



The **WIND**
of **WAR**

**JOHN BOYD AND
AMERICAN SECURITY**

GRANT T. HAMMOND

THE MIND OF WAR

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To the men and women of the United States Armed Forces and especially the mavericks
among them

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Notes

This book began nearly a decade ago, in October 1991, when a colleague at the Air War College, Col. Ray Bishop, invited me to sit in on a session of a course he was teaching entitled “Strategy beyond Clausewitz.” A guest speaker would be lecturing the class, a retired Air Force colonel named John Boyd, and Ray thought I would enjoy hearing what he had to say. A recent addition to the Air War College faculty as a civilian academic, I had become jaded rather quickly by the seemingly endless array of colonels and general officers that someone I thought had something significant to say. I acknowledged the invitation and muttered something about trying to make it. Ray said, “No, Grant. He’s not like the others. You really need to hear him. I promise you will find it rewarding.” So I heard John Boyd’s briefing, “A Discourse on Winning and Losing,” for the first of many times.

Ray was right. It was clear that this was no ordinary former Air Force officer, nor an ordinary mind. A brusque, articulate, often profane, gravel-voiced man, Boyd moved catlike about the room during the briefing, his eyes sparkling. He stalked ideas and flushed them out of his audience. He led us to discover insights and connections before he had to tell us. His ranged widely over history, politics, technology, and economics. He could discuss by book, chapter, and section Sun Tzu’s *Art of War* and Carl von Clausewitz’s *On War* with equal aplomb and in fine detail. He appeared to be as knowledgeable about guerrilla warfare as air-to-air combat. I remember thinking that was an odd combination of interests and expertise. How could this be?

Boyd was entertaining, demanding, provocative, and stimulating. After the second day of hearing and talking with Boyd, I asked Ray Bishop if he had published anything or if anyone had written about him. Ray said no, not that he knew. I remember commenting that someone should do a book about this guy and his ideas. Ray said, “Why don’t you?” I said I was far too busy with other projects and wasn’t into biographies in any event. Within a few months however, all that had changed. After reading through “The Green Book,” the 327 pages of briefing slides that constitute “A Discourse on Winning and Losing,” I was hooked. I had to learn more about these ideas and interpretations and how Boyd had come up with them.

So began a relationship that has been a transforming one. I don’t agree with Boyd on a lot of topics, and I found his sheer level of intensity difficult to take at times, but I valued our association and have profited greatly from it. What I have read and learned about how to read and learn, about a variety of subjects, some well beyond my ken, has changed me forever. I learned about the mechanics of flight and aircraft design, evolution, mathematical bits of military history, theoretical physics, the workings of the brain, philosophy, industrial production, leadership, decision-making theory, time, Japanese management theories, and John Boyd’s trinity of Gödel, Heisenberg, and the second law of thermodynamics. Reading the many works in Boyd’s “Sources” for “A Discourse” (which he deemed valuable and essential to the evolution of his thought) was an education itself, equivalent to another graduate degree. For that I and many others owe John Boyd a debt we can never repay.

Writing a biography, the story of another person’s life, is a difficult task because of the moral imperative one feels to get it right. This may be the most anyone, including longtime

friends, will ever know of John Boyd and his ideas. To be accurate in the portrayal of each a heavy responsibility, but writing a biography, personal and intellectual, of a living person even more difficult, as it becomes part of a continuing dialogue and as such is never finished. To do so when one enjoys the learning process, is sympathetic to wide-ranging syntheses, and finds the impact of the process transforming makes it more difficult still. Hence, writing the book has been an effort to hold an inquisition with myself. That is not an easy task, but I have attempted it anyway and hope the results will weather the scrutiny of others and that the product is seen as useful. Boyd and his ideas are important, however flawed my chronicle of them may turn out to be. Sadly, it was the occasion of his death that made the final investigations possible and forced me to close the dialogue.

John Boyd was a larger-than-life character who touched many people and made waves in the military system over several years, both in uniform and out. He and his exploits have taken on a legendary quality. Stories about him have been embroidered over the years. Some were told by him, some by others, but all have become jumbled and may stray from the truth. Most were told by fighter pilots, who like Southerners enjoy the telling of the story as much as the story itself. (Like the Irish, who represent another oral tradition, fighter pilots also view writers as failed conversationalists.) Thus what is recorded here is the lore and the legend of John Boyd, corroborated where possible, taken from printed sources and interviews. Some anecdotes and interpretations are impossible to verify. The participants are either lost or dead, the stories from Boyd alone or reiterated by so many others so often that they have become the record, true or not. This book deals mainly with Boyd's ideas and the effect on others. It is less a validated record of Boyd than it is an intellectual biography. In that the stories are a part of the image that was Boyd, they are a part of this chronicle, but I cannot vouch for the veracity of all of them in their finer details. That some myths may thus be perpetuated may be regrettable, but it is also the stuff of which legends are made.

Boyd is known to a relatively small coterie of people. His name is hardly a household word. He attained success in his career on a number of issues, in a number of fields. He was a major contributor on air-to-air tactics, an aircraft designer, a military strategist, a bureaucratic in-fighter, a defense reformer, and a fighter pilot of great renown. He did not seek to capitalize on his considerable talents, his access to important people, or the value of his ideas. Others have chronicled portions of his life, his ideas, and impact. Jim Burton's *Pentagon Wars* and Jim Stevenson's *Pentagon Paradox* are the most salient and revealing efforts. Harry Hillaker's forthcoming book, *Sweet Sixteen*, about the development of the F-16 is another. Each looks at only a part of the career and some of the contributions of this remarkable man. This book attempts to remedy that. It is an exercise in synthesis, to understand the man, his ideas, and their importance. It is an attempt to combine the bits and pieces of the fighter pilot and intellectual, the aircraft designer and strategist, the maneuver warfare tactician and scientist. It seeks to combine the breadth of his insights, explain them, and reveal their significance to a broader public.

The book is in part a biography of John Boyd. It is also a book on how to win and lose in the competition of life. It is about planning and strategic thinking, as appropriate to the business shelf in a bookstore as one on military history. It assesses how we conceive of time and the process of evolution. It could just as easily occupy a place in the education section for its commentary on trade-off thinking and the importance of synthesis as well as analysis. It

in part a history of the U.S. Air Force and to some degree a commentary on recent scientific thought. It has as much to do with national security and weapons procurement as with air-to-air combat, with congressional politics and media relations as with creative thinking. It combines the tactics of maneuver warfare with some finer points of aircraft design, budget building processes with guerrilla warfare, OODA loops with lightweight fighters. It is eclectic and in that at least, it is an accurate reflection of John Boyd's life and thought.

