represent different theoretical traditions, the tangible nature of Warden's theory of strategic attack against the Five Rings serves to complement Boyd's more intangible theory of conflict.

Chapter 6 argues that, together, Boyd and Warden represent a major transition in the evolution of air power theory. Before the introduction of air war, most military theorists sought to achieve war aims through either the annihilation or attrition of the enemy's armed forces. In contrast, early air power theorists argued that one could achieve war aims more effectively and efficiently by rising above and reaching beyond the engaged surface forces. That is, one could defeat the enemy by paralyzing his war-making and war-sustaining capabilities. What emerged in some quarters during the interwar years was a strategic bombardment doctrine advocating *economic warfare based upon industrial targeting*.

Boyd and Warden represent a shift from this economic warfare to what some term *control warfare*. Boyd's version of control warfare is more *process*-oriented in terms of operating inside enemy OODA loops. On the other hand, Warden's version is more *form*-oriented in terms of parallel, inside-out attack against the enemy's Five Rings. That said, both espouse *control warfare based upon command targeting*.

However, the present Information Revolution will likely alter the focus of control warfare. If current trends in the economic world suggest future changes in all bureaucracies to include the military, then decision making will be decentralized instead of centralized; organizational networks of semiautonomous agents (or agencies) will replace hierarchies; and lateral cooperation will be more vital to system operation than top-down command. As a result, control warfare in the future will be based on creating "non-cooperative centers of gravity"[4] by targeting horizontal information channels instead of vertical command channels.

Thus, as it draws to a close, this first century of air power will have witnessed a steady transformation in strategic paralysis theory from an early emphasis on war-supporting industry to a current emphasis on war-supporting command to a future emphasis on war-supporting information. Boyd and Warden have contributed significantly to this evolutionary process.

The final section reviews the major conclusions of this research and discuss some implications for the organization, equipment, and employment of air power in the twenty-first century. First, in terms of *organization*, decentralization along the lines of the "massively parallel" design of today's advanced computers may be the best way to operate inside the OODA loops of our potential enemies in the "hyperwars" of the twenty-first century. Second, in terms of *equipment*, marrying intelligence "sensors" to weapons "shooters" (either physically or electronically) in the form of "reconnaissance-strike complexes" may offer another technological way to survive and prosper in the fast-paced world of tomorrow. Finally, in terms of *employment*, it may be time to set aside the American distaste for "Pearl Harbor-like" preemptive strategic strikes if information dominance (through control of the aerospace

medium and electromagnetic spectrum) will be decided in the opening moments of future wars. If strategic paralysis is to be a viable game plan for the battlefields of tomorrow, then the armed forces of the United States need to begin preparing today.

Having laid out the central themes and arguments of this work, the stage is set for a more detailed examination of the notion of strategic paralysis.

Notes

1. In this respect, the works of Boyd and Warden represent a resurgence in strategic *conventional* air power theory. As Col Phillip Meilinger argues, the three decades of air power prior to Desert Storm witnessed the diminished doctrinal significance of strategic conventional air power. He cites two primary reasons for this: first, the organizational rise of tactical air power in the era of limited war; and second, the identification of strategic air power with nuclear weapons in the age of the atom. For more details, see Col Phillip S. Meilinger, "The Problem with Our Air Power Doctrine," *Airpower Journal* 6, no. 1 (Spring 1992): 24–31.

2. RAND Corporation's John Arquilla and David Ronfeldt have coined the term *cyberwar*, to describe the nature of future conflict. The prefix "cyber-" comes from the Greek root *kybernan*, meaning to steer or govern. They contend that *cyberwar* is a more encompassing term than *information warfare* since it bridges the fields of information and governance better than does any other available prefix or term. A RAND colleague, Denise Quigley, offers a German term, *Leitenkrieg*, which roughly means *control warfare*. I prefer this latter term to describe the content of Boyd's and Warden's strategic paralysis theories.

3. Pape has introduced a methodology by which to analyze strategic theories, particularly those dealing with the application of coercive air power. Very simply, Pape's approach links military means to political ends by way of "mechanisms." These mechanisms address *why* theorists expect their proposed means, or target sets, to achieve the ends, or desired results. In other words, if a given target is attacked (means), something will happen (mechanism) to produce the desired results (ends). Graphically, it is depicted as: TARGET => MECHANISM => RESULT.

4. John Boyd introduced this novel concept in his "Patterns of Conflict" briefing. Clausewitz defined a *center of gravity* as the "hub of all power and movement," and he beckoned the military strategist to search for a single, omnipotent hub among his opponents. While he recognized that it may not always be possible to reduce several centers of gravity to one, Clausewitz insisted, "There are very few cases where this conception is not applicable." In those rare instances when several centers coexisted, he advocated concentrating attacks upon one or another hub, counting on the devastation to spread to the rest by means of the hub's "sphere of effectiveness." If a given hub's "sphere" was too limited, other centers of gravity would have to be struck to defeat the enemy, as if fighting against "several independent opponents." Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 486, 597.

In contrast, Boyd insists that an enemy possesses many "hubs" which derives their strength more from their external, cooperative connections with each other than from their internal constitutions. As a result, he calls upon the military strategist to forego attacks upon these all-powerful centers and, instead, concentrate on destroying or neutralizing the linkages between the various hubs. For further explanation, see section 3.

Chapter 2

The Notion of Strategic Paralysis

It is the function of grand strategy to discover and exploit the Achilles' heel of the enemy nation.

—B.H. Liddell Hart, *Paris or the Future of War*

Seven years after the "war to end all wars," Basil H. Liddell Hart published the first of his many books on military strategy and modern-day war. Its clever title, *Paris or the Future of War*, recalled the mythical defeat of Achilles by his opponent, Paris, via the surgical strike of a well-aimed arrow. As the title further suggested, attacking enemy vulnerabilities (vice strengths) could and should serve as the role model for the conduct of war in the years ahead. The killing fields of World War I had certainly made Paris' strategy *preferable*; the technologies of flight and mechanization seemed to make it *possible* as well. Thus, the search began for those key vulnerabilities of an enemy nation which were crucial to its survival and protected by the sword and shield of its armed forces. Along the way, the notion of paralysis was reintroduced into the lexicon of military strategy.

******

The roots of strategic paralysis theory reach deep into history. Over two thousand years ago, the Chinese warrior-philosopher, Sun Tzu, laid the theoretical groundwork upon which later strategists would build. "The general rule for the use of the military is that it is better to keep a nation intact than to destroy it. . . . It is better to keep an army intact that to destroy it. . . . Therefore, those who win every battle are not really skillful—those who *render others' armies helpless without fighting* are the best of all"[1] (emphasis added). Furthermore, Sun Tzu advocated swift incapacitation of the enemy. "Therefore, one who is good at martial arts overcomes others' forces without battles, conquers others' cities without siege, destroys others' nations *without taking a long time*"[2] (emphasis added).

The other pillar of current American military thought, Prussian Carl von Clausewitz, is sometimes interpreted as an unwavering strategist of annihilation. However, a closer reading reveals that this is a misinterpretation. As early as 1827, Clausewitz recognized that there were at least two distinct forms of warfare. Ideal, or absolute, war focused on total annihilation of the enemy. In contrast, real war entailed more limited plans of attack in which annihilation was not a strategic option due to restrictions

imposed by political ends and/or military means.[3] As a result of war's dual nature, Clausewitz very carefully defined what he meant by "destruction of the enemy's armed forces" in Book One of *On War*. He writes: "The fighting forces must be *destroyed*: that is, they must be *put in such a condition that they can no longer carry on the fight*. Whenever we use the phrase 'destruction of the enemy's forces' this alone is what we mean."[4] The emphasis on particular words in the quote above was Clausewitz's own, and this is significant. His definition of armed force destruction is as compatible with paralysis as it is with annihilation.

In the wake of the First World War, two British veterans of that tragic carnage weighed in on the side of strategic paralysis—J. F. C. Fuller and Basil H. Liddell Hart. Fuller, the designer of what is perhaps the first modern-day operational plan aimed at enemy paralysis (plan 1919), later wrote: "The physical strength of an army lies in its organization, controlled by its brain. Paralyse this brain and the body ceases to operate."[5] Fuller insisted that such "brain warfare" was the most effective and efficient way to destroy the enemy's military organization and hence its military strength. To economize the application of military force, one needed to produce the instantaneous effects of a "shot through the head," rather than the slow bleed of successive, slight body wounds.[6]

Fuller's kindred spirit in the field of military strategy was Liddell Hart. Like his fellow countryman, Liddell Hart was a vigorous advocate of strategic paralysis. Arguing that "the most decisive victory is of no value if a nation be bled white gaining it," he insisted that the more potent and economical form of warfare was disarmament through paralysis rather than destruction through annihilation.[7]

> A strategist should think in terms of paralysing, not of killing. Even on the lower plane of warfare, a man killed is merely one man less, whereas a man unnerved is a highly infectious carrier of fear, capable of spreading an epidemic of panic. On a higher plane of warfare, the impression made on the mind of the opposing commander can nullify the whole fighting power his troops possess. And on a still higher plane, psychological pressure on the government of a country may suffice to cancel all the resources at its command—so that the sword drops from a paralysed hand.[8]

Fuller and Liddell Hart both witnessed the introduction of the aerial weapon to WWI and both envisioned a decisive role for air power in inducing strategic paralysis. Fuller predicted "an army holding at bay another, whilst its aircraft are destroying the hostile communications and bases *and so paralysing enemy action*"[9] [emphasis added]. Likewise, Liddell Hart reasoned: "Provided that the blow be sufficiently swift and powerful, there is no reason why within a few hours, or at most days from the commencement of hostilities, the nerve system of the country inferior in air power should not be paralysed."[10] They were not alone in their grand visions of air power.

Early air enthusiasts extolled the "third dimension" that the aerial weapon added to the battlefield. The airplane's unique ability to rise above the fray of surface battle led many to speculate that air power could defeat an enemy

nation and its armed forces by incapacitating, or paralyzing, the war-making potential in the rear. Strategic paralysis through aerial attack seemingly promised decisive victory at significantly lower cost in terms of lives and treasure. Many veteran airmen of the First World War supported the cause. Two men stand out because of their influence upon the initial development of strategic air doctrine—Hugh Trenchard and William Mitchell.

Marshal of the Royal Air Force Lord Trenchard, the "Father of the RAF," almost single-handedly shaped the strategic bombardment doctrine for the youngest of Britain's independent services. He believed in strategic paralysis. In a 1928 memorandum to the chiefs of staff on the War Object of an Air Force, Trenchard explicitly stated the goal of air action was "to paralyse from the very outset the enemy's production centres of munitions of war of every sort and to stop all communications and transportation."[11]

Trenchard acknowledged that strategic paralysis would have devastating effects on national morale, but insisted that these moral effects were "the inevitable result of a lawful operation of war—the bombing of a military objective."[12] In addition to this ethical defense, he offered *economical* arguments for pursuing paralysis through air action. He insisted that paralyzing attacks upon those "vital centres" which sustained the enemy's war effort offered "the best object by which to reach victory." This was because they obtain "infinitely more effect" and "generally exact a smaller toll from the attacker" than strikes against the surface and air forces which defended them. In consequence, Trenchard concluded "the weight of the air forces will be more effectively delivered against the targets mentioned above rather than against the enemy's armed forces."[13] Coincidentally, across the Atlantic, a man whom Trenchard met and influenced while on the Western Front was airing similar views in a distinctly American manner.

Brig Gen "Billy" Mitchell certainly played to the crowds in his starring role as America's prophet of air power. But his love of the spotlight and the zeal with which he championed his cause in no way diminish a very significant impact on the development of early air doctrine in the United States. He, too, believed in strategic paralysis. In a 1919 publication nominally devoted to the tactical application of military aeronautics, Mitchell asserted that aerial bombardment's greatest value lay in "hitting an enemy's great nerve centers at the very beginning of the war so as to paralyze them to the greatest extent possible."[14] Six years later, during his well-publicized court-martial, Mitchell spoke fondly of air power's unique ability to incapacitate one's foes. In his last book *Skyways*, Mitchell concluded:

> The advent of air power which can go straight to the vital centers and entirely neutralize and destroy them has put a completely new complexion on the old system of war. It is now realized that the hostile main army in the field is a false objective and the real objectives are the vital centers. The old theory that victory meant the destruction of the hostile main army is untenable.[15]

Clearly, both Lord Trenchard and General Mitchell were early advocates of strategic paralysis. Their hauntingly similar writings proclaim the revolutionary nature of aerial warfare. The airplane possessed a unique

ability to avoid the bloody stalemate on the ground below and to combine shock and firepower into a single weapon able to strike deep into the enemy heartland against his most vital centers. Given the substantial influence of Trenchard and Mitchell on their respective air services, the notion of paralysis became imbedded in the theoretical foundation of British and American strategic air doctrine.

****

This brief review of the history of strategic paralysis reveals its somewhat scattered presence among the works of war theorists before the dawn of the aerial age. However, the turbulence created by the Wright Flyer rocked the world of military thought in the form of strategic air theories which uniformly embraced the notion of paralysis. Before examining two modern-day theories of paralysis, I must present a more precise definition of this fundamental idea which has shaped the evolution of strategic air power thought. To do so, I examine the concept of paralysis in light of the theoretical constructs developed by two preeminent military writers, the British strategist J. F. C. Fuller and the German historian Hans Delbruck. Fuller's typology will help distinguish what strategic paralysis is, while Delbruck's will better demonstrate what it is not.

In *The Foundations of the Science of War*, Fuller set out to examine the nature of war as a science, beginning his study by introducing the concept of the threefold order. He insisted that the threefold order was "a foundation so universal that it may be considered axiomatic to knowledge in all its forms."[16] Since man consisted of body, mind, and soul, wars *as activities of man* must be subject to a similar constitution. Adopting the threefold order as the framework for his military study, Fuller posited three spheres of war—physical, mental, and moral.[17] Respectively, these spheres dealt with destruction of the enemy's physical strength (fighting power), disorganization of his mental processes (thinking power), and disintegration of his moral will to resist (staying power). Fuller added that forces operating within these spheres did so in synergistic, not isolated, ways. "Mental force does not win a war; moral force does not win a war; physical force does not win a war; but what *does* win a war is the highest combination of these three forces acting as *one* force."[18] One may dispute the internal logic or external validity underpinning Fuller's contention that the threefold order is the foundation of all knowledge, including that of war's essential nature. That said, his construct is still useful in beginning to understand the essence of strategic paralysis.

Paralysis of an adversary consists of physical, mental, and moral dimensions. As a strategy, it entails the *nonlethal intent* to physically disable and mentally disorient an enemy so as to induce his moral collapse. While *nonlethal intent* does not necessarily preclude destructive action or prevent fatal results, it does seek to minimize these negative outcomes as much as possible.[19] These physical, mental, and moral effects may be short- or long-term, as required by one's grand strategy. Put another way, strategic

paralysis aims at the enemy's physical *and* mental capabilities to *indirectly engage* and defeat his moral will.[20]

In addition to his threefold order, Fuller offers another theoretical proposition in *Foundations* that helps to define strategic paralysis. Appropriate for any scientist of war, Fuller establishes a variety of battle principles to assist his students of military strategy. The overriding principle which governs the conduct of war, the "law" from which he derives nine subordinate principles, is that of *economy of force*. "Throughout the history of war we discover that, in spite of man's ignorance of the science of war, the law of economy of force has been in ceaseless operation. The side which could best economize its force, and which, in consequence, could expend its force more remuneratively, has been the side which has always won."[21] It may be true that Fuller's argument is tautological, as his biographer, Anthony Trythall, contends. However, this point is irrelevant to the current discussion.[22] What Fuller's law contributes to the definition of strategic paralysis is the concept of expending minimum effort to produce maximum effect, something Paris did quite well against his nemesis, Achilles.

