



DESIGN OF WARFARE

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Acknowledgments

Several years ago, we began talking with colleagues about the importance of design thinking—both for our university and for the broader defense community. It was heartening to receive enthusiastic responses from systems engineers, management experts, defense analysts, roboticists, anti-submarine warfare specialists, and many others throughout the campus. We are grateful to all for embracing design as a path to innovation, and for seeing its potential to help in developing a deeper, broader understanding of military and security affairs in our time.

We owe a special debt of gratitude to General Raymond Odierno (U.S. Army, ret.), who, in his capacity as Army Chief of Staff, encouraged us to launch for him and his Strategic Studies Group our first major design challenge—the generation of creative ideas for the redesign of the Army. The faculty-student team that joined us in this endeavor greatly advanced the cause of design in defense-related matters.

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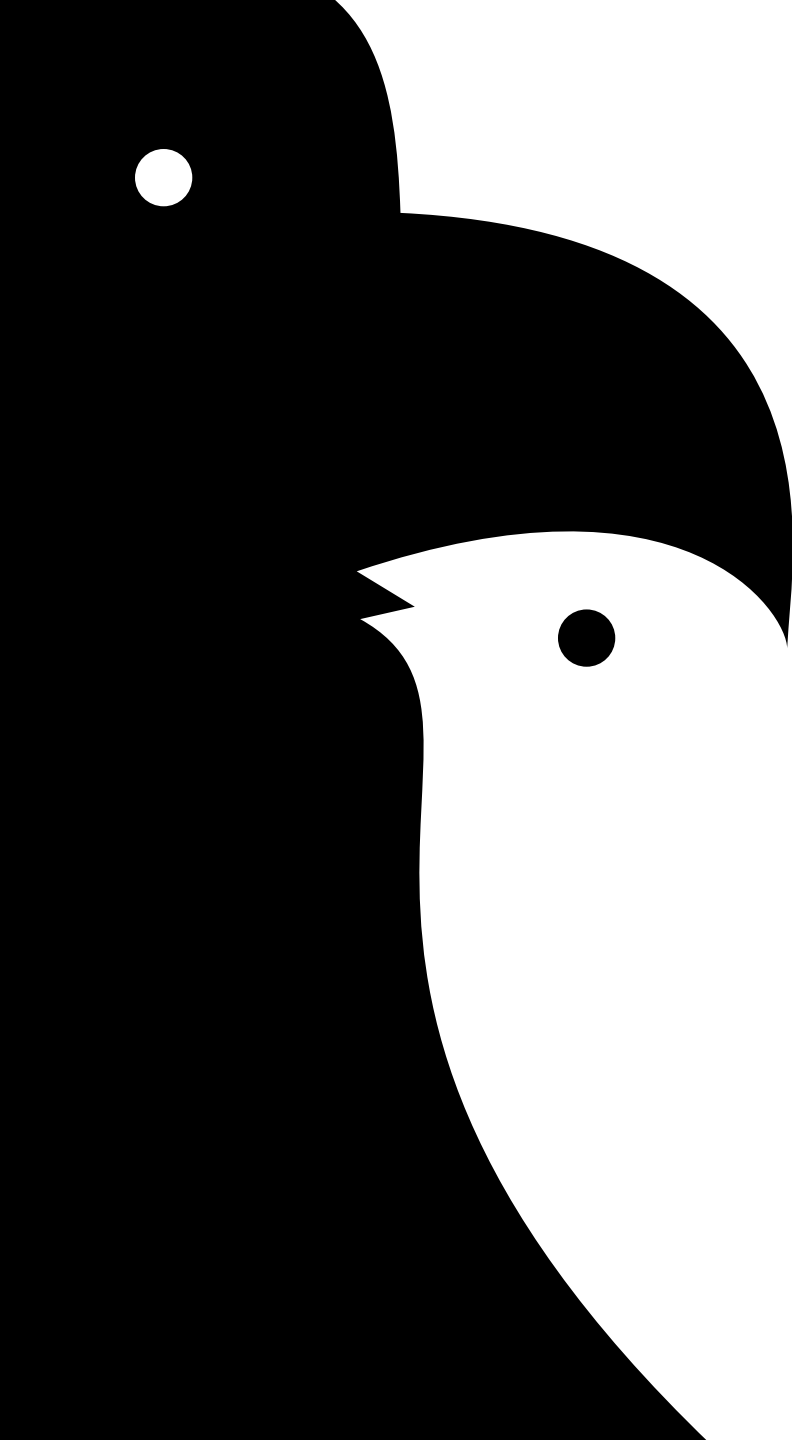
As the information domain features prominently as a design element in this monograph, our work has benefited from the support of the Department of Defense Information Operations Center for Research, located at the Naval Postgraduate School and directed by Dr. Hy Rothstein. The Center's Administrator, Rebecca Lorentz, has played a key role in the publication process. Ryan Stuart has worked a special design magic of her own in skillfully blending sizing, text call-outs, and visual imagery in ways that allow our story to unfold on multiple levels of engagement.