It is still a thin substitute for transmitting the ideas on winning and losing as Boyd himself would have. However accurate or insightful, perceptive, and summative this chronicle of Boyd may be, it is a pale reflection of a larger-than-life figure to whom so many owe so much. He was, as James Fallows has written, "a priceless original," whose "ideas about weapons, leadership, and the very purpose of national security changed the modern military." I can convey some idea about that effort and the transformation Boyd accomplished, his successes and failures, but I can only begin to hint at the combination of wit, tenacity, genius, honesty, concentration, laughter, commitment, teaching skill, competitiveness, integrity, zeal for learning, charm, and concern for other people that was John Boyd. Those of you who never knew him have been deprived of a precious gift. Those of us who did have been enriched, empowered, and ennobled by the experience. He was a demanding teacher, a model of integrity, and a man of action who made many contributions to the world. How and why he did so is the subject of this book.

It has become de rigueur in the writing of books to thank those many people who have assisted in a variety of ways in the research, writing, and production of the finished product. The other usual aspect of this custom is to absolve all others from any mistakes of omission or commission and to accept responsibility for them oneself. I hasten to comply with both conventions. The efforts of those thanked below were necessary, if not sufficient, for the project to be completed. I thank them all for their time, gracious assistance, encouragement, and insights.

First and foremost, I owe an enormous debt to John Boyd for his many hours of interview, correspondence, telephone calls, and visits. He displayed nearly endless patience in guiding me through mathematical and scientific concepts with which I was unfamiliar. He was generous in his introductions to the people and ideas that now populate my universe. He waited for me to ask the right question so the answer could fall into place for me without having to tell me. For all that and more, I am grateful. He was a consummate teacher. To learn from John Boyd has been for me, as for many others, a high point of my life.

Getting to know some of Boyd's network of friends and colleagues from the past themselves a diverse array of talent and dedication, has been another benefit of my work on this project. Much of what I know of Boyd and his work is due to their insights and generosity in sharing them with me. Some of those interviewed were close friends and associates; others were adversaries. Still others were admirers who had profited in some way from Boyd's wide-ranging expertise. Many were contemporaries who could shed light on the culture of the Air Force, the state of doctrine or training in the Marine Corps and Army, or the political climate regarding weapons procurement at the Pentagon. In addition, I owe much to a host of former students and colleagues at the Air War College (too numerous to mention without giving offense to someone inadvertently left out), whose insights into fighter tactics, aircraft design, service culture, strategy, and doctrine were most helpful. The final product is better because of their efforts in assisting me to learn about the Air Force, its customs, culture, and idiosyncrasies.

Some of those interviewed spoke under the protection of nonattribution and wish to remain anonymous. Their contributions are nonetheless important for their anonymity, but I have honored their request. Others made no such stipulation. Among the scores of people whom I have interviewed or who have contributed to the project and are deserving of special mention are Tom Amlie, Jim Booth, Gen. Charles G. Boyd, Arthur Bredehoft, Mike Burnham, Jim Burton, Bob Busch, Ron Catton, Tom Christie, Andrew Cockburn, Chuck Cooper, Bob Dilger, Gen. Mike Dugan, the late Jeff Ethell, Jim Fallows, John Fialka, Ernie Fitzgerald, Newt Gingrich, Gen. Al Gray, Eric Hehs, Harry Hillaker, I. B. Holley, Ray Leopold, Bill Linde, Gen. Mike Loh, Gen. Merrill McPeak, Dan Moore, Jim Morrison, Gen. Carl Mundy, Charles Murphy, Chuck Myers, Roland Parks, Jeff Record, Rich Riccioni, Chet Richards, John Schmitt, Maj. Gen. Lance Smith, Chuck Spinney, Vern Spradling, Pierre Sprey, Jim Stevenson, Ole Stromgren, Win Wheeler, G. I. Wilson, and Mike Wyly. Many others (too numerous to mention) contributed a variety of insights and clarifications as well. Colleagues at the A

War College—Jae Engelbrecht, Ted Hailes, Tom Hughes, Dave Sorenson, Dick Szafranski, and Jim Toner—over the years also gave graciously of their time in discussing or reading parts of the manuscript.

I am most particularly indebted to two of Boyd's friends and colleagues, Gen. Paul K. Van Riper, USMC (ret.), and Barry Watts, of the Northrop-Grumman Analysis Center, and to Hugh Ahmann, retired Air Force oral historian, and Col. Mike Slinkard for their careful reading of the entire manuscript, keen insights, and corrections of factual errors. Their contributions greatly improved both my understanding and the book. To all, thank you for your time and contributions. The final product, however imperfect, is better for your efforts.

Then too, I must thank Dick Steeves, former executive director of the Air University Foundation, which supported the research for this book, and Mark Gatlin at the Smithsonian Institution Press, for his interest in and support of the project, as well as the staff there, particularly Ruth Spiegel and Lorraine Atherton, for their invaluable assistance. Without their efforts, this project could not have been completed. Wrestling with such a complex book that defied easy labeling was a frustrating experience for all of us, but one I hope is worth the effort. In addition, the help and assistance of the library staff at Air University Library, particularly Sue Goodman, Terry Hawkins, and Steve Chun, and those at the U.S. Marine Corps Archives and Research Center, Janet Kennelly and Kerri Strong, were superb. These librarians and archivists are the unsung heroes of much research and writing and deserving of more praise and compensation than most receive. Thank you all.

My thanks too to the Boyd family. Mary Boyd, John's long-suffering wife, saw her husband devote more time and attention to the Air Force, books, and the telephone than to his family. With me alone, John spent more than three hours a week on the telephone for over five years. Those calls were interspersed with half a dozen weeklong visits at Maxwell Air Force Base or in Delray Beach, Florida, as well as sessions at summer reunions of those involved in the military reform movement in West Virginia. John's children, particularly Mary Ellen Holton, also gave graciously of their time and shared recollections, photographs, and clippings about their father.

I must also thank Arthur J. E. Child, a Canadian businessman and philanthropist whose outstanding business success was surpassed only by his care and concern for others. Arthur and his lovely wife, Mary, became good friends along the way. Arthur graciously made available gifts to the Air War College Foundation (now the Air University Foundation) that allowed the extensive interviews for this book to be conducted. Sadly, he died before the project was completed. Arthur Child was an amazing man of many talents who did many good things for the people and the military services of several nations. This book would not have been possible without Arthur's support, both personal and professional.