Having constructed a partial definition of paralysis (a three-dimensional strategy characterized by nonlethal intent and force economization), we can now examine this notion in light of Delbruck's typology to further refine our concept by demonstrating what strategic paralysis is not. In a truly seminal work with a distinct Clausewitzian flavor, Delbruck presented a comprehensive *History of the Art of War Within the Framework of Political History*. In it, he argued that there are two traditional strategies of combat, annihilation and attrition. In a nutshell, the strategy of annihilation aims to destroy the enemy armed forces, whereas the strategy of attrition seeks to exhaust them. Unfortunately, as Delbruck himself feared, these were misconstrued by the majority of his readers as the strategy of the strong (i.e., quantitatively superior) and of the weak, respectively.

Delbruck coined the term *Ermattungs-Strategie* (strategy of attrition) as an opposite to Clausewitz's *Niederwerfungs-Strategie* (strategy of annihilation), but confessed that "the expression has the weakness of coming close to the misconception of a pure maneuver strategy."[23] He worried that, since *by definition* annihilation strategy always sought destruction of enemy armed forces through decisive battle, his notion of attrition strategy would be misinterpreted as the constant avoidance of battle through maneuver. To clarify, Delbruck further defined the strategy of attrition as "double-poled strategy," one pole being battle and the other being maneuver. A military commander employing an attrition strategy would continually shift between battle and maneuver, favoring one pole over the other as circumstances dictated.[24] Thus, while strategies of annihilation produced rapid decisions through overwhelming defeat of enemy armed force capability, strategies of attrition produced more drawn out affairs capped by the slow but steady softening of the enemy's will.[25]

How, then, does strategic paralysis fit into Delbruck's framework? I contend that it is neither a strategy of annihilation nor of attrition, but

instead a third type of warfare. It does not seek rapid decision via destruction of enemy armed forces in battle. Likewise, it does not seek drawn out decision via exhaustion of the enemy by continual shifting between the poles of battle and maneuver. In contrast to both, it seeks rapid decision via enemy incapacitation *by fusing battle and maneuver*. Battle with enemy armed forces is bypassed in favor of attack upon the sustainment and control of those armed forces. Strategic paralysis is neither pure battle nor pure maneuver, but rather a unique melding of the two—"maneuver-battle" against war-making potential.

To summarize the major aspects of our working definition, strategic paralysis is a military option with physical, mental, and moral dimensions which intends to disable rather than destroy the enemy. It seeks maximum possible political effect or benefit with minimum necessary military effort or cost. It aims at rapid decision through a "maneuver-battle" directed against an adversary's physical and mental capability to sustain and control its war effort to diminish its moral will to resist. With this working definition in place, we now examine the ideas of our first modern-day theorist of strategic paralysis, Col John Boyd.

Notes

1. Sun Tzu, *The Art of War*, trans. Thomas Cleary (Boston and London: Shambhala Publications, Inc., 1988), 66–67.
2. Ibid., 72.
3. For a more detailed explanation of Clausewitz's dual nature of war, see Peter Paret, "Clausewitz," in *Makers of Modern Strategy*, ed. Peter Paret (Princeton, N.J.: Princeton University Press, 1986), 196–97.
4. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 90.
5. J.F.C. Fuller, *The Foundations of the Science of War* (London: Hutchinson and Company, 1925), 314.
6. Ibid., 292.
7. Basil H. Liddell Hart, *Strategy* (London: Faber and Faber Ltd., 1954; reprint, New York: Penguin Books, 1991), 212.
8. Ibid.
9. Fuller, 181.
10. Basil H. Liddell Hart, *Paris: Or the Future of War* (New York: Garland Publishing, Inc., 1972, c1925), 40–41.
11. Quoted in Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany 1939–45*, vol. 4 (London: Her Majesty's Stationery Office, 1961), 72.
12. Ibid., 73.
13. Ibid., 71-76.
14. Quoted in Thomas H. Greer, *The Development of Air Doctrine in the Army Air Arm, 1917–41* (Washington, D.C.: US Government Printing Office, 1985), 9.
15. William Mitchell, *Skyways* (Philadelphia and London: J. B. Lippincott Company, 1930), 255.
16. Fuller, 47.
17. Of interest, Fuller's three spheres bear notable resemblance to Clausewitz's famed "trinity" of armed forces (physical), government (mental), and population (moral).
18. Fuller, 145.

19. It is this nonlethal *intent* that distinguishes paralysis from more traditional strategies of annihilation. A differing opinion is presented by Maj Jason Barlow, "Strategic Paralysis: An Air Power Strategy for the Present," *Airpower Journal* 7, no. 4 (Winter 1993): 4–15. He contends the difference between paralysis and annihilation is one of technological *capability* rather than politico-strategic *intent*.

20. David Shlapak writes of "indirect engagement" as a mode of attack whereby "the effect is meant to be felt primarily elsewhere than at the point of attack." However, he defines paralysis as a "reduction in a combat force element's *capability* resulting from indirect engagement of that element." In contrast, I view paralysis as a direct engagement of physical and mental capabilities so as to *indirectly engage* will. See David Shlapak, "Exploring Paralysis: An Introduction to the Study," PM-107-AF (Santa Monica, Calif., RAND Corporation, December 1992), 5.

21. Fuller, 204.

22. As Trythall writes, "[Fuller's law of economy of force] is tautological; it merely states that the side which fights most effectively wins, and this means nothing since victory is the only valid criterion of the effectiveness of fighting." See Anthony J. Trythall, *Boney Fuller* (New Brunswick, N.J.: Rutgers University Press, 1977), 114. While Trythall's argument is sound, I am concerned here with the general concept of *force economization* as a defining characteristic of strategic paralysis, not with Fuller's insistence that it is *the* law governing military operations.

23. Hans Delbruck, *History of the Art of War Within the Framework of Political History*, vol. 4, trans. W. J. Renfroe, Jr. (Lincoln, Nebr.: University of Nebraska Press, 1986), 279.

24. Generally, though not exclusively, the decision for battle or maneuver was dictated by relative numbers and/or other such *material* considerations. However, they could also include such *political* factors as the aim of the war, possible repercussions within one's own government or nation, and the individuality of the enemy government and people.

25. Hans Delbruck, *History of the Art of War Within the Framework of Political History*, vol. 1, trans. W. J. Renfroe, Jr. (Lincoln, Nebr.: University of Nebraska Press, 1986), 136.

Chapter 3

Boyd's Theory of Strategic Paralysis

Machines don't fight wars. Terrain doesn't fight wars. Humans fight wars. You must get into the mind of humans. That's where the battles are won.

—Col John Boyd

The tactical seeds of John Boyd's theory of conflict were sown throughout an Air Force career spanning nearly three decades. During the Korean War, Boyd, a fighter pilot who flew the F-86 Sabre up and down "MiG Alley," developed his first intuitive appreciation for the efficacy of what he would later refer to as "fast transient maneuvers." Although the Soviet-built MiG-15 was technologically superior in many respects, the F-86's full power hydraulic flight controls provided Sabre pilots with one decisive advantage over their opponents—the ability to shift more rapidly from one maneuver to another during aerial dogfights. Just when the MiG pilot began reacting to the initial Sabre movement, a rapid change in direction would render the enemy response inappropriate to the new tactical situation. This agility contributed to the Sabre pilots' establishment of an impressive 10 to 1 kill ratio against the formidable MiG-15.

Before war's end, Boyd was reassigned as an instructor at the Fighter Weapons School at Nellis AFB, Nevada, where he codified these air-to-air combat lessons of maneuver and countermaneuver in a tactical manual entitled, *Aerial Attack Study*. A few years later at Eglin AFB, Florida, he quantified these tactical ideas in the form of his energy maneuverability theory. Although updated over the years, the basic concepts expressed in Boyd's tactical works have collectively remained the American fighter pilot's bible.

A recognized expert in both the tactical and technical world of aerial combat, Boyd was called to the Pentagon to assist in the plagued FX project. His modifications eventually resulted in the production of today's premier air superiority platform, the F-15 Eagle. However, it was his later work with the YF-16 that confirmed his earlier, implicit affinity for "fast transient maneuvers." Most test pilots favored the YF-16 over its YF-17 competitor because of its superior ability to shift maneuvers more rapidly; that is, "to win more quickly." These pilot testimonials on behalf of agility were additional data stored in the recesses of Boyd's mind on what it took to succeed in combat.

It was not until his retirement that Boyd set out to expand his tactical concepts of aerial maneuver warfare into a more generalized theory of conflict.[1] Beginning in 1976 with a concise, 16-page essay entitled "Destruction and Creation," Boyd's strategic ideas evolved over the next decade into an unpublished, five-part series of briefings, "A Discourse on Winning and Losing." Ironically, the "Discourse" itself is a product of the very process of analysis and synthesis described in "Destruction and Creation," a cognitive process which Boyd insist is crucial to prevailing in a highly unpredictable and competitive world. It is a form of *mental agility*, "a process of reaching across many perspectives; pulling each and every one apart (analysis), all the while intuitively looking for those parts of the disassembled perspectives which naturally interconnect with one another to form a higher order, more general elaboration (synthesis) of what is taking place."[2]

Boyd demonstrated his own capacity to perform these cognitive gymnastics by combining concepts from the seemingly unrelated fields of mathematical logic, physics, and thermodynamics. Analyzing these three discrete sciences, Boyd became the first individual ever to link Godel's incompleteness theorem, Heisenberg's uncertainty principle, and the Second Law on entropy.[3] In doing so, he synthesized the following: *One cannot determine the nature and character of a system within itself and, furthermore, any attempts to do so will lead to greater disorder and confusion.* Upon this single proposition, Boyd would build a comprehensive theory of conflict which linked victory to successfully forcing an *inward-orientation* upon the adversary by folding him back inside himself.

Using the dialectic process of "Destruction and Creation," Boyd embarked upon an in-depth review of military history to unravel the mysteries of success and failure in conflict. This scholarly exercise was undoubtedly influenced by a firm belief in "fast transient maneuvers" instilled during his fighter days. The end product is an eclectic and esoteric discourse on how to survive and win in a competitive world, the substance of which I now discuss in more detail.

****

Boyd's theory of conflict advocates a form of maneuver warfare that is more *psychological and temporal* in its orientation than physical and spatial.[4] Its military object is "to break the spirit and will of the enemy command by creating surprising and dangerous operational or strategic situations."[5] To achieve this end, one must operate at a faster tempo or rhythm than one's adversaries. Put differently, the aim of Boyd's maneuver warfare is to render the enemy powerless *by denying him the time to mentally cope* with the rapidly unfolding, and naturally uncertain, circumstances of war.[6] One's military operations aim to: (1) create and perpetuate a highly fluid and menacing state of affairs for the enemy, and (2) disrupt or incapacitate his ability to adapt to such an environment.[7]

Based upon an analysis of ancient and modern military history, Boyd identifies four key qualities of successful operations—initiative, harmony,

variety, and rapidity.[8] Collectively, these characteristics allow one *to adapt to and to shape* the uncertain, friction-filled environment of war. Boyd credits Clausewitz for recognizing the need to improve one's *adaptability* in war by minimizing one's own frictions. In addition, borrowing from Sun Tzu, Boyd insists that friction can be used to *shape* the conflict in one's favor by creating and exploiting the frictions faced by one's opponent. He then relates this idea of minimizing friendly friction and maximizing enemy friction to his key qualities of initiative, harmony, variety, and rapidity.

To minimize friendly friction, one must act and react more quickly than one's opponent. This is best accomplished by the exercise of *initiative* at the lower levels within a chain-of-command. However, this decentralized control of how things are done must be guided by a centralized command of what and why things are done. This shared vision of a single commander's intent ensures strategic and operational *harmony* among the various tactical actions and reactions. Without a common aim and similar outlook on how best to satisfy the commander's intent, subordinate freedom-of-action risks disunity of effort and an attendant increase in friction.[9]

To maximize enemy friction, one should plan to attack with a *variety* of actions which can be executed with the greatest possible *rapidity*. Similar to the contemporary notion of parallel warfare, this lethal combination of varied, rapid actions serves to overload the adversary's capacity to properly identify and address those events which are most threatening. By steadily reducing an opponent's physical and mental capability to resist, one ultimately crushes his moral will to resist as well.

While Boyd's theory of conflict addresses all levels of war (to include the grand strategic), this discussion focuses on the operational and strategic levels. At the operational level, Boyd speaks of severely disrupting the adversary's combat operation process used to develop and execute his initial and subsequent campaign plans. This disruption occurs by rapidly and repeatedly presenting the enemy with a *combination of ambiguous, but threatening events and deceptive, but* nonthreatening ones. These multiple events, compressed in time, will quickly generate mismatches, or anomalies, between those actions the opponent believes to threaten his survival and those which actually do. The enemy must eliminate these mismatches between perception and reality if his reactions are to remain relevant—that is, if he is to survive.

The operational aim should be to ensure the opponent cannot rid himself of these menacing anomalies by hampering his ability to process information, make decisions, and take appropriate action. In consequence, he can no longer determine what is being done to him and how he should respond. Ultimately, the adversary's initial confusion will degenerate into paralyzing panic, and his ability and/or willingness to resist will cease.

Similarly, at the strategic level, Boyd speaks of penetrating an adversary's "moral-mental-physical being to dissolve his moral fiber, disorient his mental images, disrupt his operations, and overload his system." This three-dimensional being consists of "moral-mental-physical bastions, connections, or

activities that he depends upon."[10] To paralyze this strategic being, Boyd advocates standing Clausewitz on his head. Instead of destroying "hubs of all power and movement," one should create *noncooperative centers of gravity* by attacking the moral-mental-physical linkages which bind the hubs together. At the operational level, the end result is the destruction of the enemy's internal harmony and external connection to the real world. Theoretically, this severing of internal and external bonds produces paralysis and collapses resistance.

In what is perhaps the most well-known feature of Boyd's theory, he contends that all rational human behavior, individual or organizational, can be depicted as a continual cycling through four distinct tasks—observation, orientation, decision, and action. Boyd refers to this decision-making cycle as the "OODA loop." (fig. 1) Using this construct, the crux of winning vice losing becomes the *relational* movement of opponents through their respective OODA loops.[11] The winner will be he who repeatedly observes, orients, decides, and acts more rapidly (and accurately) than his enemy.[12] By doing so, he "folds his opponent back inside himself" and eventually makes enemy reaction totally inappropriate to the situation at hand.[13] The key to attaining a favorable edge in OODA loop speed and accuracy (and, hence, to winning instead of losing) is efficient and effective *orientation*.