J.A. & N.R.

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THE OBJECT IN WAR
IS A BETTER STATE OF
PEACE.

—B.H. LIDDELL HART

Preface

MUCH OF WHAT IS WRITTEN ABOUT WAR, BEYOND THE GENERALLY

quite searing eyewitness recollections of the combatants themselves, consists of the official reports, carefully crafted analyses, histories, and memoirs of senior leaders that focus upon planning, operations, and the outcomes of the particular conflicts in question. The common themes that arise—across times and cultures—highlight the importance of valor, the subtle interplay of strategy and contingency and, most of all, the determinative factors of sheer numbers and superior technology. What is too seldom considered, though, with few exceptions, is the matter of the *design for warfighting*. By this term we mean not only the design of weaponry, but also the structure of military units, the concepts of operations for their use in battle, and the information systems that first sense the enemy's composition and disposition of forces, then process and transmit this knowledge as a guide to action. Taken together these elements form the design for warfighting.

WHAT IS TOO SELDOM CONSIDERED IS THE DESIGN FOR WARFIGHTING

The current era is one in which longstanding ideas about military affairs have come under strain. Weight of numbers and advanced weaponry have proved of little moment against supple networks of insurgents and terrorists. Indeed, the much vaunted “war on terror” has morphed into terror’s war on the world, as reflected in the roughly seven-fold increase in the yearly totals of terrorist attacks between 2001 and the present. Another troubling development is that an increasing number of nation-states now see the value of cultivating relationships with illicit networks of nonstate actors, or are forming their own dark networks with which to conduct covert warfare. The strong connection between Iran and Hezbollah provides an example of the former, Russia’s “little green men” of the latter. In the face of such developments, the costly American-led military interventions, manpower “surges,” and even the sophisticated use of highly advanced technologies have proved insufficient. Thus it seems that we live in

one of those revolutionary times when, as Karl Marx and Friedrich Engels put the matter in the first section of their *Communist Manifesto*, “all that is solid melts into air.”

We offer an antidote to the Marxist prediction that the liberal, capitalist world system is sowing the seeds of its own destruction: we can design our way out of the problems that face us. In the realm of war especially.

How can this be done? By recognizing that war is, in essence, a “design competition.” Whatever weapons are crafted, however military forces are structured, their information flows determined, and no matter the ways in which the use of these various elements

in battle is pondered, all must come together in a manner that enables them to contend with and then prevail against the adversary’s designs. Because the enemy is often quite familiar with the standard-use tools of war and well-worn, longstanding practices, design innovations very often come from “the outside” and aim at overthrowing conventional approaches to conflict. Of course, to each

side the other *is* the enemy—which should serve as a spur to all to become innovative designers of warfighting capabilities.



DESIGN INNOVATIONS VERY OFTEN COME FROM “THE OUTSIDE”



Sometimes the warfare design competition has been one-sided, with the combatant who enjoys seemingly substantial advantages often suffering from complacency. This was the case in many of the efforts to tamp down the anti-colonial insurgencies that flared up in the wake of World War II, culminating in the general collapse of overseas empires—their echoes still sounding as the American design for war failed to avert the fall of South Vietnam in 1975. The following decade saw the Russians defeated in Afghanistan in a similar manner. And in all the years since 9/11, the advanced militaries of many countries have failed to curtail the highly networked global terrorist insurgency under way. The key insight to be drawn from all these troubles is that weight of firepower

and even the most advanced, precise weapons systems can be deftly thwarted—even defeated outright—by skillful designs for warfighting.