Finally, I must thank my family for their patience and support. My wife, Caroline, and my daughters, Sage and Dana, had many frustrating times when Dad took an inconvenient trip, stayed on the phone with John for hours, or pored over research material instead of giving them more time and attention. My family's patience and understanding have been absolutely essential for this project. It is as much theirs as it is mine. Thank you, ladies, for your love and encouragement.

Boyd has personally spent hours briefing (tutoring would be the better word) more recent members of the Joint Chiefs of Staff, many of their senior officers, and several recent top civilian defense officials, up to Secretary Cheney.

Gregg Easterbrook, "With Enemies Like These," *Washington Monthly*

This nation lost an incredible array of talent during the second week of March 1997. One of its premier fighter pilots—a man of legendary skill and scholarship who wrote the first manual on jet aerial combat, developed tactics against Soviet planes and surface-to-air missiles, and thereby saved innumerable lives in Vietnam—died that week. So too did one of the nation's premier aircraft designers, whose work on something called energy maneuverability theory changed the way aircraft were designed and tested. He was largely responsible for the development of the U.S. Air Force's premier fighters, the F-15 Eagle and the F-16 Fighting Falcon.

That same week saw the passing of one of the more original students of military history. This was a man whose views on war and warfare through the ages did much to change how the U.S. armed forces went about preparing for war in the last quarter of the twentieth century. His views on maneuver warfare helped change the U.S. Marine Corps and the U.S. Army. Another who labored behind the scenes succumbed that week. For more than a decade he had waged a campaign to change how the U.S. military went about the business of defense, changing the procurement process and helping to improve a variety of weaponry in the U.S. arsenal.

A man of great thought and originality, whose views on how we learn and think in order to survive and prosper in a complex world have infected American business and education, also passed from the scene. His notions of competition and time cycles—observation, orientation, decision, action (OODA) loops—have followers around the world who study his insights and employ them in a variety of ways and professions.

Last, a paragon of virtue who was loved by many in politics, business, and the military for his character and integrity, who shunned personal wealth and private gain for service to his country, died that week. That the nation is less for the passing of these men should be obvious. That they were little honored during their lives is regrettable, but perhaps understandable. None was a published author, decorated hero, high-ranking government official, or an academician of renown. More startling still is that they all were really one man, Col. John R. Boyd, USAF (ret.).¹

This book is about John Boyd, his life, times, and accomplishments. Most important, it is about his ideas on winning and losing. It does not do the man or his ideas justice. No single volume could. It tries, however imperfectly, to give some sense of the man, his thought and his importance to the nation. It can in no way substitute for the sheer dynamism of his personality, the intensity of his thought, the richness of his intellect, the breadth of his conversation, the warmth of his friendship, or the wrath he inspired in those with whom he

disagreed. Nor can it convey the insight, imagination, and innovation contained in his ideas and the verbal give and take that was an eclectic conversation—a discourse—with Boyd and his ideas. John Boyd was a man both loved (called “Christ-like” by the head of one branch of the U.S. military) and vilified as “a 24-karat pain in the ass” by other senior general officers. There is merit to both descriptions.

This is an effort to introduce the man and his work to a wider audience. For a variety of reasons, Boyd never published his ideas. This book begins a discourse on his massive 320-page briefing entitled “A Discourse on Winning and Losing.” It is an explanatory presentation, not a critical analysis. It is a first step in the extension of his discourse. Detailed scholarly assessments of his ideas will follow later, but his views must first be made known before they can be debated.

John Boyd’s death on 9 March 1997 was the occasion for a rather extraordinary outpouring of tributes. There was a lengthy obituary in the *New York Times*, and his life and accomplishments were celebrated at length in *U.S. News and World Report* and *Defense Week*. Yet, it is likely that 99 percent of the readers of those publications, save perhaps for *Defense Week*, had never heard of John Boyd. Why should they? He was one of thousands of USAF colonels who did not make general officer, and he had been retired for more than twenty years at the time of his death. He was unknown to most but vitally important to a few. Why was John Boyd? Why was he so important?

An Honorary Marine

Some hint of the answers to those questions is contained in a glowing tribute written two days after his death and published in *Inside the Pentagon*.

To the Editor:

I was deeply saddened to learn of the passing of Colonel John Boyd, USAF (Ret.). How does one begin to pay homage to a warrior like John Boyd? He was a towering intellect who made unsurpassed contributions to the American art of war. Indeed, he was one of the central architects in the reform of military thought which swept the services, and in particular the Marine Corps, in the 1980’s. From John Boyd we learned about competitive decision making on the battlefield—compressing time, using time as an ally. Thousands of officers in all our services knew John Boyd by his work on what was to be known as the Boyd Cycle or OOD loop. His writings and his lectures had a fundamental impact on the curriculum of virtually every professional military education program in the United States—and on many abroad. In this way, he touched so many lives, many of them destined to ascend to the highest levels of military and civilian leadership.

Those of us who knew John Boyd the man knew him as a man of character and integrity. His life and values were shaped by a selfless dedication to Country and Service, by the crucible of war, and by an unrelenting love of study. He was the quintessential soldier-scholar—a man whose jovial, outgoing exterior belied the vastness of his knowledge and the power of his intellect. I was in awe of him, not just for the potential of his future contributions but for what he stood for as an officer, a citizen and as a man.

As I write this, my mind wanders back to that morning in February, 1991, when the

military might of the United States sliced violently into the Iraqi positions in Kuwait. Bludgeoned from the air nearly round the clock for six weeks, paralyzed by the speed and ferocity of the attack, the Iraqi army collapsed morally and intellectually under the onslaught of American and Coalition forces. John Boyd was an architect of that victory as surely as he'd commanded a fighter wing or a maneuver division in the desert. His thinking, his theories, his larger than life influence were there with us in Desert Storm. He must have been proud of what his efforts wrought.

So, how does one pay homage to a man like John Boyd? Perhaps best by remembering that Colonel Boyd never sought the acclaim won him by his thinking. He only wanted to make a difference in the next war ... and he did. That ancient book of wisdom—Proverbs—sums up John's contribution to his nation: "A wise man is strong, and a man of knowledge adds to his strength; for by wise guidance you will wage your war, and there is victory in a multitude of counselors." I, and his Corps of Marines, will miss our counselor terribly.