To survive and grow within a complex, ever-changing world of conflict, we must effectively and efficiently orient ourselves; that is, we must quickly and accurately develop mental images, or schema, to help comprehend and cope with the vast array of threatening and nonthreatening events we face. This

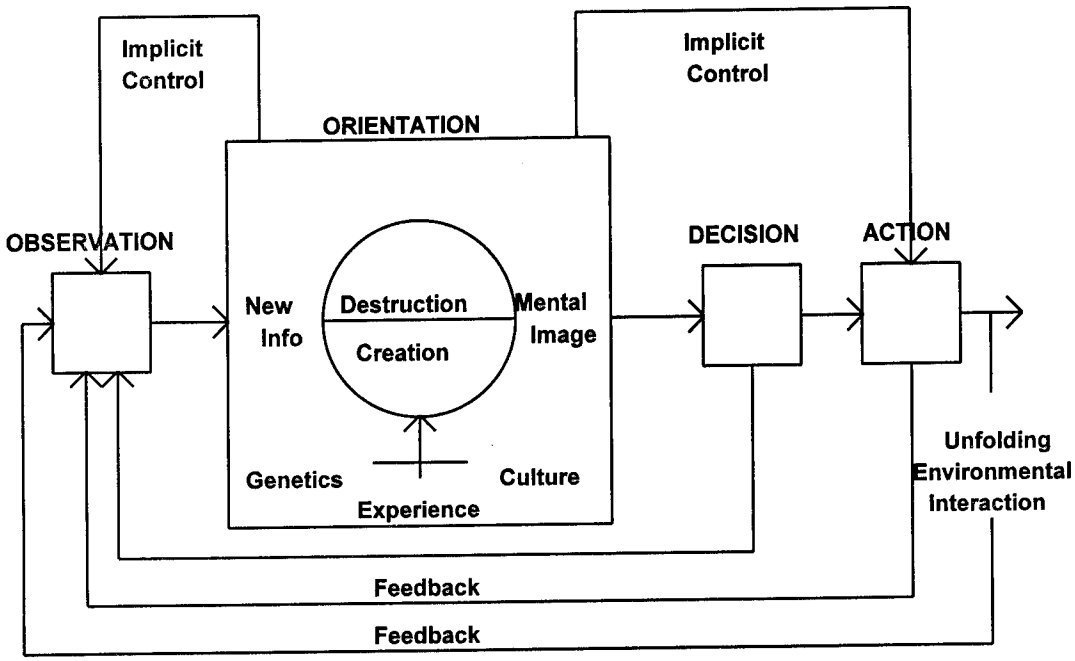

Figure 1. Boyd's OODA Loop

image construction, or orientation, is nothing more than the process of destruction (analysis) and creation (synthesis) described earlier. It is, in Boyd's words, the process of "examining the world from a number of perspectives so that we can generate mental images or impressions that correspond to that world."[14] Done well, it is the key to winning instead of losing. Done exceedingly well, it is the mark of genius.[15]

The mental images we construct are shaped by our personal experience, genetic heritage, and cultural traditions. They ultimately influence our decisions, actions, *and* observations.[16] Observations that match up with certain mental schema call for certain decisions and actions. The timeliness and accuracy of those decisions and actions are directly related to our ability to correctly orient *and reorient* to the rapidly unfolding, perpetually uncertain events of war. Mismatches between the real world and our mental images of that world will generate inaccurate responses. These, in turn, produce confusion and disorientation which then diminish both the accuracy and the speed of subsequent decision making. Left uncorrected, disorientation will steadily expand one's OODA loop until it eventually becomes a death trap.

Tying the preceding comments together, Boyd proposes that success in conflict stems from getting inside an adversary's OODA loop and staying there. The military commander can do so in two supplementary ways. First, he must minimize his own friction through initiative and harmony of response. This decrease in friendly friction acts to "tighten" his own loop (i.e., to speed up his own decision-action cycle time). Second, he must maximize his opponent's friction through variety and rapidity of response. This increase in enemy friction acts to "loosen" the adversary's loop (i.e., to slow down his decision-action cycle time). Together, these "friction manipulations" assure one's continual operation within the enemy's OODA loop in menacing and unpredictable ways. Initially, this produces confusion and disorder within the enemy camp. Ultimately, it produces panic and fear which manifest themselves in a simultaneous paralysis of ability to cope and willingness to resist.

Using an analytical model developed by political scientist Robert Pape, Boyd's theory of strategic paralysis can be graphically depicted as follows in figure 2:

****

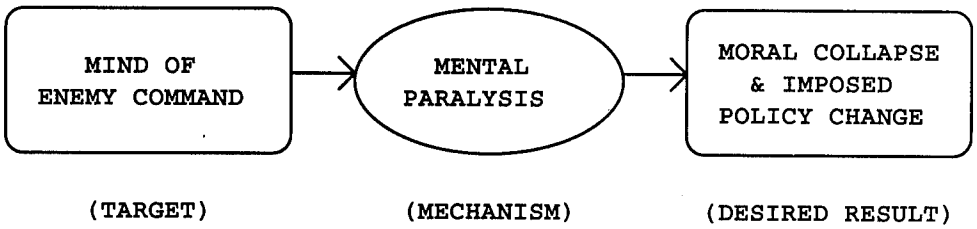

Figure 2. Boyd's Theory of Conflict

As Boyd himself would admit, his theory of conflict is quite esoteric. He speaks of dismembering the "moral-mental-physical being" of the enemy, of getting inside his "mind-time-space," yet offers few, if any, operational details as to how to go about accomplishing these abstract aims. The absence of detail is particularly frustrating for the practically minded war fighter whose profession centers on translating relatively obscure political ends into concrete military ways and means. But while Boyd's purpose is not to frustrate, neither is it to dictate.

As he tells it, John Boyd is a believer in *theories* not theory, in *doctrines* not doctrine.[17] He refuses to advocate any one approach, any one formula; following a single path to victory makes one predictable and vulnerable. Moreover, through the study of all theories and doctrines, the warrior is able to accumulate a full bag of strategic tricks. Then, as a particular conflict unfolds, he can pick and choose from this bag as the situation demands. So, although Boyd's work is void of practical recipes for success, it is so *by design*.[18] A more appropriate critique of his discourse on winning and losing lies elsewhere.

Ironically, one of the greatest strengths of Boyd's theory is, at the same time, a potential weakness—the emphasis on the temporal dimension of conflict. Reflecting an American bias for fast-paced operations and the related preference for short wars, Boyd *presumes* that operating at a faster tempo than one's opponent matters; or, more to the point, that it matters to the enemy. He may not care that we are "OODA looping" more quickly. Indeed, it may be in his interest to refuse to play by our rules. To illustrate this point, I turn to the game of basketball.

If our opponent is not particularly suited to a "fast break" style of play, it is in his interest to slow things down if we are a "run and gun" team. If he refuses to play at our faster pace and intentionally tries to slow things down, he may succeed in taking us out of our game just enough to win—even if we retain a relative advantage in speed throughout. Boyd would no doubt argue that the "fast breaking" side will paralyze its opponent because of its quicker tempo. This point may be true in some instances. It is certainly true if the naturally slower opponent agrees to speed things up. If, however, he slows the pace down, *knowing full well that our fans will not stand for anything but "fast break" ball*, he may frustrate our game plan sufficiently such that, in the end, he is the victor. This basketball analogy seems to apply even better when, as in war, we remove the time clock.

In fact, it was precisely this approach that Mao Tse-tung advocated as the strategy by which to liberate China from the scorch of the Rising Sun in the War of Resistance against Japan. In contrast to both the subjugationists within the Kuomintang government and the theorists of quick victory within his own Communist party, Mao proposed the notion of "protracted war" as the way by which to defeat the militarily superior Japanese aggressors.

In a series of lectures from 26 May to 3 June 1938 , Mao explained and justified his plans for protracted war against Japan, couching his descriptions and arguments in the traditional Eastern dialectic of *yin* and *yang*. For Mao,

this Taoist "duality of opposites" informed not only the object of war, but also the strategy for war. He argued that war aimed at the destruction of one's enemy *and* the preservation of oneself.[19] This two-fold object "is the essence of war and the basis of all war activities, an essence which pervades all war activities, from the technical to the strategic." As such, "no technical, tactical, or strategic concepts or principles can in any way depart from it."[20]

In consequence, he preached that the War of Resistance against Japan should not be characterized by either the "desperate recklessness" of perpetual attack or the "flightism" of perpetual retreat.[21] Instead, the current military advantage enjoyed by Imperial Japan demanded a blend of attack and retreat, a blend of operational/tactical swiftness and strategic protraction. In this way alone could the Chinese resistance simultaneously preserve itself and defeat the enemy through the gradual erosion of his relative superiority.

Mao insisted that calls for quick victory within the Chinese Communist camp were not based upon an objective appraisal of *current capabilities*, and therefore played into the hands of the Japanese army. Similarly, calls for national subjugation within the Kuomintang government were not based upon an objective appraisal of *future possibilities*.

> It follows from the contrast between strength and weakness that Japan can ride roughshod over China for a certain time and to a certain extent, that China must unavoidably travel a hard stretch of road, and that the War of Resistance will be a protracted war and not a war of quick decision; nevertheless, it follows from the other contrast—a small country, retrogression and meagre support versus a big country, progress and abundant support—that Japan cannot ride roughshod over China indefinitely but is sure to meet final defeat, while China can never be subjugated but is sure to win final victory.[22]

In other words, Mao claimed the Chinese could win the War of Resistance against Japan tomorrow if they could survive today. Brandishing time as a weapon to achieve the dual object of enemy destruction and self-preservation, Mao's strategy of protracted war proved successful in the Chinese resistance of Japan and, later, in the Vietnamese resistance of both France and the United States.

Boyd readily acknowledges the influence of Maoism and other Eastern philosophies of war on his own thoughts. This impact is most evident in his emphasis on the temporal dimension of war; specifically, in his incorporation of the notion of *time as a weapon*. Yet, Boyd fails to fully appreciate this weapon in the context of Taoism's *yin* and *yang*. The "duality of opposites" suggests, and twentieth century revolutionary warfare supports, the conclusion that time can be a most potent force in either its contracted or its protracted forms.

****

Throughout his retirement, Boyd has briefed his "Discourse on Winning and Losing" to hundreds of audiences in both civilian and military circles, leaving copies behind to assure a degree of permanence for his ideas. Interestingly, one of the agencies he talked to several times in the early 1980s

was the newly formed Checkmate Division within the Air Staff at the Pentagon. This division's responsibilities include the short- and long-range contingency planning for the employment of the United States Air Force. Eventually, this same division would be run by our second modern-day theorist of strategic paralysis, Col John Warden.[23]

Notes

1. Boyd's ideas have significantly impacted the operational doctrines of both the United States Army, as reflected in Field Manual (FM) 100-5, 1986, and Marines, as reflected in Fleet Marine Force Manual Number 1, 1989. To date, they have had little or no influence upon Air Force or Navy operational doctrines.

2. John R. Boyd, "A Discourse on Winning and Losing." (August 1987) A collection of unpublished briefings and essays. Air University Library, Document No. M-U 30352-16 no. 7791, 2.

3. Very briefly, Godel proved that one could not determine the consistency of a system *within itself*; that is, using its own language and logic. Heisenberg demonstrated that one could not *simultaneously* measure the position and velocity of a particle since the observer intrudes upon the observed, making the true nature of the observed indeterminate. Finally, the Second Law states that, *within closed systems*, the entropy, or state of disorder, is ever-increasing.

4. Boyd's biographer, Grant Hammond, claims that Boyd is doing for time what Sun Tzu did for space. Interview with Grant T. Hammond, 3 February 1994.

5. William S. Lind, "Military Doctrine, Force Structure, and the Defense Decision-Making Process," *Air University Review* 30, no. 4 (May–June 1979): 22.

6. This psychological paralysis often entails physical destruction, but such destruction is never an end in itself.

7. Interestingly, these two aims comprise the essence of *parallel warfare*, a term currently in vogue thanks to the aerial successes enjoyed by coalition air forces during the Persian Gulf War, as well as to the theoretical works of John Warden. See section 4 for additional details.

8. Boyd's analysis is documented in his "Patterns of Conflict" briefing within "A Discourse on Winning and Losing."

9. Boyd's coupling of initiative and harmony stems from his study and acceptance of the German concepts of *Auftragstaktik*—mission order tactics—and *Schwerpunkt*— focus of main effort.

10. Boyd, "Patterns of Conflict" in "A Discourse on Winning and Losing," 141.

11. William S. Lind, "Defining Maneuver Warfare for the Marine Corps," *Marine Corps Gazette* 64 (March 1980): 56.

12. Boyd treats decision making and action taking as the process and product of a unitary rational actor. However, as Graham Allison argues, there are other models of nation-state behavior which account for the *bureaucratic nature of governments* and the complications this introduces into the behavioral equation. See Graham T. Allison, *Essence of Decision* (Boston: HarperCollins Publishers, 1971). Boyd would maintain, however, that minimizing the impact of such bureaucratic factors by streamlining organizational form and process is just another way to enhance your own OODA loop.

13. By "folding an opponent back inside himself," Boyd simply means to restrict an opponent's ability to reorient to a rapidly changing environment.

14. Boyd, "The Strategic Game of ? and ?" in "A Discourse on Winning and Losing," 10.

15. Boyd's dialectic process of destruction and creation corresponds fairly well with the modern scientific literature on genius. In "The Puzzle of Genius" (*Newsweek* 121, no. 26, 28 June 1993), Sharon Begley suggests that genius rests in the ability to combine in novel ways elements from seemingly unrelated fields. Interestingly, Boyd's analysis/synthesis also correlates with the bi-hemispheric organization of the human mind as indicated by modern split-brain research. Pioneered by California Institute of Technology psychologist

R.W. Perry, co-winner of the 1981 Nobel Prize, this research suggests a division of labor between the left and right cerebral hemispheres of the brain. As Jan Ehrenwald explains in *Anatomy of Genius* (New York: Human Sciences Press, 1984), the left side is analytic and rational in its thinking, focusing on the trees. In contrast, the right side is holistic and artistic, focusing on the forest. He then states that concerted evidence supports a combined left- and right-hemispheric approach to the mental process we call "genius." (See pp. 14–19) R. Ochse offers a similar definition of creative genius in *Before the Gates of Excellence* (Cambridge: Cambridge University Press, 1990). It involves "*bringing something into being* that is *original* (new, unusual, novel, unexpected) and also *valuable* (useful, good, adaptive, appropriate)."

16. This is precisely why Boyd claims that *orientation* is the most important portion of the OODA loop.

17. John R. Boyd, interview, 30 March 1994.

18. For those disappointed readers still looking for an operational example of Boyd's ideas, I offer the following two, both of which were acceptable to Boyd as possible applications. The first was mentioned to me by Robert Pape and is the Russian concept of the Operational Maneuver Group (OMG). The OMG is a combined-arms team of raiders, paratroopers, and diversionary units designed to operate *within* enemy formations. As Dr Harold Orenstein describes it, "Such activity changes the classical concept of crushing a formation from without (by penetration, encirclement and blockade) into one of splitting it from within (by raids, airborne landings and diversions)." See Harold Orenstein, "Warsaw Pact Views on Trends in Ground Forces Tactics," *International Defense Review* 9 (September 1989): 1149–52.