It is with this thought in mind that we offer herein a brief introduction to the concept of design in war, along with some observations about the way to employ design as a distinct paradigm that integrates technology, information flows, force structure and battle doctrine. Weaving these elements together in creative ways is, we believe, the key to winning the design competitions that undergird and define all wars. In what follows, we begin by sketching the concept of the design for warfighting, which is one part, perhaps the central part of a larger phenomenon of “strategic design” — which is itself a key component of the even broader, and more familiar, notion of “grand strategy.” For now, we feel it is enough to examine how design sensibilities form a key aspect of warfighting approaches.

After introducing the elements that comprise the design for warfighting, we explore in some historical vignettes, and in one detailed case study, whether there might be some identifiable favoring conditions that tend to undergird victory—and conversely, “dis-favoring conditions” that are the harbingers of defeat. The central insights to watch for



Bulgarians ambush and kill the governor of Thessalonica, Duke Gregory Taronites.

have to do with the relationship a combatant has with “standard practices”—ranging from slavish devotion to a kind of strategic free-spiritedness—and with the notion of “alignment” of the elements of design. Our vignette drawn from ancient history, for example, finds that the Roman military stayed too attached to the infantry-heavy legionary formation, while the Byzantines shifted to greater reliance on cavalry, informed and guided—needless to say, well aligned with—an optical telegraph system that created a network of coverage impressive even by today’s standards. Our medieval and modern vignettes, from the Hussites to Wilhelmine Germany, echo these themes about the willingness to depart from the standard practices of the day—the Hussites did, the Kaiser’s top naval advisers did not—and the need to align the design elements skillfully. As to our analysis of Vietnam from a design perspective, we believe that this approach brings fresh insight to that much-studied conflict.

THIS MONOGRAPH IS A FIRST STEP TO SEEING DESIGN AS A PARADIGM FOR THINKING ABOUT & ANALYZING MILITARY AND SECURITY AFFAIRS