Sincerely,
C. C. Krulak
General, U.S. Marine Corps
Commandant of the Marine Corps

To understand how extraordinary such a tribute is, one should remember that one has to earn the right to be called a Marine. There are few honorary Marines. Retired Air Force Col. John Boyd was one.

What did he do to earn such accolades? What made him different? Why is he a hero to the Marine Corps and not his service, the U.S. Air Force? Like many others of Tom Brokaw's "greatest generation," he lived through the Depression, World War II, and the Cold War. Conflict and war were a part of his existence. He studied war, both tactically and strategically. If one had to fight, he wanted to know how to do it faster and better than an opponent. John Boyd played many roles in the course of his life: a student, an athlete, a mathematician, a teacher, an engineer, an aircraft designer, a military historian, a strategist, and a fighter pilot. But it is the last of these roles that was the most important. Out of the experience of aerial dogfights in Korea flowed most of what he came to learn.

Boyd (or more often "that fucking Boyd," "the Mad Major," "Genghis John," "the Ghetto Colonel," or "the Ayatollah," as he was referred to at various times in his career) was anything but a typical military officer. A colonel in the U.S. Air Force who retired in 1975, he had entered the military out of high school as the Battle of Okinawa raged in the Pacific. He served as a private in the U.S. Army Air Forces from 1945 to 1947 with the occupation forces in Japan. While attending the University of Iowa, he joined Air Force ROTC and was commissioned in 1951. His adult life was synonymous with the first fifty years of the independence of the U.S. Air Force. His military career spanned the thirty years from the fall of Berlin to the fall of Saigon. It was, as the Chinese curse says, "an interesting time."

The Making of a Strategist

Taking his cue from what he learned in air-to-air combat in Korea, the essence of Boyd's thought is rooted in something called the OODA loop, or Boyd Cycle. OODA stands for

observation, orientation, decision, action. The first element, observation, is sensing yourself and the world around you. The second, orientation, is the complex set of filters of genetic heritage, cultural predisposition, personal experience, and knowledge. The third is decision, the review of alternative courses of action and the selection of the preferred course as a hypothesis to be tested, and the fourth is action, the testing of the decision selected by implementation. The notion of the loop, the constant repetition of the OODA cycle, is the essential connection that is repeated again and again. This and Boyd's study of military history led to the theories he presented in his "Discourse on Winning and Losing."

It is a significant contribution to strategy. As Colin Gray describes it:

Boyd's loop can apply to the operational, strategic, and political levels of war as well as to tactics for aerial dogfights. Boyd's theory claims that the key to success in conflict is to operate inside the opponent's decision cycle. Advantages in observation and orientation enable a tempo in decision-making and execution that outpaces the ability of the foe to react effectively in time. This seemingly simple tactical formula was duly explained and copiously illustrated historically by Boyd in many briefings within the U.S. defence community over the course of twenty years. The OODA Loop may appear too humble to merit categorization as a grand theory, but that is what it is. It has an elegant simplicity, an extensive domain of applicability, and contains a high quality of insight about strategic essentials, such that its author well merits honourable mention as an outstanding general theorist of strategy.⁴

That is high praise from one of the premier students of strategy. It places Boyd and his ideas in a rather select circle of strategists whose theories transcend temporal, cultural, geographical, historical, and technological contexts.

Totally self-taught, Boyd's strategic odyssey was an odd one that flowed from the tactical experience of air-to-air combat in Korea and then branched out in myriad directions. How did he do it? Boyd read. He read military history, studied mathematics, learned about evolution and geology, and delved into formal logic and thermodynamics. He developed a taste for theoretical physics, quantum theory, and cosmology. He studied the mechanics of flight, the essence of aerodynamics, and engineering requirements for designing aircraft of different types, at different speeds and performance envelopes and how to compare them. He taught himself calculus and computer programming, studied history and politics, biology and how the brain works, economics and international relations, psychology and human development. He tried to summarize what he had learned from those different pursuits about how the world works, what life was all about, and how an organism should behave in order to survive and prosper.

Boyd talked with people. He talked with defense contractors, engineers, politicians, journalists, historians, people in other services (a taboo in his era for many officers), scientists, mathematicians, bureaucrats, consultants, other pilots, German war heroes from World War II, businessmen, academicians, and writers. In the 1980s, he had regular conversations with people as disparate as James Fallows of *Atlantic Monthly*, John Fialka of the *Wall Street Journal*, and business guru Tom Peters on the one hand and politicians such as Dick Cheney, Sam Nunn, Gary Hart, and Newt Gingrich on the other. He gave briefings to the

President's Scientific Advisory Board, the School for Advanced Military Studies of the U.S. Army at Fort Leavenworth, Kansas, the Institute for Advanced Studies at Princeton University, Navy pilots at Cecil Field, Florida, and the congressional Military Reform Caucus. For five years, a retired Air Force colonel taught every young lieutenant who went through the Marine Corps basic course at Quantico, Virginia, about maneuver warfare. He taught them how to think about combat, how to develop a *fingerspitzengefühl* ("fingertip feel"), as the Germans call it, for war, and to seize the initiative to shape the battlefield.

Boyd made a difference in how the U.S. military prepares to fight its wars, in the aircraft the U.S. Air Force has to fly, and in the cost of military procurement. He tried, with little success, to change how many political leaders think about war. He improved how well U.S. pilots of all services flew in combat, and his ideas have been used to help businessmen compete. He taught people how to synthesize complex ideas across different disciplines. His "Discourse on Winning and Losing" has made a difference while leaving Boyd himself in relative anonymity, known only to a few thousand cognoscenti interested in defense, air-to-air combat, and his brand of synthetic thinking. His accomplishments were made with no expectation or receipt of great financial reward, fanfare, or fame (except in isolated cases) and virtually no publication of his ideas, a rare circumstance for a person deemed so important in certain circles in the last decade of the twentieth century.

The Making of a Maverick

An iconoclast and self-proclaimed maverick thinker, Boyd was hated by many, admired by some, respected by most. Arrogant, brash, cocky, bright, articulate, profane, he was always testing the limits—of airplanes, people, science, the military, and, most especially, bureaucracies. Although he was consumed by the importance of time, Boyd was always late for meetings, not by ten or fifteen minutes but usually by much more. On first meeting, people (even those who admired or respected him or his reputation) thought Boyd crazy or brilliant, perhaps both. Unkempt in his appearance, unruly in his behavior, and unpredictable in his thinking, Boyd hardly inspired confidence. He was frequently dismissed as a crackpot. That's the way he wanted it. If people thought he was "bright but screwy," as Boyd said, that meant they underestimated him, and that gave him an edge.