A second example specifically relates to air power and revolves around another Russian concept, that of the "reconnaissance-strike complex." In a nutshell, this complex weds real-time intelligence (from space-based surveillance and target acquisition systems) to long-range strike platforms. See Mary C. FitzGerald, "The Soviet Mililtary and the New 'Technological Operation' in the Gulf," *Naval War College Review* 44 no. 4 (Autumn 1991): 16–43. Used in conjunction with comprehensive psychological operations, these platforms would engage in parallel warfare against strategic command, control, communications, computer, and intelligence (C^4I) targets to get inside and disintegrate the enemys "moral-mental-physical being."

19. Clausewitz defines the "ultimate object" of war in identical terms. See Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 484.

20. Mao Tse-tung, *Six Essays on Military Affairs* (Peking: Foreign Languages Press, 1972), 273.

21. Ibid., 299.

22. Ibid., 219-20.

23. In discussing his briefings to the USAF Checkmate Division, Boyd implies that he implanted this idea of strategic paralysis in the Air Staff. (Interview with Boyd, 30 March 1994) However, the historical review in section 2 suggests that this notion has underpinned US strategic air theory from its earliest days. Boyd does not recall briefing John Warden directly and Warden claims to have only a superficial appreciation of Boyd's ideas. He is, however, most familiar with those concerning air combat and energy maneuverability, owing to his fighter background. Interview with Col John A. Warden III, 27 January 1994.

Chapter 4

Warden's Theory of Strategic Paralysis

Real exploitation of air power's potential can only come through making assumptions that it can do something we thought it couldn't do. . . . We must start our thinking by assuming we can do everything with air power, not by assuming that it can only do what it did in the past.

—Col John Warden

As the first century of air power draws to a close, Col John Warden has emerged as a leading advocate of force application in the third dimension. Credited as the originator of the four-phase campaign which guided allied air efforts during Desert Storm, Warden's vision of twenty-first century warfare unabashedly asserts the dominance of aerospace power over surface force. Furthermore, in concert with the "Long Blue Line" of American air theorists, he contends that the most effective and efficient application of air power is in the strategic realm. However, unlike his predecessors, particularly those at the Air Corps Tactical School, Warden's strategic air warfare is more political than economic in nature. Targeting enemy leadership to produce desired policy changes is the overarching aim that should guide the employment of friendly air forces. In this respect, Warden acknowledges an intellectual debt to the British military theorist, J. F. C. Fuller. One of Fuller's classic works, *The Generalship of Alexander the Great*, convinced the young Air Force Academy cadet of the efficacy of attacking the command element as a means of defeating armed forces—a strategy of incapacitation through "decapitation."

While a student at the prestigious National War College, Warden began to construct his theory of air power. An academic thesis, originally planned to be an examination of Alexander's genius, evolved instead into *The Air Campaign*. An influential text on the use of air forces at the operational level of war, this book focuses on translating national political objectives and strategic military goals into theater campaign plans, with primary focus on planning air power's contribution to the overall effort. In its content, it reflects the unique heritage of American air theory and practice.

Warden's argument for the absolute criticality of controlling the skies, and his mission prioritization of air superiority over interdiction over close air support, flows directly from the pages of the Army's 1943 Field Manual (FM) 100-20, *Command and Employment of Air Power*. Likewise, Warden's emphasis on air strikes against enemy centers of gravity (COGs) and his prescriptions for conducting air superiority and interdiction missions recall

the writings of Billy Mitchell and his kindred spirits at the Air Corps Tactical School with regard to attacks against "vital centers" deep within the enemy heartland.[1]

The main theme of *The Air Campaign* is that air power possesses a *unique* capacity to achieve the strategic ends of war with maximum effectiveness and minimum cost. Its inherent speed, range, and flexibility allow it to rise above and reach beyond surface forces engaged in bloody battle to strike the full spectrum of enemy capabilities in a *swift* and *decisive* manner. Central to this theme is the Clausewitzian concept of an enemy's COG, defined by Warden as "that point where the enemy is most *vulnerable and* the point where an attack will have the best chance of being *decisive*."[2] (emphasis added) The proper identification of these COGs is the critical first step in planning and conducting military operations.

As suggested earlier, the incorporation of this notion of COGs into air power theory is by no means novel. However, Warden's description above, and his later equation of Clausewitz's COG with Samson's hair, suggest that such centers are both strengths *and vulnerabilities*.[3] This dual nature of COGs has implications for campaign planning, particularly in terms of identifying which force—ground, sea, or air—is the *key force*. As Warden noted, "Air must be the key force when ground or sea forces are incapable of doing the job because of insufficient numbers *or inability to reach* the enemy center of gravity."[4] (emphasis added) Air power's ubiquity *theoretically* makes many more strategic COGs vulnerable to attack relative to surface forces, providing air forces with a higher degree of strategic decisiveness.[5]

Although it stresses the importance of correctly identifying and appropriately striking COGs, *The Air Campaign* does not elaborate further on how to go about doing so. Warden's process of COG identification materialized some years after publication of his first work. While working for the Air Force Deputy Chief of Staff for Operations, Lt Gen (later general and chief of staff) Michael Dugan, Warden recognized what Harold Winton has creatively termed "a black hole in the wild blue yonder;" that is, the need for a coherent theory of air power. He had been searching for some organizing scheme for the concept of COGs as it relates to air power and, in the late fall of 1988, developed such a model in the form of five concentric rings—an air force targeting bullseye of sorts.

Analyzing the enemy as a system, Warden contends that all strategic entities can be broken down into five component parts.[6] The most crucial element of the system, the innermost ring, is leadership. Extending outward from the leadership center, *in descending importance to the overall functioning of the system*, are the rings of organic essentials, infrastructure, population, and fielded forces (fig. 3).[7]

Within each ring exists a COG or collection of COGs that represents "the hub of all power and movement" for that particular ring. If destroyed or neutralized, the effective functioning of the ring ceases, and this will impact the entire system in more or less significant ways (depending upon whether it is an inner or outer ring). To accurately identify these key hubs within each

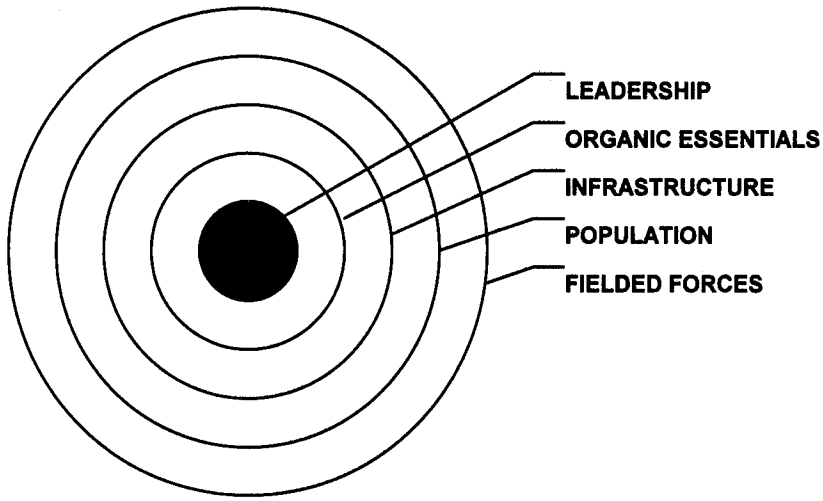

Figure 3. Warden's Five Strategic Rings

ring, Warden proposes the further breakdown of any given ring into five sub-rings (of leadership, organic essentials, etc.), and these into five more, if necessary, until the true COG surfaces.

The central theme of the Five Rings model is that the most effective strategic plan always focuses on leadership first and foremost. Even if leadership is unavailable as a target set, the air strategist must still focus on the *mind of the commander* when selecting centers of gravity among the other rings.[8] For within these rings lie centers of gravity which, when hit, impose some level of physical paralysis, thereby raising the costs of further resistance in the mind of the enemy command.[9] The implicit message is that destruction or neutralization of the leadership COG(s) will produce total *physical* paralysis of the system, whereas successful attack upon COGs within the other rings will produce partial physical paralysis, but unbearable *psychological* pressure upon the leadership.

When Iraq invaded Kuwait in August 1990, and US military planners considered possible responses, Warden's Checkmate Division within the Air Staff at the Pentagon developed an air option. Firmly believing in the efficacy of striking enemy centers of gravity, he resurrected the Five Rings model to guide the creation of a strategic air campaign. As Warden observes, "This was a case where the theory existed before the fact and the facts validated the theory."[10]

Further refinement of his strategic air theory occurred in the afterglow of Desert Storm. Warden drew several lessons from the Gulf War which would influence his thinking. Among the most prominent were (1) the importance of strategic attack and the fragility of states at the strategic level; (2) the fatal consequences of losing strategic and operational air superiority; (3) the overwhelming effects of parallel warfare (that is, the near-simultaneous

attack upon strategic COGs throughout the entire theater of war); (4) the value of stealth and precision weaponry in redefining the principles of mass and surprise; and (5) the dominance of air power as the key force in most, but not all, operational and strategic level conflicts within the next quarter to half century.[11]

Coupling his early thoughts on air power with his experiences in the Gulf War, Warden established a theoretical foundation for employing air power in the twenty-first century. Fundamentally, this groundwork relates ends, ways, and means. First, the air strategist must appreciate the political objectives being sought by military action (ends). Second, he must determine the best military strategy to induce the enemy to comply with his will as defined by those political objectives (ways). Third, he must use the Five Rings systems analysis to identify which centers of gravity to subject to parallel attack (means).

In terms of ends, Warden accepts Clausewitz's maxim that all wars are fought for political purpose; that while wars may have their own distinct capabilities and limitations relative to other tools available to the statesman, they are *by nature* political instruments.[12] Seen as such, wars are essentially discourses between the policy makers on each side. The aim of all military action, then, is not the destruction of enemy armed forces capability, but rather the manipulation of enemy leadership will. Warden elaborates:

> Wars are fought to convince the enemy leadership to do what one wants it to do—that is, concede something political. . . . The enemy leadership agrees that it needs to make these political concessions when it suffers the threat or the actuality of intolerable pressure against both its operational and strategic centers of gravity . . . thus, an attack against industry or infrastructure is not primarily conducted because of the effect it might or might not have on fielded forces; rather it is undertaken for its direct effect on the enemy system which includes its [direct or indirect] effect on national leaders and commanders. . . .[13]

Warden proposes three main ways to make the enemy do what we want him to do—the military strategies of imposed cost (coercion), paralysis (incapacitation), and destruction (annihilation).[14] Collectively, these strategies represent a continuum of force application. The point chosen along that strategy continuum should coincide with the level of objective intent.

An *imposed cost strategy* seeks to make continued resistance too expensive for the enemy command. It attempts to do so by estimating the opponent's pain threshold, based on *his* value system, and then exceeding this threshold as violently and instantaneously as possible through simultaneous, or "parallel," attacks upon the designated target set. Theoretically, such attacks coerce the enemy leadership to accept our terms and change its policy through the *actual* imposition of partial system paralysis, as well as the *potential*, or threatened, imposition of total system paralysis.

A *paralysis strategy* seeks to make continued resistance impossible for the enemy command. It does so by thoroughly and simultaneously incapacitating the entire enemy system from the inside out. This total system paralysis, in turn, provides us the freedom of movement to change policy for the enemy leadership without interference.

Finally, a *destruction strategy* seeks to annihilate the entire system, making policy change by the enemy leadership irrelevant. However, as Warden cautions, "the last of these options is rare in history, difficult to execute, fraught with moral concerns, and normally not very useful because of all the unintended consequences it engenders."[15] In light of these observations, he dismisses this military strategy as politically unviable for twenty-first century warfare.[16]

Finally, regarding means, Warden advocates the continual breakdown (or, in mathematical terms, the differentiation) of each strategic and operational ring until one surfaces the key to partial or total paralysis. Such successive differentiation exposes the interdependent nature, or "connectedness," of the enemy as a system.[17] Consequently, a thorough systems analysis may reveal COGs that are linkages *between* rings as well as components *within* them.

To summarize the salient points of Warden's theory of strategic paralysis: First, the air strategist must fully appreciate the general nature and specific content of the objectives set by his political masters since these (1) prescribe the behavioral change(s) expected of the enemy leadership and (2) suggest the level of paralysis needed to effect the change(s); second, the air strategist must focus all energies in war on changing the mind of the enemy leadership, directly or indirectly, through the imposition of the necessary level of paralysis upon him and/or his system; third, the air strategist must analyze the enemy as an interdependent system of Five Rings to determine those centers of gravity *within and between* rings whose destruction or neutralization will impose the necessary level of paralysis; fourth, the air strategist must plan to attack all defined targets in parallel to produce the most rapid and favorable decision. Using Pape's methodology, Warden's theory can be graphically depicted as follows:

****

At first glance, Warden's theory of strategic paralysis is marked by a type of reductionism inherent in any "systems analysis" approach. It attempts to simplify complex, dynamic sociocultural phenomena (the constitution, operation, and interaction of strategic entities) by reducing them down to their basic parts or functions. In so doing, his theory risks losing some of its explanatory power and practical relevance.

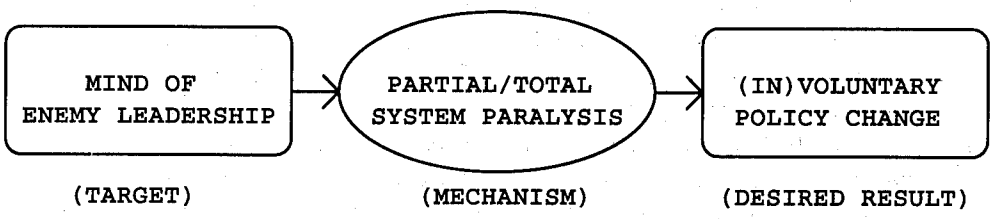

Figure 4. Warden's Theory of Strategic Attack

Arguing that "social scientists make bad generals," Eliot Cohen cautions against such an analytical approach to military strategy since it regards the enemy as "a passive collection of targets," assumes that the enemy resembles us, and considers technology rather than human nature to be the controlling element in war. He goes on to argue that, collectively, these assumptions "discourage the detailed study of one's opponent, his language, politics, culture, tactics, and leadership."[18] Colonel Pat Pentland contends that such comprehensive study is crucial to effective strategy development since sociocultural factors determine both the *form*, or structure, of an enemy and the *process*, or dynamics, by which it operates.[19]

To be fair, Warden does not deny the need for thorough examination of the enemy as a political, economic, military, and sociocultural system. In addition, he would argue that, while the basic Five Rings model may be an oversimplified, "first order" analysis, successive differentiation of the rings will reveal the dynamic interrelationships within and between rings that are unique and important to the particular society or culture in question. The standard Five Rings model is simply meant to be a starting point for further "higher order" analysis, a theoretical framework to guide the air strategist in his critical task of identifying enemy centers of gravity.[20] Thus, Warden's model reflects a subtle holism which undercuts the normal criticism that it is reductionist and oversimplistic.