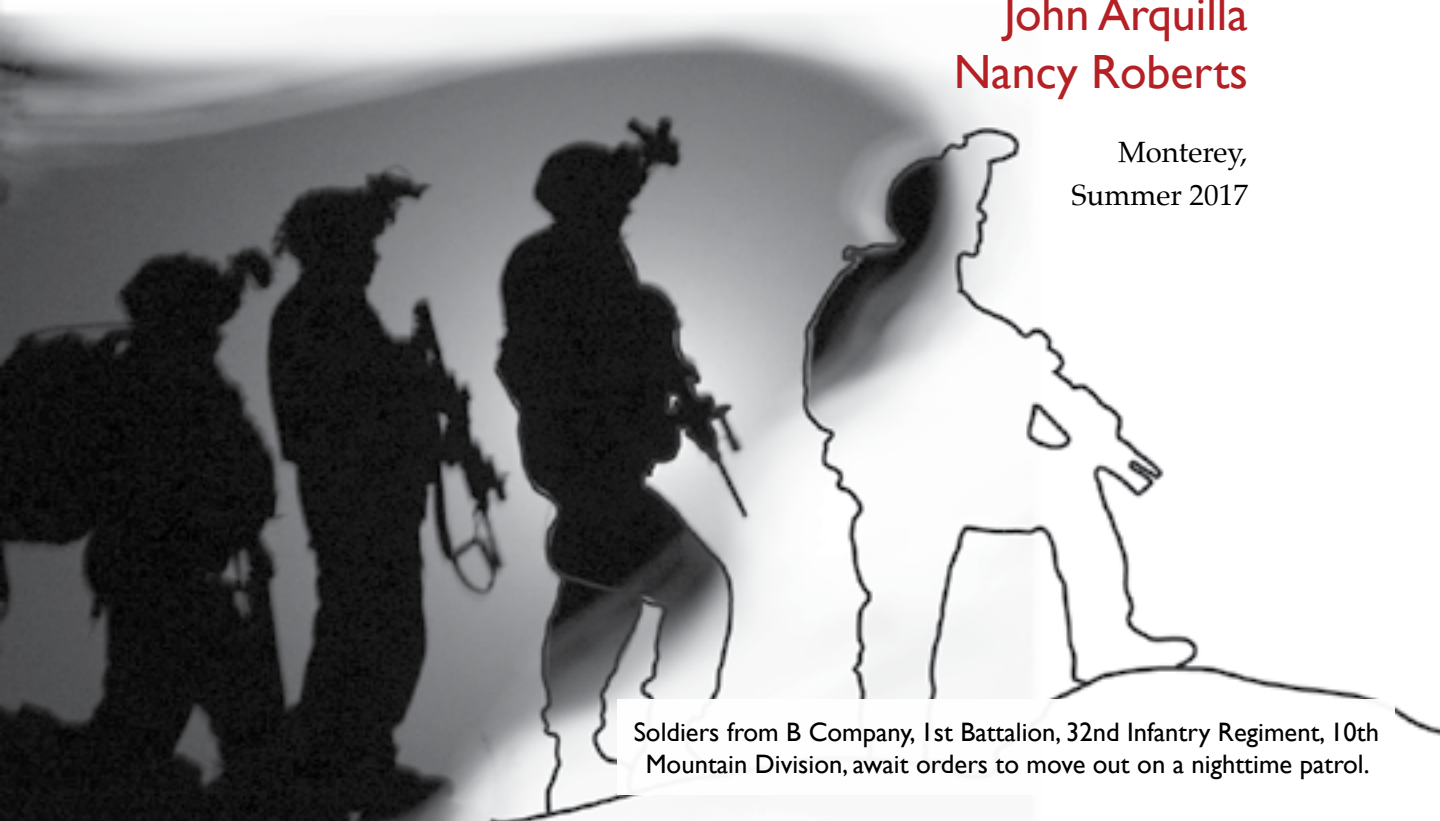
This monograph should be viewed as a first step on the path to seeing design as a distinct paradigm for thinking about and analyzing military and security affairs—different from algorithm-based quantitative study, as well as from empirically-oriented cultural/historical analyses. The next step will be to move beyond a focus on designs for warfighting to explore the broader level of strategic design and its relationship with grand strategy. In an era of seeming perpetual warfare, in which the United States and its allies have incurred massive costs for all too small returns, the design paradigm offers fresh hope that we may indeed prove able to meet and master the range of vexing challenges that darken and bedevil our world.

We are deeply grateful to our colleagues across campus here at the U.S. Naval Post-graduate School who have embraced notions of design and incorporated this approach

in their teaching and research. General Ray Odierno (USA, ret.) deserves much credit for encouraging us to launch our inaugural study about how to redesign the Army. Equal credit goes to the range of American and International graduate students who have employed “the design approach” in major projects ranging from study of the strategic challenges posed by a warming, much-disputed arctic zone to the various ways in which special operations forces might be called upon to operate in the future in an increasingly restive East Asia. These endeavors, and others, have helped to foster a growing awareness of the power of the design paradigm. We hope that this monograph will prove to be yet another contribution that helps sharpen the awareness of design and whets the appetite for its further employment across the spectrum of military and security affairs.

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Soldiers from B Company, 1st Battalion, 32nd Infantry Regiment, 10th Mountain Division, await orders to move out on a nighttime patrol.

British 17th Division in the Great War, March 1918



I. INTRODUCTION

WAR IS MANY THINGS. IN THE AGE OF TOOLS, A GRIM SHOVING-match of phalanx and legion. With the coming of machines, a mechanized engine of mass attrition. On all occasions a time portal reflecting both the strong pull of the past and the possible future face of battle. The Great War a century ago, for example, featured both the tight-packed infantry formations of previous centuries and the submarines, tanks, and attack aircraft that foretold the future of conflict. The former reflected traditional military belief in the pre-eminence of mass; the latter demonstrated a growing faith in and reliance upon technology to solve operational problems. In the century since the Great War, quite often to the detriment of strategic thinking and direction about the kinds of forces, unit structures, doctrine, and the role of information, faith in the power of sheer numbers and advanced weapons—the fundamental tenets of “military science”—have dominated the discourse. And sadly so since, for our part, *all* of these factors are necessary in the design of warfare.