To his admirers, he was a superb pilot, a brilliant thinker, and a premier strategist of the twentieth century. To his detractors, he was loud, brash, a foe of new technologies, and a source of irreconcilable pain in the ass. Boyd was known as someone who regularly bucked the system. Many knew of him by reputation, but few really knew him. To some, he was not much different from many good pilots, just a hard-driving type who usually went too far to get his way. To many, his greatest skill and damning sin was in pushing his ideas and end-running the system. He disregarded the chain of command with impunity and cared little about the rank of those he crossed or those who agreed with him. The hierarchy that counted was the one based on sound ideas. He did what he had to do to push his ideas; others did not. He was called simply "Boyd." Controversial, routinely; memorable, always; John Boyd was truly an unforgettable character. He was a maverick—a wild, unbranded stallion, owned by no one and beholden to no one—and proud of it.

From such personal preferences emerged a brilliant fighter pilot who helped shape air combat training for the Air Force and other services. He literally wrote the book—*Aerial*

*Attack Study*⁵—on jet combat fighter tactics. He knew almost instinctively how to get the most out of an airplane and to fly it better than anyone else, but he needed to explain why and how to do it for others. So, as a young captain at Nellis Air Force Base, Nevada, he taught himself calculus at night and flew during the day. He sought to understand the mathematics and the physics of what he was able to do with an airplane. Nellis and the Fighter Weapons School were the basis for the education of John Boyd. Everything he knew flowed from the insights he had while flying the F-86 in Korea and thinking about and refining those ideas at Nellis after the war.

It was at Nellis that he first achieved fame within the Air Force. He was simply the best instructor pilot at the Fighter Weapons School, and everyone knew it. The secret to air-to-air combat was to get inside the other guy's OODA loop. Get your opponent in a position where he was already reacting one or more moves behind what you were able to do; fling him off in front of you by quickly changing speed, altitude, or direction. Then nail him. The key was the speed with which you could change and adapt to the changes ("fast transients"). Do it well, and you would win. At Nellis, Boyd earned the nickname "40-Second Boyd" for standing bet against all comers, including any USAF pilot or Navy or Marine aviator from Miramar Naval Air Station in California, later the home of the Navy's Top Gun school: if he couldn't outmaneuver you in a dogfight and get on your tail in position to shoot you down in 40 seconds, he'd pay you 40 bucks. In six years, he never lost the bet.⁶ It was usually over 10 to 20 seconds.

Boyd needed not only to understand but also to explain to others what he had learned and why. He began treatises on air combat maneuvering in 1957 and kept working on them. The result, in 1960, was the first comprehensive manual on jet aircraft combat, the *Aerial Attack Study* that Boyd produced while at Nellis. Though *Aerial Attack Study* was the basic manual for fighter tactics used by the Air Force, Navy, and Marines, he went farther. At Eglin Air Force Base, while working with Tom Christie for the Systems Command of the USAF in the early 1960s, Boyd developed his ideas on energy maneuverability (EM) theories that revolutionized fighter design.

In typical Boyd fashion, he and Christie sketched out their ideas at the Officer's Club bar on cocktail napkins and pursued them with stolen computer time in dummy accounts. He had an idea that the performance characteristics of an airplane could be plotted in terms of the trade-off in the relationships between altitude and energy expressed in terms of maneuverability. Doing this for several aircraft, he could plot one against the other and determine the precise conditions of speed, altitude, and g forces at which one aircraft, handled by a knowledgeable pilot, would have an advantage over another. Luckily, the work to develop the EM concept was completed before an Air Force audit discovered the subterfuge. The results were so profound that the manner in which the data were developed was forgiven in an effort to share the insights with Tactical Air Command and senior Air Force leadership. Boyd and Christie won several Air Force awards for their work. The energy maneuverability concept and subsequent refinements revolutionized U.S. air superiority tactics, doctrine, and equipment.

Taking on the System

After his work on EM theory at Eglin, Boyd was assigned to the Pentagon to work on the A

Force's new fighter project called the F-X (Fighter Experimental). After reporting for duty, he was shown the current plans and projections for a 60,000-pound plus, swing-wing follow-on to the F-111 fighter-bomber and asked for his opinion. After spending two weeks reviewing all the materials, Boyd (a major at the time) was called into Gen. K. C. "Casey" Dempster's office with his boss Colonel Ricci and asked what he thought. His reply? "Hell, I've never designed an airplane before, but I could f—up and still do better than this."⁷

He gradually convinced the powers-that-be that the performance differential was not worth the extra weight and complexity of the pivot for a swing-wing fighter or the increased financial cost over a more conventional fixed sweptwing model. The F-15 Eagle, the U.S. Air Force's premier fighter, was the result. Along the way, Boyd and his colleagues Pierre Spreng (a Department of Defense analyst) and fellow Air Force officer Rich Riccioni decided that the F-15 was too expensive and not agile enough. They thought what the Air Force really needed was another fighter that was simpler and cheap enough to be bought in large numbers to insure air superiority through both quality and quantity. Joining forces with others of similar insight—fighter pilot C. E. "Chuck" Myers, Jr., General Dynamics engineer Harry Hillaker, and a bevy of others—they worked behind the scenes, outside the rules, and inside the Pentagon to push their ideas. Thus was born what came to be known as the Fighter Mafia, their quest for a lightweight fighter, and a conceptual mutiny within the Air Force.

Convincing others of the merits of what became the F-16 was an epic five-year struggle inside the Pentagon. The Air Force senior leadership did not want the F-16 and worked hard to kill it. Ultimately, a bunch of upstarts centered in the Tactical Air shop took on the system and won. Perhaps most remarkable was the creation of a fighter that cost less than its predecessor, a record likely to stand in perpetuity.⁸ Boyd reveled in the role of David against Goliath. He managed to change the way the Air Force and Department of Defense designed aircraft and, at least for a while, how they procured and tested new weapons systems. In the process, he made adversaries as well as friends. Spies were assigned to his office. He was followed at work. His phone was tapped. His close associates and allies were transferred, or nearly so, to remote assignments in Korea and Alaska. This was hardball.