Perhaps a more accurate criticism was penned by Carl von Clausewitz over 150 years before Warden published his ideas. He wrote:

> It is only analytically that these attempts at theory [i.e., von Bulow, Jomini, etc.] can be called advances in the realm of truth; *synthetically, in the rules and regulations they offer, they are absolutely useless*. They aim at fixed values; but in war everything is uncertain, and calculations have to be made with variable quantities. *They direct the inquiry exclusively toward physical quantities*, whereas all military action is intertwined with psychological forces and effects. *They consider only unilateral action*, whereas war consists of a continuous interaction of opposites.[21] (emphasis added)

As applied to Warden's theory of strategic paralysis, this Clausewitzian critique is three-fold, as suggested by the italicized passages in the above quotation.

First, even if Warden's analysis of the enemy system is correct, his "synthesized" rule of targeting leadership does not *necessarily* follow. Although his analogy with the human brain is seductive, the center ring of leadership is not always the most important target. Other rings (or linkages between rings) may, and often do, offer more lucrative centers of gravity. Warden would not disagree with this, but would insist that outer ring targets must be selected *so as to influence the leadership's cost-benefit calculus.* But this assumes that this calculus is relevant to the defeat of the enemy. It may or may not be; the leadership may decide one thing, the population or armed forces another. What matters most, the true center of gravity, may be what matters to the society as a whole, not just to its leadership.

Second, despite Napoleon's observation that the moral is to the physical as three is to one, John Warden focuses exclusively on the physical aspects of war. He feels justified in doing so since he contends that enemy combat effectiveness can be mathematically represented as follows:

$$\text{combat effectiveness} = \text{physical strength} \times \text{moral strength}$$[22]

By this formula, one can theoretically eliminate the fighting power of an opponent through *exclusive* attack upon the physical component of that power. If the physical variable is driven to zero, the moral variable can remain at 100 percent and combat effectiveness will still be zero. Additionally, Warden notes that destroying *physical* targets is easier than destroying the enemy's *moral* will to resist. He explains: "The physical is conceptually knowable. So *theoretically*, if I knew everything about the enemy, I could drive the physical side of the equation to zero. Morale, I know almost nothing about."[23] (emphasis added) *Practically*, however, driving the physical side to zero (i.e., annihilating the enemy system) is, to borrow Warden's own words cited earlier, "rare in history, difficult to execute, fraught with moral concerns, and normally not very useful because of all the unintended consequences it engenders."[24] Consequently, the issue of moral strength remains.

Third, Warden's theory deals with unilateral action taken against an unresponsive enemy and, thus, disregards the action-reaction cycles and their attendant frictions which mark the actual conduct of war. Again, Warden feels justified in doing so because he claims that the parallel hyperwars of the twenty-first century will eliminate the possibility of enemy reaction at the strategic and operational levels. In fact, Warden goes so far as to proclaim that the revolution in warfare ushered in by Desert Storm has made most Clausewitzian notions irrelevant. "The whole business of action and reaction, culminating points, friction, et cetera, was a function of serial war and the imprecision of weapons . . . [These nineteenth century concepts are] an accurate description of the way things were, but not a description of how they ought to be or can be."[25] While *theoretically possible*, it is difficult to imagine *real war* that is reaction-less and friction-free, even if conducted in parallel fashion at hyperspeed. If human nature rather than technology is indeed the controlling element in war, then war will remain an unpredictable, "nonlinear" phenomenon even in the presence of technological revolution.

****

The next section shows that this Clausewitzian critique is even more fitting given the different traditions represented by John Warden and John Boyd regarding what theory is and what it should provide to its audience. The influence of these traditions on both men result in fundamentally distinctive approaches to achieve the common aim of strategic paralysis.

Notes

1. There is a distinct "strategic" flavor to Warden's discussions of air superiority and interdiction in *The Air Campaign* (Washington, D.C.: National Defense University Press, 1988). Emphasizing that "command is the *sine qua non* of military operations," he advocates attacking the three elements of command (information gathering, decision, and communication) as part of the effort to win air superiority, 51–58. Likewise, he clearly prefers "distant interdiction" against the source of men and materiel as the "most decisive" form of interdiction, 94–95.

2. Ibid., 9.

3. In defining a center of gravity as "the hub of all power and movement," Clausewitz views these COGs as strengths alone. Also, in his quest to narrow the enemy's COGs down to a single, omnipotent hub, Clausewitz diminished the strategic significance of interrelationships between COGs. He did acknowledge that it was not always possible to reduce several COGs to one (though these cases were "very few" in number). He also recognized a certain "connectedness" between COGs when he wrote of their "spheres of effectiveness" to describe the influence of one hub upon the rest. However, Clausewitz still advocated attacks upon the COGs themselves, overlooking the possibility of targeting the vulnerable linkages between COGs. These linkages and interactions are addressed by Boyd, Warden, and, most recently, Maj Jason Barlow through his creative concept of "National Elements of Value" (NEV). For more on NEVs, see Maj Jason Barlow, "Strategic Paralysis: An Air Power Strategy for the Present," *Airpower Journal* 7, no. 4 (Winter 1993): 4–15.

4. Warden, 149.

5. This assertion contains two presumptions: first, an enemy's COGs are material in nature; and second, an enemy possesses at least some COGs which are vulnerable to attack. Regarding the first presumption, certain non material COGs may actually be more vulnerable to attack by surface forces than by air forces. For example, if popular support is the strategic COG for a guerrilla insurgency, then surface forces may have the advantage over air forces due to their ability to occupy territory and, if necessary, forcibly separate the population from the insurgents. In terms of the second presumption, it is plausible that an enemy has no vulnerable COGs at all due to the inherent redundancy and/or resiliency of its system.

6. Warden defines a strategic entity as "any organization that can operate autonomously; that is, it is self-directing and self-sustaining." As he goes on to explain, this definition implies that his theory of strategic attack against the enemy as a system is "as applicable to a guerrilla organization as [it is] to a modern industrial state." See John A. Warden III, "Strategic Warfare: The Enemy as a System" (Air Command and Staff College, Maxwell AFB, Ala., 3 January 1993), 4, note 1. While one can certainly argue with Warden's contention that his theory applies to all forms of warfare, one cannot insist (as many do) that he assumes that the enemy is a modernized nation-state. He does presume that the enemy, whether a nation-state or a guerrilla organization, can be analyzed as a system of five strategic rings with leadership at the center.

7. Warden uses a biological analogy to draw parallels with the human body. The brain, receiving inputs from the eyes and central nervous system, represents the body's leadership. Food and oxygen are two organic essentials, while blood vessels, bones, and muscles provide the infrastructure. Cells constitute the body's population, while specific lymphocytes and leukocytes, along with other white blood cells, provide protection from attack. If any part of the body stops functioning, it will have a *more or less* important effect on the rest of the body.

8. The terminology often used by Warden to discuss the leadership ring suggests that, like Boyd, he treats governmental decision making as the process and product of a unitary rational actor—Allison's Model I. See Graham T. Allison, *Essence of Decision* (Boston: HarperCollins Publishers, 1971) However, he argues that the leadership bullseye can be described and targeted in either Model I (rational actor), Model II (organizational process), or Model III (governmental politics) terms. In fact, the analysis, or breakdown, of the center ring into its subsystems will reveal the Model I, II and/or III dynamics at play. The job of the air strategist is to determine how best to influence leadership decision making *given its particular system dynamics*. Interview with Warden, 17 February 1994.

9. Warden interview.

10. Ibid.

11. Warden, "Air Theory for the Twenty-first Century" (Air Command and Staff College, Maxwell AFB, Ala., January 1994), 4-19. Interestingly, both Billy Mitchell and the Air Corps Tactical School drew similar lessons from their examination of WWI which subsequently impacted their visions of future war and air power.

12. Although the depiction of war *as an extension of politics* is widely accepted in both civilian and military circles, two prominent military historians have recently cast doubt on this proposition in their latest publications. See Martin van Creveld, *The Transformation of War* (New York: Free Press, 1991) and John Keegan, *A History of Warfare* (New York: Alfred A. Knopf, 1993).

If, as they claim, war is a *sociocultural* phenomenon rather than a *political* one, this has significant implications for Warden's emphasis on enemy leadership as *the* critical center of gravity.

13. Warden, "Employing Air Power in the Twenty-first Century," in *The Future of Air Power in the Aftermath of the Gulf War*, eds. Richard H. Shultz, Jr. and Robert L. Pfattzgraff, Jr. (Maxwell AFB, Ala.: Air University Press, 1992), 62, 67.

14. For additional detail, see Warden, "Air Theory for the Twenty-first Century," 8–14.

15. Ibid., 3.

16. In certain respects, Warden's dismissal of *destruction strategies* resembles Clausewitz's idea that absolute war (involving pure violence and the total annihilation of the enemy state) was virtually impossible to conduct due to real-world constraints.

17. As mentioned in a previous footnote, Maj Jason Barlow provides an excellent discussion of the dynamic interactions between what he calls "National Elements of Value" (NEVs). He explains that these NEVs are both interdependent and self-compensating, both critical attributes to consider when one is trying to dismantle the enemy as a system.

18. Eliot Cohen, "Strategic Paralysis: Social Scientists Make Bad Generals," *The American Spectator* (November 1980): 27.

19. Col Pat Pentland, School of Advanced Airpower Studies, Course 633 class notes. See also Col Pat Pentland, "Center of Gravity Analysis and Chaos Theory: Or How Societies Form, Function, and Fail" (thesis Air War College, Maxwell AFB, Ala., AY 1993–94).

20. Warden interview.

21. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 136.

22. Warden, "Strategic Warfare: The Enemy as a System," 3. Again, notable parallels exist between Warden's formula and the following one developed by the Air Corps Tactical School: Nations War-Making Potential = War-Making Capability × Will to Resist

23. Warden interview.

24. "Air Theory for the Twenty-first Century," 3.

25. Warden interview.

Chapter 5

Clausewitz and Jomini Revisited

There have existed in all times fundamental principles, on which depend good results in warfare. . . . These principles are unchanging, independent of the kind of weapons, of historical time and of place.

—Antoine Henri Jomini
Traite des Grandes Operations Militaires

Genius . . . rises above all rules. . . . What genius does is the best rule, and theory can do no better than show how and why this should be the case.

—Carl von Clausewitz,
On War

The previous chapters revealed some notable agreement between the theories of John Boyd and John Warden. Both men contend that the target for all military action should be the enemy command, and that the most effective and efficient mechanism by which to translate military expenditure into political gain is paralysis of that command. Yet while they may share certain fundamental beliefs about the proper conduct of war, Boyd and Warden diverge sharply in theoretical approach. Their distinct approaches represent two traditions regarding the nature and purpose of theory. These traditions are best personified by two nineteenth-century theorists of war.

****

In the early to mid-1800s, two warrior-scholars, one Swiss and one Prussian, set out to explain the remarkable success enjoyed by Napoleon Bonaparte before his fateful decision to march on Moscow. Although sharing similar experiences of Napoleonic warfare, each man attributed the Corsican's victories to fundamentally different causes. The Swiss theorist, Antoine Henri Jomini, credited Napoleon for conducting his military affairs in accordance with the great, veritable principles of war; truths he, then, proceeded too divine for his readers. In contrast, the Prussian theorist, Carl von Clausewitz, credited Napoleon for his military genius, suggesting that the art of war consisted of much more than strict adherence to a particular set of rules.

Admittedly, careful reading of each man's final treatise, Jomini's *Summary of the Art of War* and Clausewitz's *On War*, blurs the sharp distinctions some like to draw between their respective thoughts on success in war. It reveals the ironic twist that, in their theoretical approaches to the study of conflict,

Jomini is more Clausewitzian, and Clausewitz more Jominian, than many people believe.

Jomini is often, and unjustly, depicted as rigid, methodical, and legalistic in his approach to military theory. Yet, in the opening passages of his *magnum opus*, he defends himself against such accusations.

> the ensemble of my principles and of the maxims which are derived from them, has been badly comprehended by several writers; that some have made the most erroneous application of them; that others have drawn from them exaggerated consequences which have never been able to enter my head; for a general officer, after having assisted in a dozen campaigns, ought to know that *war is a great drama*, in which a thousand physical or moral causes operate more or less powerfully, and *which cannot be reduced to mathematical calculations*.[1]

Similarly, Clausewitz is often, but erroneously, characterized as eschewing rules of war altogether. While *On War* is best known and highly regarded for its introduction and evaluation of the moral and psychological aspects of war, Clausewitz does devote a significant portion of his classic work to the presentation of strategic and tactical principles.[2]

However, while a clear line cannot be drawn between the two, an indisputable tension still exists between Jomini and Clausewitz that is as much theoretical as it was personal. This tension is captured very well in the following two passages:

> The fundamental difference between Clausewitz and Jomini is that while the Prussian roamed in the psychological and philosophic domains of battle, peering into the metaphysical darkness whence come the intangible but nevertheless omnipresent components of combat, Jomini was more concerned with the more immediate character of war as it *exists*, and so dealt more with the tangible, less with the philosophic.[3]

> In contrast to Clausewitz, who bent his mind to the consideration of the nature and spirit of war, Jomini stands in the history of military thought as the theorist of strategy. He was not interested in the philosophical problems arising from the concepts of war-in-essence or war-in-being; he confined himself to what in his mind were the practical issues involved in warfare.[4]

Thus, we are presented with two distinct approaches to the study of war—one practical and focused on the physical realm, the other philosophical and focused on the moral and mental realms. We have two different schools of thought regarding the nature and purpose of military theory—one Jominian, the other Clausewitzian. One is not wholly right, the other is not wholly wrong. They are simply different viewpoints—and worth further explanation.

The Jominian tradition believes that the practice of war (i.e., its strategy) can be reduced to a set of general principles or rules which can be scientifically derived and universally applied. It recognizes that the nature of war may change due to political and/or moral variables, but that the conduct of war is constant and governed by principles. For Jominians, the duty of theory is to uncover these immutable truths and to advocate their adoption and use. In the words of Jomini himself, "convinced that I had seized the true point of view under which *it was necessary to regard the theory of war in order to discover its veritable rules*, . . . I set myself to the work with the ardor of a neophyte."[5]

The Jominian school acknowledges that the *nature* of war is complex and dramatic, and that, consequently, its complete mastery is truly an art form. However, the *strategy* of war is scientific, knowable, constant, and governed by principles of eternal validity. To borrow a concept from the emerging science of chaos and complexity, Jominians are predominantly "linear" thinkers regarding the conduct of war. They believe in a certain casuality, or predictability, of actions taken in war. That is, they believe that similar inputs produce similar outputs. Translated into the language of strategy, if a given plan of attack is devised and executed in accordance with veritable principles of war, it will necessarily produce victory time and again.