That the Air Force would not only tolerate but also promote one such as Boyd—who challenged the ideas and decisions of superior officers, who questioned tenets of institutional culture, or who spoke his mind and gleefully took on the system—is rather miraculous. Without a senior officer patron or two along the way who remained behind the scenes, it couldn't have happened. Many in the Air Force were appalled by Boyd's ideas and even more so by his actions. He was not a team player; he defied authority and told others in detail what he thought of their "dumb-ass ideas." As one author has put it, "Almost more than his theories, the Air Force's brass hated Boyd. They perceived him as overbearing, arrogant and conceited. Boyd said he simply suffered no fools; that, said Boyd, included both pilots and generals."⁹

But he was tolerated, however grudgingly. Being a "good stick" (a superb pilot) and helping to design the Air Force's premier fighters counted for something. John Boyd did all that and more. As a retired Air Force officer, he worked with a small group of devoted military and civilians who met at senatorial staffer Bill Lind's townhouse in Alexandria for Friday-night seminars on maneuver warfare. He helped set the stage for a complete revision of U.S. Army doctrine that eventually became known as "AirLand Battle" and, along with other mavericks

in and out of the service, helped the Marine Corps to embrace maneuver warfare. When he retired from the Air Force, he worked as a consultant for an additional thirteen years (albeit for only one day's pay per pay period, the least he could receive and still have routine access to the Pentagon). While doing so, he helped to run what became known as the military reform movement of the late 1970s and early 1980s from inside the Pentagon. Boyd proved even more adept at guerrilla warfare in the policy debates in the Pentagon than he was in air-to-air tactics at the Fighter Weapons School. He is still having an impact on how the U.S. military thinks about strategy, doctrine, tactics, and decision-making.

To Be or To Do?

Along the way, he set out to implement his personal credo—philosophic and strategic—everything he did, every job he held, and every decision he could influence. Simply stated, it was more important to do what was right than to be promoted. As he put it in talking with younger officers: Do you want *to be* promoted to general officer or *to do* what is right? On active duty, Boyd delighted in finding the very best officers the Air Force had (Air Force Academy graduates, promoted below the zone two or three times and thus several years ahead of their contemporaries) and challenging them. They were the epitome of competitor men, team players who wouldn't rock the boat and who wanted desperately to become Chiefs of Staff of the Air Force. Anything else would be a failure, despite the very long odds against it.

One such example was Jim Burton, then a lieutenant colonel recommended to Boyd by a colleague because he was bright. Boyd hired him, and they became close friends. Burton would go on to occupy a critical post in Test and Evaluation and to blow the whistle on rigged tests in the Army's procurement of the new Bradley Fighting Vehicle. He recalls the Boyd "To Be or To Do" speech as follows:

Jim, you are at a point in your life where you have to make a choice about what kind of person you are going to be. There are two career paths in front of you, and you have to choose which path you will follow. One path leads to promotions, titles, and positions of distinction. To achieve success down that path, you have to conduct yourself a certain way. You must go along with the system and show that you are a better team player than your competitors. The other path leads to doing things that are truly significant for the Air Force but the rewards will quite often be a kick in the stomach because you may have to cross swords with the party line on occasion. You can't go down both paths, you have to choose. So, do you want *to be* a man of distinction or do you want *to do* things that really influence the shape of the Air Force? To be or to do, that is the question.¹⁰

Burton's decision and his personal, Boyd-inspired crusade are documented in his book *The Pentagon Wars: Reformers Challenge the Old Guard*.

For doing what was right, Burton's career was sabotaged. The Air Force tried to have him reassigned to Alaska with no notice, and several officials lied under oath to Congress regarding the Bradley and the Army's testing of it. Burton, schooled in guerrilla tactics and

strategy *a la* Boyd, countered with powerful congressional allies, media contacts, and stories (*Washington Post*, *Time*, and *60 Minutes*), all orchestrated by Boyd. He didn't shrink from fight and wouldn't desert those who challenged the system.

A whole coterie of junior officers, most of whom left the Air Force rather than compromise or put up with the system, have gone on to do important work in a variety of fields: Chuck Spinney, Ray Leopold, Barry Watts. Others, like Jim Burton, stayed and even attempted to outdo Boyd in taking on the system and making it do what was right. A few profited from the association and went on to senior rank; Gen. John M. "Mike" Loh, a four-star general who became head of the Air Combat Command, was the most notable example. All grew immensely in the process and looked on John Boyd with awe and respect. Ray Leopold, from his position as a senior engineer at Motorola, recalled, "I had a Ph.D. in electrical engineering at twenty-seven, but my education began when I met John in 1973." He was a mentor for a lot of them, a father figure for some, and a demigod for a few. To his detractors he was a troublemaker whose harebrained antitechnology ideas caused enormous problems for the Air Force in particular and the U.S. military in general.

To do what he thought right, Boyd didn't care how high he had to reach or how many senior officers' feathers were ruffled in the effort. His influence always exceeded his rank, a damning sin in a military hierarchy, particularly when he did end runs on the system. And his influence others he did, from the Office of the Secretary of Defense and the U.S. Congress in the 1970s to a *Time* magazine cover story (1983) and a supplement on technology and defense in *The Economist* (1995).¹¹ The terms "OODA loop," "cycle time," and "Boyd Cycle" had meaning not only in the U.S. military but also in American business, as articles in *Forbes* and the *Harvard Business Review* will attest.¹² Though he wrote only a handful of Air Force studies (some of which are still classified) and never published anything commercially, John Boyd is mentioned in scores of books, journal and newspaper articles, and dissertations by those fortunate to know him or his work. His reputation is global. Business school students in Denmark; military officers in Australia, Holland, and Thailand; graduate students in Canada and businessmen throughout the United States know of John Boyd and use his teachings. As one author characterized it, "John Boyd is a national asset, but the public does not know him. He prefers it that way."¹³

The Man and His Mind

For Boyd, thinking—thinking differently—came naturally and defined his very existence. His study of chemistry, physics, and biology, his investigations about how the brain works, the nature of memory, how one learns, thinks, and questions, were central to his worldview. These combined with a moral sense of the highest order and a belief in a hierarchy that ranked people first, ideas second, and things third made him a force to be reckoned with. He had a rare but effortless and intuitive capacity to collect disparate pieces of information over a period of days, months, or years and to connect them. He could interpolate among and between these disparate bits of information and create sweeping insights. More important, they were generally correct, though often abstract and flowing from seemingly unconnected sources. These intuitive leaps were frequent and allowed Boyd to paint broad-brushed understandings of complex issues that others could grasp only in pieces.