Believing, as they do, that strategy can be reduced to a science, the Jominians tend to be more prescriptive than heuristic in their presentation of military theory. In other words, Jominian theories tend toward teaching soldiers how to act rather than how to think. Theory should provide answers to the warrior facing the daunting prospect of battle.[6]

In contrast, the Clausewitzian tradition views the practice of war from a more "nonlinear" perspective.[7] Similar inputs, or strategies, often do not produce similar outputs, or desired end-states. War's natural uncertainty makes it impossible to guarantee that what worked yesterday will work tomorrow. Two plus two will not always equal four. This unpredictability demands that any theory of war be more heuristic than prescriptive since "no prescriptive formulation universal enough to deserve the name of law can be applied to the constant change and diversity of the phenomena of war."[8] As Clausewitz continued, "Theory should be study not doctrine. . . . It is meant to educate the mind of the future commander, or, more accurately, to guide him in his self-education, not to accompany him to the battlefield."[9]

Thus, the Clausewitzian school insists that the primary function of military theory is to provide the intellectual methods by which to unveil the answers to war's perplexing questions rather than provide the answers themselves. It should nourish a commander's mental faculties so that he proceeds to find solutions on his own, despite the menacingly uncertain environment in which he must operate. "Continual change and the need to respond to it compels the commander to carry the whole intellectual apparatus of his knowledge within him. . . . By total assimilation with his mind and life, the commander's knowledge must be transformed into a *genuine capability*."[10] (emphasis added) Military theory is meant to be an intellectual stimulant, not a battlefield checklist; it is the means by which to transform knowledge into capability.

Clausewitzian theorists seek to develop a mind-set, or way of thinking, rather than to prescribe rules of war; in the former lies the key to victory in the midst of war's fog and friction.

> War is the realm of uncertainty; three quarters of the factors on which action in war is based are wrapped in a fog of greater or lesser uncertainty. . . . The commander continually finds that things are not as he expected. . . [These uncertainties] continually impinge on our decisions, and *our mind must be permanently armed*, so to speak, to deal with them.[11] [emphasis added]

The Clausewitzian school seeks to *permanently arm* the military commander with "genius," which the Prussian himself defined as "a very highly developed mental aptitude for a particular occupation." In the profession of war, this mental aptitude represents a psychological strength that entails a harmonious balance of intellect and temperament and allows one to function in the presence of uncertainty.[12] Furthermore, this aptitude can be developed. "That practice and a trained mind have much to do with it is undeniable."[13] Thus, Clausewitzians share the belief that the *genius of war* can be defined and should be taught, a cherished conviction similar to the Jominian belief in the *principles of war*.

****

Evaluating our theorists of strategic paralysis in this light, Warden's thoughts are predominantly Jominian in their character, content, and intent, while Boyd's are predominantly Clausewitzian. Warden's theory of swift, simultaneous attack against the enemy's *physical form*, as depicted by the Five Rings model, is practical, concrete, and linear. He prescribes direct and/or indirect attack upon the enemy leadership as the way to impose one's will in a world of conflict. Though one may want to vary one's tactical approach, if a "bullet through the brain" has worked once, it will always work— and, therefore, it should always be the strategic aim of one's military operations.[14]

In addition, Warden's representation of combat effectiveness as the multiplicative product of physical strength and moral strength allows him to focus on the tangible variable in the equation to the exclusion of the intangible one. If you decimate the enemy's physical capability, his moral strength becomes irrelevant. Thus, in terms of both the practice and the theory of war, emphasis on the physical sphere is understandable, acceptable, and, indeed, preferable.

In contrast, Boyd's theory of maneuvering inside the enemy's *mental process*, as depicted by the OODA loop model, is more philosophical, abstract, nonlinear. He recognizes the uncertainty of war and the subsequent need for mental agility and creativity—in short, genius. He believes genius can be taught, and sets out to do just that for his audience by means of the mental process of "destruction and creation." He preaches familiarity with many different theories, doctrines, and models so that, through the genius of "destruction and creation," the military strategist can build from the gems in each of them a plan of attack most appropriate to the situation at hand. Furthermore, through extensive training and practice, the strategist will be able to do so at a faster tempo than his adversary so as to fold him back inside himself and ultimately defeat his will to resist.

Warden asserts that success in twenty-first century war will be the result of adherence to the principles of parallel, inside-out attack. Boyd asserts that success in future war, *as in all past war*, will be the result of genius in the face of menacing uncertainty. As Grant Hammond observes, "Boyd knows certainty doesn't exist; Warden wants it to."[15] Thus, while both men are

theorists of strategic paralysis, John Warden is more Jominian in his approach and John Boyd is more Clausewitzian.

Yet, as noted earlier, neither approach is right nor wrong. Indeed, in this case, the paralysis theories of Boyd and Warden complement each other fairly well. Whereas Boyd speaks of operating at a faster tempo or rhythm than one's opponent, Warden describes the strategic and operational advantages inherent in high-technology "hyperwar." Whereas Boyd talks of creating a highly fluid and menacing environment to which the enemy cannot adapt, Warden advocates parallel attack against the enemy's key operational and strategic nodes. And whereas Boyd focuses on disrupting the enemy's command and control (C^2) *process* via operation within his OODA loop, Warden concentrates on disrupting the enemy's C^2 *form* via attack upon an interdependent system of Five Rings with leadership at its center.

In their distinct, but complementary, theoretical approaches to the common aim of strategic paralysis, John Boyd and John Warden are twin sons of different mothers.

****

Having explored the respective ideas of Boyd and Warden and highlighted areas of convergence and divergence, we can now examine the contribution of both theories to the evolution of air power thought in the twentieth century. As we shall see, the works of these two airmen represent a fundamental shift in strategic air theory—one from paralysis via economic warfare to paralysis via control warfare.

Notes

1. Antoine Henri Jomini, *The Art of War* in *Roots of Strategy*, Book 2 (Harrisburg, Pa.: Stackpole Books, 1987), 437.

2. An 1813 treatise on *Principles of War*, written by Clausewitz for the Crown Prince, is even more prescriptive in nature. However, as he cautions his royal pupil, the principles presented "will not so much give complete instruction . . ., as they will stimulate and serve as a guide for your own reflections." Carl von Clausewitz, *Principles of War* in *Roots of Strategy*, Book 2, 315.

3. Brig Gen J. D. Hittle, "Introduction to Jomini," in *Roots of Strategy*, Book 2, 408–9.

4. Crane Brinton et. al., "Jomini," in *Makers of Modern Strategy*, ed. Edward Meade Earle (Princeton, N.J.: Princeton University Press, 1943), 89.

5. Jomini, *Art of War* in *Roots of Strategy*, 436.

6. Interestingly, many prominent historians note that the Jominian tradition has dominated American military thinking over the past century and a half. For example, Michael Howard argues that, "it is in Jominian rather than in Clausewitzian terms that soldiers are trained to think" since the complicated craft of war is most easily taught by focusing on the mechanics of military operations rather than on the more nebulous features of morale, genius, etc. Peter Paret traces this Jominian dominance back to the "intensely empirical atmosphere" of the late nineteenth century. Michael Howard, "Jomini and the Classical Tradition in Military Thought," and Peter Paret, "Clausewitz and the Nineteenth Century," in *The Theory and Practice of War*, ed. Michael Howard (Bloomington, Ind.: Indiana University Press, 1975), 13–14, 31.

7. In an extremely thought-provoking article, Alan Beyerchen argues that Clausewitz himself was a "nonlinear" thinker and that *On War* is a classic expose on the essential nonlinearity, or unpredictability, of battle. See Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *International Security* 17, no. 3 (Winter 1992-93): 59–90.

8. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 152.

9. Ibid., 141.

10. Ibid., 147.

11. Ibid., 101–2.

12. Ibid., 100.

13. Ibid., 110.

14. John A. Warden III, interview with author, 23 February 1994.

15. Grant T. Hammond, interview with author, 3 February 1994.

Chapter 6

Boyd, Warden, and the Evolution of Air Power Theory

The way humans make wealth and the way they make war are inextricably connected . . . . It is still not fully appreciated that the great age of industrialism is behind us. The basic system for wealth creation is being revolutionized—and war, as usual, is mutating in parallel.

—Alvin and Heidi Toffler
"War, Wealth, and a New Era in History"
World Monitor

As the twentieth century passed its midpoint, the modern world began a slow metamorphosis from an industrial society to an informational society. Fueled by steady advance in computer and communications technologies, this transfiguration continues today. Interestingly, as the opening passage suggests, the methods of aerial warfare appear to be changing in parallel. John Boyd and John Warden are transitional figures in this evolution of strategic air power theory. While paralysis remains the common underpinning for all twentieth century thought on the subject, the theoretical transformation represented by Boyd and Warden is one from economic warfare based on industrial targeting to control warfare based on informational targeting. I now offer a more detailed examination of this permutation in the character of strategic paralysis theory.

****

The Past—Paralysis by Economic Warfare and Industrial Targeting

In the first half of air power's inaugural century, the strategic air doctrines that evolved in both Great Britain and the United States were fashioned by the theory of strategic paralysis and a belief that this incapacitation of a hostile nation and its armed forces was best induced by striking directly at the enemy's economic war-making potential.

Royal Air Force (RAF) strategic bombardment doctrine reflected the man in charge from 1919 until 1928, Air Marshal Sir Hugh Trenchard. The stated aim of Trenchard's air policy was to bring about the disintegration

and collapse of the enemy's war economy. In the last of his ten years as air chief, he produced perhaps the clearest statement of his beliefs on air warfare in the form of a memorandum to his fellow service chiefs. In it, Trenchard proposed the following war object for the RAF: "The aim of the Air Force is to break down the enemy's means of resistance by attacks on objectives selected as most likely to achieve this end." He went on to specify these military objectives as the enemy's "vital centres" of production, transportation, and communication from which the enemy war effort is sustained.[1]

Trenchard highlighted the moral effect of such attacks, claiming they would "terrorise munition workers (men and women) into absenting themselves from work or stevedores into abandoning the loading of a ship with munitions from fear of air attack upon the factory or dock concerned."[2] Thus, British strategic air policy had a dual nature in that it focused on destroying enemy *capability and will* to resist. It sought to produce strategic paralysis by means of the psychological dislocation and terror that ensued from economic disruption and collapse.

Meanwhile, in the United States, the Air Corps Tactical School (ACTS) took the lead in developing American strategic bombardment doctrine. As mentioned, the preachings of Billy Mitchell did influence this doctrinal development, but so, too, did the ideas of a fellow WWI veteran, Col Edgar Gorrell. As chief of the Air Service Technical Section for the American Expeditionary Forces (AEF) in France, Gorrell was responsible for the Air Service's strategic air program for WWI. Writing after the war, Gorrell noted: "The object of strategic bombing is to drop aerial bombs upon the *commercial centers and the lines of communications* in such quantities as will wreck the points aimed at and cut off the necessary supplies without which the armies in the field cannot exist."[3] He went on to compare the enemy's armed forces to a drill bit. The "point" of the army would remain effective only so long as the "shank" of supporting infrastructure remained intact. Break the shank and the entire drill became useless.

The ACTS instructors fine-tuned Gorrell's ideas of economic warfare, transforming the "shank of the drill" into a closely knit industrial web requiring precision bombardment to unweave it.[4] ACTS did not discount the potentially incapacitating effects on morale that such precise bombing might provide as the natural consequence of economic deprivation. However, they primarily focused (at least, publicly) on the *physical* paralysis induced by precise industrial targeting, as opposed to the British emphasis on the *physical* and *psychological* paralysis of economic area bombing.

Both the British and the American versions of economic warfare through strategic air attack would be severely tested once Germany's lightning strikes into Poland and France ignited the Second World War.

The Present—Paralysis by Control Warfare and Command Targeting

The end of WWII was coincident with the dawn of the Information Age. As Alvin and Heidi Toffler contend, this information revolution would transplant the industrial revolution of the nineteenth and early twentieth century and transform both wealth-creation and war-making accordingly. While the notion of strategic paralysis through economic warfare was not completely dismissed, a new form of incapacitation warfare held out great promise—control warfare against an enemy's systems of governance and information processing.[5]

John Boyd is one contemporary theorist who focuses on paralysis through control warfare.[6] More specifically, he concentrates on disorienting the mind of the enemy command by disrupting the *process* by which command and control are exercised. Boyd represents this process in the form of the OODA loop.[7] As we have seen, victory in conflict is ensured by securing a *temporal advantage* over one's opponent in transiting the OODA loop which, in turn, produces a *psychological paralysis* of his decision-making and action-taking process.

In addition to being a governance loop, the OODA model represents the process of information collection, analysis, and dissemination. In this sense, Boyd clearly reflects the influence of Sun Tzu on his thinking by highlighting the importance of information to successful combat operations. He does so by tying it to the speed and accuracy in the decision cycles of strategic, operational, and tactical commanders. He who has better control of the information flow can observe, orient, decide, and act in a more timely and appropriate manner, and thereby operate within his adversary's OODA loop. This control provides the opportunity to deny and/or exploit the information channels of one's adversary while simultaneously protecting access to one's own channels.

Likewise, John Warden advocates paralysis through control warfare based on command targeting. However, in contrast to Boyd's *process*-oriented theory, Warden focuses on the *form* by which command and control are exercised. The leadership bullseye of his Five Rings model is euphemistically described as the brain and all its sensory inputs. If a direct "shot through the head" is unattainable for political or practical reasons, indirect attack through the destruction, disruption, and/or exploitation of the brain's informational and control channels can be equally effective.

Warden also recognizes the importance of information management to the effective operation of the enemy as a system.[8] He speculates that the five strategic rings are connected by an "information bolt." This bolt holds all the rings in place and, if it is destroyed, the components within the rings may spin wildly out of control.[9] This suggests that information linkages between rings may present the key to taking down the entire enemy system.

Together, Boyd and Warden have transformed paralysis theory as it pertains to strategic conventional air power.[10] They have shifted the focus

from war-supporting industry to war-supporting command, from economic warfare to control warfare. Yet, Boyd and Warden do not represent the end of the road. As many futurists predict, the Information Revolution will continue to impact how governments and their militaries wage war.

The Future—Paralysis by Control Warfare and Informational Targeting

Former RAF Marshal Sir John Slessor once wrote: "If there is one attitude more dangerous than to assume that a future war will be just like the last one, it is to imagine that it will be so utterly different that we can afford to ignore all the lessons of the last one."[11] One of the foremost lessons of strategic air power application in the 1991 Persian Gulf War was the efficacy of information dominance.[12] By destroying Iraq's eyes, ears, and mouth, and by exploiting its own surface- and aerospace-based data platforms, the Coalition forces quickly established a form of "information superiority" that may have been as decisive as the more traditional control of the air. The increasing dependence of modern war-fighting machines upon efficient information processing systems will continue to create opportunities to deny, disrupt, and manipulate the collection, analysis, and dissemination of battlefield information.[13] Therefore, it is not unreasonable to suggest that future wars will resemble Desert Storm in at least one important respect—the strategic and operational pursuit of information dominance via control of the war-fighting "datasphere."[14]

RAND Corporation's John Arquilla and David Ronfeldt have termed these future battles for information dominance *cyberwar*.[15] As they define it:

> Cyberwar refers to conducting, and preparing to conduct, military operations according to information-related principles. It means disrupting if not destroying the information and communications systems, broadly defined to include even military culture, on which an adversary relies in order to "know" itself: who it is, where it is, what it can do when, why it is fighting, which threats to counter first, etc. It means trying to know all about an adversary while keeping it from knowing much about oneself. It means turning the "balance of information and knowledge" in one's favor, especially if the balance of forces is not. It means using knowledge so that less capital and labor may have to be expended.[16]

In a very real sense, Arquilla and Ronfeldt are speaking of inducing strategic paralysis by attacking (physically and/or electronically) key information-related centers of gravity, be they nodes or connections.