Most men possessed of Boyd's contacts and insights would have become multimillionaires

by writing, consulting, and advising others on putting these ideas to work. Not Boyd. He found money to be corrupting and wanted no part of the temptation. He told his family—wife and five children then living in a basement apartment in Alexandria, Virginia—that they should get used to living on a retired colonel's pension early because that's all they would have. When the children complained about some of the strictures this caused, Boyd went out and bought a copy of Darwin's *On the Origin of Species* and told them to read it. Other than token honoraria (a couple of hundred dollars from time to time, and that under duress), Boyd made no money from his rather considerable intellectual talents in the 22 years after he retired from the Air Force.

The reason was simple. John Boyd did not view knowledge as a proprietary commodity. He wanted to share his insights, not charge for them. And he has. Despite not publishing his "Discourse on Winning and Losing," there are businessmen, officers in all branches of the U.S. military and in other militaries around the world, aircraft designers and engineers at aerospace defense firms, politicians in Washington, students, academics, and journalists who regularly use John Boyd's ideas.

This is really quite extraordinary, that near the end of the last decade of the twentieth century, a man is known mainly by word of mouth and the passing of his insights from one person to the next. The knowledge of his accomplishments more resembles something out of the Middle Ages, 997 perhaps, but not 1997. But Boyd and his accomplishments are well known to those whose knowledge and opinions count. This is true even though he did not appear on television, did not publish anything (even within the Air Force in more than 30 years), and retired from military service more than 25 years ago. Boyd was still a significant force until shortly before his death. Up until 1996 Boyd still briefed consulting firms, military classes, and groups inside and outside the Pentagon interested in the nation's defense.

In his last 22 years, Boyd delved deeper and probed more widely and connected more completely insights from a variety of disciplines to improve his understanding of thinking strategy, and time. He delivered his famous briefing "Patterns of Conflict" nearly 1,500 times. (It grew into "A Discourse on Winning and Losing" in nineteen different versions ranging from one hour to almost fifteen hours in length.) Originally, it was called simply "The Green Book" because of the green paper cover on its 327 pages. (In recent years, after Boyd's partial rehabilitation within the Air Force, "A Discourse" has been distributed with a light blue cover, more befitting its origins and heritage.) Boyd would distribute it to nearly anyone who wanted it, telling him or her to make as many copies as you like and spread the word. Indeed, as a colleague tells the story, the first time Boyd saw a copy machine his eyes lit up and he grinned with Machiavellian glee. "Now," he said, "there are no secrets!"¹⁴

Until the mid-1990s, Boyd was adamant about giving the whole briefing and would not give pieces of it. As the master teacher of his own ideas, he "had to take people through it" so they would understand the full implication of what the words, maps, diagrams, and such could only imperfectly represent. Gen. Edward Meyer, Chief of Staff of the U.S. Army, once called Boyd: "I hear you've got a briefing that I should hear. I've got an hour or two later this week I could use to hear it. Can you do that?" Boyd replied, "Sorry, General. The briefing is four hours long. You get the whole brief or no brief."¹⁵ General Meyer somehow found the time for the whole briefing. Eventually, after one version ran for nearly fifteen hours over two days, Boyd consented to give that part entitled "An Organic Design for Command and

Control” or “The Conceptual Spiral” as stand-alone presentations that could be delivered far less time than the magnum opus itself. But it was done reluctantly and infrequently. hurt to discuss only pieces of his vision, to share only the fragments of his fleece.

Integrity and Intensity

In the dozens of interviews conducted for this book, the most consistent theme and near universal comment was that John Boyd was the essence of an honorable man and incorruptible. All men may have their price, but Boyd’s was apparently never offered. He refused consulting opportunities, avoided asking for speaking fees even when he and his family could have used them, rejected jobs, expensive dinners, and other blandishments to change his mind for defense contractors, senior officers, and high-ranking political officials. Indeed, after his death, when archivist Janet Kennelly from the USMC Research Center was collecting his papers prior to taking them to Quantico where they are housed, she found stacks of government checks for travel expenses, honoraria, and reimbursements of various kinds that Boyd had never cashed. They amounted to thousands of dollars. Even if it was legitimate, Boyd did not want to feel beholden to anyone. Besides, he was retired and didn’t work for the government anymore.

Boyd lived modestly, with few clothes, no cable TV, in an apartment. He had owned a home only briefly in the early 1960s. His life style was less than modest. His nickname “Ghetto Colonel” referred to his basement apartment in Alexandria, in a rather rundown area. (His youngest son, artistically and scientifically inclined at an early age, is said to have filled a sketchbook with 70 different kinds of insects he found in and around the apartment.) Boyd often read large portions of books and magazines (if not whole volumes) at local bookstore. He drove old cars, ate out rarely, and instead spent wild amounts of money on his own extravagance, the telephone. Boyd didn’t write many letters, didn’t have a computer to use e-mail; he talked on the phone. He talked frequently—at least weekly and sometimes daily—with a circle of a dozen or so close associates and less frequently with a secondary realm of another two dozen contacts. His passion for discussion and what he learned in the active interchange of ideas was nearly boundless, as were his monthly phone bills.

Boyd was a complex combination of intense intellect, dedication to high principles, deep friendships, and focus on fundamental, serious issues confronting the Air Force, the military, and the nation. He was also a kid at heart at times, fun loving and possessed of an infectious laughter that could sweep away nearly any other emotion. Though rarely shown, he had a tenderness of concern for others that is uncharacteristic of many fighter jocks but an important part of his essential humanity. His key ability was his intensity, his ability to focus to shut out everything while he solved a particular problem, human or mathematical. It was almost frightening to behold.

That a mind could concentrate so intensely to the exclusion of all else—noise, temperature, food, sleep, time, and place—was astonishing. To see him do so conjured up images of a hypnotic, trancelike state in which the brain’s instruction is all consuming. It was his essential mental characteristic. When his mind was seized with a problem, he could shut down everything else to concentrate on finding a solution, actually an array of alternative solutions in most cases, until he was satisfied that he had exhausted the possibilities. Colleagues tell of Boyd going for hours almost in a trance, doing formulae in his head until he solved

particularly vexing problem. He could go for days focused on just one element of a complex problem.

John Boyd was, as the subtitle of Murray Gell-Mann's book *The Quark and the Jaguar* states a set of "adventures in the simple and the complex." Coming to understand him, his ideas, their implications and significance on a variety of levels, has been no easy task. I am under no illusions that the task is complete, that either he or I have everything right, or that the insights, debates, and issues with which he wrestled are resolved. This volume is a beginning of a continuing discourse that will no doubt follow on Boyd, his ideas, and the military reform movement.