Future advances in command, control, communications, computers, and intelligence (C^4I) technologies, *and their integration with weapons delivery platforms*, promise to radically increase the tempo of twenty-first century warfare.[17] Friendly and enemy OODA loops will be "tightened" enormously as battlefield information is collected, analyzed, disseminated, and acted upon within a matter of minutes, not days. As a result, controlling the datasphere will be a top priority in most, if not all, future conflicts since "defeating the

collection or dissemination of the information [upon which the 'shooters' will be so dependent for effective strikes] will be tantamount to destroying the attacking platform itself."[18] Achieving information dominance will be the key to military victory as it will provide both the means to remain oriented and the opportunity to disorient the enemy. In this way, one can obtain relative advantages in the speed and accuracy of the OODA process.

While the Information Revolution may not impact the *process* of decision making as described by Boyd, it threatens to fundamentally alter the *form* of the enemy system as depicted by Warden's Five Rings model. As Arquilla and Ronfeldt astutely observe, there are both technological *and organizational* dimensions to this new revolution. "The Information Revolution reflects the advance of computerized information and communications technologies and *related innovations in organization and management theory*. Sea-changes are occurring in how information is collected, stored, processed, communicated and presented, *and in how organizations are designed to take advantage of increased information*."[19] (emphasis added)

In his 1982 best-seller, *Megatrends,* John Naisbitt accurately forecast the organizational trends that would accompany the shift from an industrial society to an information society. Centralization would give way to decentralization, and hierarchies would be replaced by networks.[20] As they are currently unfolding in the business community, these trends produce what Naisbitt calls "a vertical to horizontal power shift."[21] As strategic decisionmaking and control is decentralized, *lateral cooperation* between semiautonomous agents and agencies becomes more vital to effective system operation than *top-down command.*

In terms of combat operations, George Orr defines two opposing styles of command which correlate with these economic trends.

> The hierarchical control style of command attempts to turn the entire military force (or the entire national system) into an between levels in the *extension of the commander*. . . . The emphasis is upon connectivity hierarchy, upon global information gathering or upon passing locally obtained information to higher levels, and upon centralized management of the global battle.
>
> The distributed problem-solving style, on the other hand, views the commander as controlling only in the sense of directing a *cooperative problem-solving effort*. . . . The emphasis in this style is on autonomous operation at all levels, upon the development of distributed systems and architectures, upon networking to share the elements needed to detect and resolve possible conflicts, and upon distributed decisionmaking processes.[22] (emphasis added)

Although Orr acknowledges that arguments can be made for each of these styles, his research concludes: "A distributed C^3I system designed to exploit the stochastic nature of combat operations and the strengths of American fighting units [ingenuity, initiative, and espirit de corps] is best suited to the realities of warfare and the American character."[23] While Orr and, for that matter, John Boyd strongly support the decentralization and networking of the United States Armed Forces, these organizational trends are certainly not givens in this country or elsewhere. As Alvin Toffler speculates, of the "big three" organizations—economic, political, and military—the military will likely

be the last to undergo a vertical to horizontal power shift due to its particular affinity for hierarchical institutions. However, recent organizational adjustments within the US military ushered in by "total quality management" do mirror changes in the business world, and suggest that, even if the military is the last to change, change will indeed occur.

If a worldwide military power shift does occur, it will make the leadership bullseye of John Warden's Five Rings increasingly less relevant to system operation. On the other hand, a vertical to horizontal power shift, with its emphasis on "distributed problem solving,"[24] will add a great deal of credence to John Boyd's notion of *non-cooperative centers of gravity*. Control warfare based on lateral cooperation targeting may indeed replace control warfare based on top-down command targeting as the paralysis "strategy of choice" in the twenty-first century.

****

Yet, as the Tofflers point out, all future warfare will not be exclusively "third wave," or information, warfare. That is to say, "first wave," or agrarian, and "second wave," or industrial, war-forms will not disappear with the emergence of the Information Age. Instead, what we will observe is that

> Every large-scale conflict will be distinguished by a *characteristic combination of these war*-forms. Put differently, each war or battle will have its own 'wave formation' according to how the three types of conflict are combined. (Beyond this, every army, and even every branch of military service, is likely to have its own "signature"—its own mix of First, Second, and Third Wave elements or war-forms.)[25] (emphasis added)

Thus, while the future of strategic paralysis *theory* may lie in the concept of control warfare ushered in by John Boyd and John Warden, actual *plans* to incapacitate an adversary may themselves be "characteristic combinations" of the three war-forms of paralysis discussed in this section—economic warfare based on industrial targeting, control warfare based on vertical command targeting, and control warfare based on lateral information targeting.

Notes

1. Quoted in Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany 1939–45*, vol 4 (London: Her Majesty's Stationery Office, 1961), 72.

2. Ibid., 73. Trenchard did deplore "the indiscriminate bombing of a city for the sole purpose of terrorising the civilian population." That said, he did focus heavily on the *moral effects* of strategic bombardment. The minutes of a meeting he chaired in July 1923 quote him as advocating "the policy of hitting the French nation and making them squeal before we did" as "more vital than anything else," 67. Similarly, a 1924 Air Staff memorandum succinctly stated that the proper employment of the RAF was "to bomb military objectives in populated areas from the beginning of the war, *with the object of obtaining a decision by the moral effect which such attacks will produce* and by the serious dislocation of the normal life of the country." (See Air Staff Memo 11A, March 1924, AIR 9-8).

3. Col Edgar S. Gorrell, "Gorrell: Strategical Bombardment," in *The US Air Service in WW1*, vol 2, ed. Maurer Maurer (Washington, D.C.: US Government Printing Office, 1978), 143.

4. It should be noted that ACTS' strategic bombardment doctrine was not the War Department's official doctrine as laid out in TR 440-15, Employment of the Air Forces of the Army. Yet, despite only lukewarm endorsement by the Army General Staff, the school's "high altitude, daylight, precision bombing" of the enemy's industrial web did form a basis for US air plans in WWII and is widely recognized as the definitive American strategic air doctrine in the interwar period.

5. This notion of control warfare assumes, of course, that the enemy possesses a developed, identifiable, and vulnerable system of governance and information processing upon which it depends to conduct its affairs.

6. As Alan Campen points out: "Actually, the Soviet Union moved to formalize targeting of command and control almost two decades ago when it adopted Radio-Electronic Combat (REC) as a formal doctrine and created forces to execute the concept of physical and electronic attacks on enemy command and control systems." See Alan D. Campen, *The First Information War* (Fairfax, Va.: AFCEA International Press, 1992), 21, note 6.

7. In his briefing, "Organic Design for Command and Control," Boyd specifically states that the OODA loop is, by its very nature, a command and control loop, p. 26.

8. Warden states that precision, speed, stealth, and *information management* are the essential ingredients of parallel warfare. John A. Warden, "War in 2020," lecture, Spacecast 2020, Air War College, 29 September 1993.

9. Warden interview with author, 23 February 1994.

10. As suggested in sections 3 and 4, the applicability of their ideas to unconventional conflict is questionable, though not altogether inappropriate.

11. J. C. Slessor, *Air Power and Armies* (London: Oxford University Press, 1936), x.

12. Andrew Krepinevich of OSD defines "information dominance" as a relatively superior understanding of an enemy's political, economic, military, and social structures. He contends that establishing such information dominance may be the decisive operation in future wars. See Andrew Krepinevich, "The Military-Technical Revolution" (Paper for the OSD Office of Net Assessment, Washington, D.C., Fall 1992), 22.

13. Clearly, our potential adversaries differ significantly in terms of their reliance upon advanced information technologies. Because of this, the viability of paralysis by control warfare based on information targeting must vary likewise.

14. In fact, the most recent Joint Publication 1, *Joint Warfare of the US Armed Forces*, codifies the use of advanced technologies to establish a favorable "information differential." It states, "The joint campaign should fully exploit the information differential, that is, the superior access to and ability to effectively employ information on the strategic, operational and tactical situation which advanced US technologies provide our forces," 57. In addition, the National Defense University at Fort McNair, D.C., is opening a School of Information Warfare and Strategy in August 1994. Its 10-month long curriculum focuses on advances in information technology and how these impact the definition of national security needs and the development of military strategy.

15. See chap. 1, note 1 for the derivation of this term.

16. John Arquilla and David Ronfeldt, "Cyberwar is Coming" (RAND Corporation Study P-7791, Air University Library, Document No. M-U 30352-16 no. 7791), 6.

17. This assertion does not imply that all future wars will be high-tech, hyperspeed infowars. I agree with Alvin and Heidi Toffler's view that the advent of information warfare does not eliminate other forms of conflict. Generally speaking, however, advances in information technology will increase the pace of twenty-first century warfare, albeit to varying degrees based on the technological capabilities of the opposing sides.

18. Maj James L. Rodgers, "Future Warfare and the Space Campaign" (Thesis, Air Command and Staff College, Air Campaign Course Research Projects, AY1993–1994), 116.

19. Arquilla and Ronfeldt, 2.

20. John Naisbitt, Megatrends (New York: Warner Books, 1982), 1–2.

21. Ibid., 204.

22. Maj George E. Orr, *Combat Operations C^3I: Fundamentals* and *Interactions* (Maxwell AFB, Ala.: Air University Press, 1983), 87–88.

23. Ibid., 90.

24. Ibid., 41–42. "Distributed problem solving is the solution to problems through the use of multiple cooperative (usually physically separated) problem solvers. Truly distributed problem solving must be contrasted with centralized problem solving with remote execution. In true distributed problem solving, no one element has access to all the information which will be used in the eventual solution. The essential issues involve the decomposition of problems, insuring cooperation among problem-solving elements, managing communications, and dynamically adjusting the system problem statements in response to changes in the situation."

25. Alvin and Heidi Toffler, "War, Wealth, and a New Era in History," *World Monitor* 4, no. 5 (May 1991): 52.

Chapter 7

Conclusion

If we should have to fight, we should be prepared to do so from the neck up instead of from the neck down.

—Jimmy Doolittle

Throughout air power's brief history, theorists and strategists alike have debated whether the most appropriate application of this new-found force lay in its independent roles and missions or its auxiliary ones.[1] Those in the former camp have viewed the air weapon as inherently strategic and offensive. They have envisioned the effective and efficient employment of air forces against an enemy's key nodes deep within its heartland—a form of aerial surgery directed against those nerve centers and connections which are vital to enemy resistance. In their staunch advocacy, they have spoken the common language of strategic paralysis.

Encouraged by both evolutionary and revolutionary advances in aerospace technology, some tout strategic paralysis as "an air power strategy for the present."[2] However, though experiencing a renaissance in the wake of Desert Storm, the idea of paralyzing one's opponent has been around for quite some time. The nonlethal intent of incapacitating (vice annihilating or attriting) the enemy sprang quite forcefully from the carnivorous trenches of WWI. Air power's first war was one of mankind's bloodiest and most senseless. It was no surprise, then, that air veterans of that war heeded the strategic call to "think in terms of paralysing, not of killing."[3] Two modern-day airmen, John Boyd and John Warden, have also thought in terms of *strategic paralysis*.

As I have explained, Boyd's thoughts are *process*-oriented and aim at *psychological* paralysis. He speaks of folding an opponent back inside himself by operating inside his observation-orientation-decision-action (OODA) loop. This severs the adversary's *external bonds* with his environment and thereby forces an *inward orientation* upon him. This *inward focus* necessarily creates mismatches between the real world and his perceptions of that world. Under the menacing environment of war, the initial confusion and disorder degenerate into a state of *internal dissolution* which collapses his will to resist. To counter this dissolution, Boyd offers the orientation process of "destruction and creation," a form of mental gymnastics designed to permit more rapid construction of more accurate strategies in the heat of battle. His theory of conflict is Clausewitzian in the sense that it is philosophical,

emphasizes the mental and moral spheres of conflict, and considers it important to teach warriors how to think—that is, to teach the *genius of war.*

Warden's theory of strategic attack is *form*-oriented and aims at *physical* paralysis. It advocates parallel, inside-out strikes against an enemy's five strategic rings, with unwavering emphasis on the leadership bullseye. Continual differentiation of these rings by air strategists will reveal those centers of gravity *within and between rings* which, when struck, will incapacitate the enemy system through the rapid imposition of either total or partial paralysis. Warden's theory is Jominian in the sense that it is practical, emphasizes the physical sphere of conflict, and considers it important to teach warriors how to act—that is, to teach the *principles of war.*

The ideas of Boyd and Warden complement each other and, together, have helped usher in the era of strategic paralysis by means of control warfare. This general war-form should remain predominant in the Age of Information, though specific targeting schemes may vary somewhat. If true, the pursuit of strategic paralysis through control warfare, as advocated by Boyd and Warden, contains implications for how best to organize, equip, and employ the air forces of tomorrow.

****

Organizationally, John Boyd favors and John Warden foresees the demise of a middle management of information conduits. In a series of provocative articles on command and control (C^2) systems, Gary Vincent argues for "centralized command - decentralized control and execution" in lieu of the current USAF doctrinal tenet of "centralized control - decentralized execution."[4] To realize this goal, he proposes a C^2 system that mirrors the "massively parallel" design of today's advanced computers. Very crudely, "massively parallel" computers quicken their information processing by replacing the traditional, large central processor and memory bank with many smaller processors which draw upon a distributed memory capacity to work *simultaneously and cooperatively* on the assigned task. In a massively parallel C^2 system,

> the command unit does not issue explicit orders but instead identifies mission objectives and a focus of main effort . . . . [By means of a single data net] the [Basic Action Unit, or BAU] commanders can then access the battlefield model [or "big picture"] and pull out the information they need to accomplish their objectives. The BAUs are given wide latitude in conducting their mission. Coherence is achieved because all the units share a common doctrine, a common goal, and a common view of the situation [which the BAUs also update] . . . . Instead of waiting for exact orders to funnel through intermediate units, each BAU will access its mission order against the common model and act accordingly.[5]

Vincent's "massively parallel" cybernetic design for command and control is a "distributed problem-solving" model which mirrors both the German concept of *Auftragstaktik* and the cyberwarriors' system of "decentralization with topsight."[6] Without the "big picture" provided by topsight, decentralization could very well dissolve into chaos. With topsight, the decentralized

organization functions "at the edge of chaos" as an admittedly complex, but highly adaptive system. As Roger Lewin observes:

> Part of the lure of the edge of chaos is an optimization of computational ability, whether the system is a cellular automaton or a biological species evolving with others as part of a complex ecological community. *At the edge of chaos, bigger brains are built.*[7]

And bigger brains should help in the complex, dynamic atmosphere of war.

Equipping one's forces so as to remain "in the loop" of potential adversaries should seek to minimize the time it takes to transfer battle information from the "sensors," or intelligence collection platforms, to the "shooters," or weapons delivery platforms. "Reconnaissance-strike complexes" aim to do just that by fusing sensors and shooters either physically or electronically. Theoretically, this wedding of datum to bullet would provide the precision and speed that several futurists, such as John Warden, consider to be the keys to success in twenty-first century warfare.[8] While the "reconnaissance-strike complex" would increase the dependency of the "shooter" on the "sensor," this dependency has been a strategic, operational, and tactical vulnerability since the days of Sun Tzu. Taking out the "eyes and ears" of the archer has always impacted the aim of the arrow. If anything, this informational dependency should become more a strength and less a vulnerability as the time available for enemy counteraction rapidly diminishes.[9]

Along these lines, as time becomes progressively compressed in the "hyperwars" of the Information Age, preemptive employment of force may become a prerequisite for success. Americans are very uncomfortable with preemption, a feeling firmly ingrained one December morning in 1941. Although the United States military exalts initiative and lists surprise among its principles of war, its commander-in-chief at the time branded the assault on Pearl Harbor as infamous. During the Cuban Missile Crisis, the president's brother and confidant argued against preemptive air strikes against nuclear missile sites on the island by resurrecting the memory of analogous attacks by Imperial Japan. In the American psyche, preemption is nothing but a morally cheap shot. However, if immediate control of the aerospace medium and electronic spectrum is the sine qua non of future military success, then those who aspire to such victory may need to sacrifice the moral high ground to possess the informational high ground.

****

Like death and taxes, a shrinking military budget may continue to be a sure bet as we enter the next millennium. As the United States Armed Forces "build down," effectiveness and efficiency will continue to represent the sharp horns of a defense dilemma. We must choose wisely, forever mindful of the Tofflers' warning that First and Second Wave war-forms do not disappear in the Era of Third Wave Conflict. If twenty-first century technologies ever enable nonlethal capability to match nonlethal intent, then the strategic paralysis theories of John Boyd and John Warden may offer the guidance

necessary for effective and efficient operations inside the loops and rings of First, Second, and Third Wave adversaries who threaten our national interests.

Notes

1. Lt Col Mark Clodfelter distinguishes among air power's applications in two ways. First, they can be either direct (lethal) or indirect (nonlethal). Direct applications include strategic bombing, interdiction, and close air support. Indirect applications include airlift, refueling, and reconnaissance. Second, they can be either independent or auxiliary. Independent roles and missions seek to achieve objectives apart from those sought by surface forces on the battlefield. Auxiliary roles and missions directly support surface operations on the battlefield. School of Advanced Airpower Studies Course 631, class notes.

2. For example, see Maj Jason Barlow, "Strategic Paralysis: An Air Power Strategy for the Present," *Airpower Journal* 7, no. 4 (Winter 1993), 4–15.

3. Basil H. Liddell Hart, *Strategy* (London: Faber and Faber Ltd., 1954; reprint, New York: Penguin Books, 1991), 212.

4. AFM 1-1, *Basic Aerospace Doctrine of the United States Air Force,* vol. 1 (Washington, D.C.: US Government Printing Office, 1992), 8, 18.

5. 1Lt Gary A. Vincent, "A New Approach to Command and Control: The Cybernetic Design," *Airpower Journal* 7, no. 2 (Summer 1993): 30–31.

6. Topsight is nothing more than "a central understanding of the big picture that enhances the management of complexity." John Arquilla and David Ronfeldt, "Cyberwar is Coming" (RAND Corporation Study P-7791, Air University Library, Document No. M-U 30352-16 no. 7791), 6–7.

7. Roger Lewin, *Complexity: Life at the Edge of Chaos* (New York: MacMillan Publishing Co., 1992), 149.

8. Warden lists *precision* and *speed* as two of four prerequisites for successful parallel warfare. John A. Warden, "War in 2020," lecture, Spacecast 2020, Air War College, 29 September 1993; and Alvin and Heidi Toffler also cite these two attributes as keys to success in "Third Wave" war. "War, Wealth, and a New Era in History," *World Monitor* 4, no. 5 (May 1991): 52.

9. Interestingly, while Warden would likely support the concept of "reconnaissance-strike complexes" on account of their precision and speed, these platforms would actually make the center ring of leadership increasingly less relevant to successful military operations. What could emerge as crucial targets are the data linkages between rings which collectively comprise Warden's "information bolt."

Bibliography

Books

Alger, John I. *The Quest for Victory*. London: Greenwood Press, 1982.

Allison, Graham T. *Essence of Decision*. Boston: Harper Collins Publishers, 1971.

Burton, James G. *The Pentagon Wars*. Annapolis, Md.: Naval Institute Press, 1993.

Campen, Alan D., ed. *The First Information War*. Fairfax, Va.: AFCEA International Press, 1992.

Clausewitz, Carl von. *On War*. Edited and translated by Michael Howard and Peter Paret. Princeton, N.J.: Princeton University Press, 1976.

Delbruck, Hans. *History of the Art of War Within the Framework of Political History*, vols. 1 and 4. Translated by W. J. Renfroe, Jr. Lincoln, Nebr.: University of Nebraska Press, 1986.

Douhet, Giulio. *The Command of the Air*. Translated by Dino Ferrari. Washington, D.C.: US Government Printing Office, 1983.

Earle, Edward Meade, ed. *Makers of Modern Strategy*. Princeton, N.J.: Princeton University Press, 1943.

Ehrenwald, Jan. *Anatomy of Genius*. New York: Human Sciences Press, 1984.

Fallows, James. *National Defense*. New York: Random House, 1981.

Fuller, J. F. C. *The Foundations of the Science of War*. London: Hutchinson and Company, 1925.

Gilder, George. *Microcosm*. New York: Simon and Schuster, 1989.

Gleick, James. *Chaos*. New York: Viking Press, 1987.

Greer, Thomas H. *The Development of Air Doctrine in the Air Arm, 1917–41*. Washington, D.C.: US Government Office Press, 1985.

Hallion, Richard P. *Storm Over Iraq*. Washington, D.C.: Smithonian Institute Press, 1992.

Howard, Michael, ed. *The Theory and Practice of War*. Bloomington, Ind: Indiana University Press, 1975.

Jomini, Antoine Henri. *The Art of War*. Translated by Capt G.H. Mendell and Lt W.P. Craighill. Westport, Conn.: Greenwood Press, 1971.

Keegan, John. *A History of Warfare*. New York: Alfred A. Knopf, 1993.

Lewin, Roger. *Complexity: Life at the Edge of Chaos*. New York: MacMillan Publishing Co., 1992.

Liddell Hart, B. H. *Paris; Or the Future of War*. New York: Garland Publishing, Inc., 1972 (c1925).
_____. *Strategy*. London: Faber and Faber Ltd., 1954; reprint, New York: Penguin Books, 1991.

Mao Tse-tung. *Six Essays on Military Affairs*. Peking: Foreign Languages Press, 1972.
Mitchell, William. *Skyways: A Book on Modern Aeronautics*. Philadelphia and London: J. B. Lippincott Company, 1930.
_____. *Winged Defense*. New York: G.P. Putnam's Sons, 1925.

Naisbitt, John. *Megatrends*. New York: Warner Books, 1982.

Ochse, R. *Before the Gates of Excellence*. Cambridge: Cambridge University Press, 1990.
Orr, George C. *Combat Operation C^3I: Fundamentals and Interactions*. Maxwell AFB, Ala.: Air University Press, 1983.

Paret, Peter, ed. *Makers of Modern Strategy from Machiavelli to the Nuclear Age*. Princeton, N.J.: Princeton University Press, 1986.
Prigogine, Ilya and Isabelle Stengers. *Order Out of Chaos*. New York: Bantam Books, 1984.

Roots of Strategy, Book 2, Three Military Classics. Pennsylvania: Stackpole Books, 1987.

Stevenson, James P. *The Pentagon Paradox*. Annapolis, Md.: Naval Institute Press, 1993.
Sun Tzu. *The Art of War*. Translated by Thomas Cleary. Boston and London: Shambhala Publications, Inc., 1988.

Toffler, Alvin. *Powershift: Knowledge, Wealth and Violence at the Edge of the Twenty-first Century*. New York: Bantam Books, 1990.
Trythall, Anthony J. *Boney Fuller*. New Brunswick, N.J.: Rutgers University Press, 1977.

Van Creveld, Martin L. *The Transformation of War*. New York: Free Press, 1991.

Warden, John A. III. *The Air Campaign*. Washington, D.C.: National Defense University Press, 1988.
Watts, Barry D. *The Foundations of US Air Doctrine: The Problem of Friction in War*. Maxwell AFB, Ala.: Air University Press, 1984.
Webster, Charles, and Noble Frankland. *The Strategic Air Offensive Against Germany* 1939–45, vol. 4. London: Her Majesty's Stantionery Office, 1961.
Wylie, J. C. *Military Strategy*. Annapolis, Md.: Naval Institute Press, 1989.

Articles

Barlow, Maj Jason B. "Strategic Paralysis: An Air Power Strategy for the Present." *Airpower Journal* 7, no. 4 (Winter 1993): 4–15.

Begley, Sharon. "The Puzzle of Genius." *Newsweek* 121, no. 26 (28 June 1993): 46–51.

Beyerchen, Alan. "Clausewitz, Nonlinearity, and the Unpredictability of War." *International Security* 17, no. 3 (Winter 1992–93): 59–90.

Brinton, Crane, Gordon A. Craig and Felix Gilbert. "Jomini." In Edward Meade Earle, ed. *Makers of Modern Strategy*. Princeton, N.J.: Princeton University Press, 1943.

Cohen, Eliot. "Strategic Paralysis: Social Scientists Make Bad Generals." *The American Spectator* (November 1980): 23–27.

FitzGerald, Mary C. "The Soviet Military and the New 'Technological Operation' in the Gulf." *Naval War College Review* 44, no. 4 (Autumn 1991): 16–43.

Furlong, Raymond B. "Strategymaking for the 1980s." *Parameters* 9, no. 3 (March 1979): 9–16.

Handel, Michael I. "Clausewitz in the Age of Technology." *Journal of Strategic Studies* 9, nos. 2 and 3 (June-September 1986): 51–92.

Hittle, Brig Gen J.D. "Introduction to Jomini." In *Roots of Strategy*, Book 2, 3 Military Classics. Harrisburg, Pa.: Stackpole Books, 1987.

Howard, Michael. "Jomini and the Classical Tradition in Military Thought." In Michael Howard, ed. *The Theory and Practice* of *War*. Bloomington, Ind.: Indiana University Press, 1975.

Lind, William S. "Defining Maneuver Warfare for the Marine Corps." *Marine Corps Gazette* 64 (March 1980): 55–58.

_____. "Military Doctrine, Force Structure, and the Defense Decision-Making Process." *Air University Review* 30, no. 4 (May–June 1979): 21–27.

Mann, Steven R. "Chaos Theory and Strategic Thought." *Parameters* 12, no. 2 (Autumn 1992): 54–68.

Meilinger, Lt Col Phillip S. "The Problem with Our Air Power Doctrine." *Airpower Journal* 6, no. 1 (Spring 1992): 24–31.

Orenstein, Harold. "Warsaw Pact Views on Trends in Ground Forces Tactics." *International Defense Review* 9 (September 1989): 1149–52.

Paret, Peter. "Clausewitz and the Nineteenth Century." Michael Howard, ed. *The Theory and Practice of War*. Bloomington, Ind.: Indiana University Press, 1975.

Rothfels, H. "Clausewitz." In Edward Meade Earle, ed. *Makers of Modern Strategy*. Princeton, N.J.: Princeton University Press, 1943.

Steele, Robert D. "C4I: The New Linchpin." *U.S. Naval Institute Proceedings* 118, no. 7 (July 1992): 35–40.

Toffler, Alvin and Heidi. "War, Wealth, and a New Era in History." *World Monitor* 4, no. 5 (May 1991): 46–52.

Vincent, 1Lt Gary A. "A New Approach to Command and Control: The Cybernetic Design." *Airpower Journal* 7, no. 2 (Summer 1993): 24–38.

_____. "In the Loop: Superiority in Command and Control." *Airpower Journal* 6, no. 2 (Summer 1992): 15–25.

Warden, Col John A. III. "Air Theory for the Twenty-first Century." Unpublished Article. Air Command and Staff College, Maxwell AFB, Ala., January 1994.

_____. "Employing Air Power in the Twenty-first Century." In Richard H. Shultz, Jr. and Robert L. Pfattzgraff, Jr., eds. *The Future of Air Power in the Aftermath of the Gulf War*. Maxwell AFB, Ala.: Air University Press, 1992.

_____. "Strategic Warfare: The Enemy as a System." Unpublished Article. Air Command and Staff College, Maxwell AFB, Ala., 3 January 1993.

Winton, Harold R. "A Black Hole in the Wild Blue Yonder: The Need for a Comprehensive Theory of Air Power." *Air Power History* 39, no. 4 (Winter 1992): 32–42.

Documents, Studies, and Lectures

Air Force Manual 1-1, *Basic Aerospace Doctrine of the United States Air Force*. Vols. 1 and 2. Washington, D.C.: US Government Printing Office, 1992.

Arquilla, John. "Cyberwar." Lecture to Spacecast 2020, Maxwell AFB, Ala., 29 September 1993.

Arquilla, John, and David Ronfeldt. "Cyberwar is Coming." RAND Corporation Study. Air University Library, Document No. M-U 30352-16 no. 7791.

Boyd, John R. "A Discourse on Winning and Losing." August 1987. A collection of unpublished briefings and essays. Air University Library, Document No. M-U 43947.

_____. "Conceptual Spiral." Lecture to Spacecast 2020, Maxwell AFB, Ala., 20 September 1993.

Clodfelter, R. Mark. SAAS Course 631 Class Notes, Fall 1993.

Fleet Marine Force Manual Number 1. Washington, D.C.: US Government Printing Office, 1989.

Gorrell, Col Edgar S. "Gorrell: Strategical Bombardment." In Maurer Maurer, ed. *The US Air Service in WWI*, vol. 2, 141–57. Washington, D.C.: US Government Printing Office, 1978.

Joint Publication 1. *Joint Warfare of the U.S. Armed Forces*. Washington, D.C.: US Government Printing Office, 1992.

Krepinevich, Andrew. "The Military-Technical Revolution." Unpublished Manuscript. OSD Office of Net Assessment, Washington, D.C., Fall 1992.

Pape, Robert A. SAAS Course 632 Class Notes, Fall 1993.

Pentland, Pat. "Center of Gravity Analysis and Chaos Theory: Or How Societies Form, Function, and Fail." Unpublished Thesis. Air War College, Maxwell AFB, Ala., AY1993–94.

_____. SAAS Course 633 Class Notes, Fall 1993.

Rodgers, James L. "Future Warfare and the Space Campaign." Unpublished Thesis. Air Campaign Course, Air Command and Staff College, Maxwell AFB, Ala., June 1993.

Shlapak, David. "Exploring Paralysis: An Introduction to the Study." RAND Corporation Study, PM-107-AF, December 1992.

United States Army Field Manual 100-5. *Operations*. Washington, D.C.: US Government Printing Office, 1986.

Warden, Col John A. III. "War in 2020." Lecture to Spacecast 2020, Maxwell AFB, Ala., 29 September 1993.

Personal Interviews

Interview with John R. Boyd. School of Advanced Airpower Studies, Maxwell AFB, Ala., 30 March 1994.

Interview with Grant T. Hammond. Air War College, Maxwell AFB, Ala., 3 February 1994.

Interviews with Col John A. Warden III. Air Command and Staff College, Maxwell AFB, Ala., 27 January 1994, 3 February 1994, 17 February 1994, and 23 February 1994.