Boyd's Way

What I call Boyd's Way, his thought and vision, is a sort of Western Zen, oxymoron though that is. It is a state of mind, a learning of the oneness of things, an appreciation for the fundamental insights known in Eastern philosophy and religion as simply the Way. For Boyd the Way is not an end but a process, not a state of mind but a journey. It is kaleidoscopic in its effect, with new patterns emerging from the same colored stones of insight and reflection mirrored in constantly changing patterns. The connections, the insights that flow from examining the world in different ways, from different perspectives, from routinely examining the opposite proposition, were what were important. What one takes to be the question may be the answer and vice versa. The key is mental agility and the ability to sort through the "windmills of your mind."¹⁶

All of this came naturally to Boyd. A single comment that he found intriguing for its richness fueled his mind for hours and was revisited over weeks and months until he fully appreciated the insights contained in the compression of a few words and what they signified. He was not satisfied until he could wring out the totality of an idea or concept. Alternatively, he strove to compress complex ideas into their most elemental formulation. In this sense he used words as a mathematician uses numbers and symbols. The very concept of algorithmic compressibility fascinated him. The height of elegance was the simplest representation of the most complex phenomena. Boyd's equivalent of $E = MC^2$ is OODA loops. That to Boyd is the sum total of life. All organisms seek to survive and prosper. They do so by enhancing the freedom of independent action or establishing symbiotic relationships through time adaptation to a constantly changing environment. Those who adapt will survive; those who do not, die. Those who do survive do so by being good at doing OODA loops. Though abstract, this was an important concept to a fighter pilot who had only seconds to make the right decision or perish.

Boyd's trinity was a synthesis of the breakthrough thinking of three major scientific concepts. They are linked by the mathematical compressibility of complex events into simple truths. These three concepts form the theoretical basis for Boyd's view of the world. The irony is that he knew these things before he discovered them. He was aware of their importance before he knew the provenance of his insights. The three elements of Boyd's Way in a scientific sense are taken from the second law of thermodynamics, Werner Heisenberg's indeterminacy principle, and Kurt Gödel's incompleteness results. Collectively, they underpin Boyd's Way with a scientific gravitas. The second law implies that working within a closed system, over time, the amount of confusion and disorder will increase. Heisenberg's

uncertainty principle states that there is a limit to the precision with which even physical values can be known. Gödel's results show that the concept of truth is not coextensive with provability in formal systems. "Taken together, these three notions support the idea that an inward-oriented and continued effort to improve the match-up of concept with observed reality will only increase the degree of mismatch."¹⁷

This is heavy stuff and not the usual sort of reading or thought processes for a fighter pilot, but for Boyd it was necessary. He was a bird of prey circling his domain, constantly alert and surveying his environment. He processed an immense amount of data, selected carefully the bits that he needed at the moment, remembered where he had seen other pieces that might be needed later, and swooped in for the kill. His talons were his neural network, his mental ability to grasp instantly and hold complex ideas, seemingly unrelated, and synthesize some new construct. He fed on ideas and maintained, "When there are no new ideas or I am unable to think, I'll be dead because that's my life's sustenance."¹⁸

An Anomaly

Boyd's contributions to the military and the country did not stop after his retirement. He continued to talk with people on the phone, give his briefing, consult with think tanks and politicians, fighter pilots and academics, business people and journalists. Talking on the phone was raised to a high art with Boyd. During the work on this book, Boyd and I would talk several times a week, sometimes several times a day, for anywhere from three to twelve hours a week. I was continually astounded by his contacts among defense intellectuals, senior military and political leaders, and journalists. He had access to a large number of high-profile influential people.

Jim Burton, now a retired Air Force colonel, recalls that he and Boyd talked so much on the phone for a period of three years that his teen-age daughter complained. He got a second phone line just for Boyd's calls, which his daughter christened "the Boyd phone." Gen. Mike Loh, long before he became commander of Air Combat Command, worked with Boyd as a major in the Pentagon in the early 1970s—surreptitiously. Unbeknownst to his superiors, he was feeding information to Boyd at night that his boss at the Pentagon had tried to use during the day to defeat Boyd's latest initiative. He later became the system project officer for the J-16. Interviewed as we flew from Maxwell Air Force Base to Langley, General Loh said he spent so much time on the phone with Boyd at night that his wife resented it. Twenty years later, Loh could still recite Boyd's telephone number from memory.¹⁹

With such gifts, contacts, and talents, why isn't Boyd better known and why didn't he write anything other than a few Air Force tracts? First, Boyd came from a culture that is, though technically competent, essentially anti-intellectual. You don't earn fame and promotion by thinking and writing but by flying, leading, and doing. Second, most information is presented and distributed in the military through the briefing. A briefing is a set of overhead projections, 35mm slides, or, more recently, Power Point programs presented in a darkened room to a group of usually superior officers. Its purpose is to convince them that whatever is supposed to be happening is—preferably on time and under budget. If not, it presents the necessary excuses for the delay and cost overruns. Oral, not written, communication and conviction, not accuracy, still rule in military culture. It was not a part of Boyd's culture to write, and when he wrote, it was done in briefing format.

Third, his ideas were always imperfect, always being refined, connected in new and different ways. If one's understanding is always imperfect, it can't be committed to print because revision is imminent, or so it seemed to Boyd. Hence, he read, discussed, refined and polished ideas, and kept synthesizing and reexamining. His thoughts would never be complete, fixed, or perfect. He was caught in a spiral of unending OODA loops. The possibilities were limitless. Although he came to understand the importance of his insights and the need to share them with others, he did not necessarily hit upon the most efficient and effective way to go about doing that.

We have the anomaly of an individual known very well to a few thousand important people who share his concerns about war, about winning and losing, about thinking, strategy, and time, and yet who is unknown to the general public. This book is an effort to remedy that in some small way and to make his insights available to all who might benefit from them. It is belated, incomplete, and not nearly the same as if Boyd had written it himself, but he didn't and somebody should. Boyd's Way is not the only or the easiest way to come to grips with problems and their solutions, but it is a way of thinking, connecting, learning, synthesizing, solving, and surviving. Immersing ourselves in it cannot help but improve our ability to cope—as all organisms must—with a complex, unknown, constantly changing environment. So begins a more detailed examination of John Boyd and his way.

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