**WAR REFLECTS BOTH
THE STRONG PULL OF
THE PAST AND THE
POSSIBLE FUTURE FACE
OF BATTLE.**

Failure to include any of the above factors increases the risk of ruin in war. For surely there is a need to craft the best weapons and field enough forces. But developing the right types of units, acquiring information and distributing it effectively, then identifying the best-suited fighting doctrines are crucially important to a well-formed design. Granted, each of these factors is familiar, taken one by one. But from our perspective, rarely have they been well aligned to best effect in war. And alignment of these factors into an integrated and mutually supportive whole forms the core of the concept of design. During the Great War, doctrinal innovation lagged far behind the logistical capability to deliver massive forces to the field and remained farther behind the technical ability to deliver accurate, deadly firepower. The result of such a serious misalignment: years of mindless slaughter that killed millions.

There have been many other examples of misalignments in warfare designs. In 1940, the French military had sufficient numbers of troops and weapons that were advanced enough (for that era) to defend the nation; but they were very poorly aligned with fighting unit structures. France was conquered in weeks. A generation later in Vietnam,

MISALIGNMENT IS A COMMON FLAW OF WARFARE DESIGNS

American air supremacy, firebases, and “big units” fell afoul of opponents’ doctrinal innovations whose alignment of virtually all their war-fighting factors was near perfect—and so the superpower was defeated. In the ongoing “global war on terror,” an epochal struggle between nations and networks, nations have failed for the most part to shift their warfare designs from notions of mass-on-mass confrontation to a focus on finding hidden foes. In this war, as in so many others, the informational dimension has proved key.

Whether arising from disputes over territory, god-concepts or economic systems, war is a design challenge. For superior numbers, and even the most advanced technologies have all too often been overcome by well aligned innovative doctrines, ingenious fighting unit formations, and “information advantages.” Integration of all of these factors—numbers, weapons, doctrines, structures, and information—is essential for effective war-fighting capabilities. Their skillful blending has separated victors from vanquished for millennia, and has shaped the course of human history.

But there is more to design than just considerations that focus on war-fighting. Peace, too, is a design challenge. Ancient Athens and Sparta learned this the hard way after more than a decade of conflict, when the troubled Peace of Nicias unraveled and the tragic Peloponnesian War dragged on for another decade. The Carthaginians, who fought so long and hard against Rome, foolishly agreed to a peace designed around their own unilateral disarmament. Their city was soon razed, the survivors sold into slavery. In more modern times, the retributive Treaty of Versailles in 1919 so poorly designed the peace that even the victors saw it as little more than a “twenty-year truce.” When Neville Chamberlain returned from Munich in 1938 with a scrap of paper that he

said represented “peace in our time,” he was holding an exceptionally flawed design. War returned the next year—right on the timeline of the critics of Versailles.¹ The United States had its very own Chamberlain moment in 1973, when Richard Nixon acceded to a design that he called “peace with honor” in Vietnam. Two years later the North Vietnamese Army headed south. Saigon fell. Ambrose Bierce was right, in his *Devil’s Dictionary*, when he defined war as “a byproduct of the arts of peace.” Yes, designing peace matters, too. A great deal.

Clearly, issues of war and peace are among nations’ highest concerns. Yet for all the attention given to military affairs, we find far too little evidence of or focus upon design. Instead, sheer material factors have tended to be emphasized. For example, the Powell Doctrine of “overwhelming force” ruled over American national security

Prime Minister Neville Chamberlain upon his return to London on September 30, 1938.



strategy for decades, despite clear evidence that adherence to it ran up extravagant costs, proved quite insufficient to ensure the vital interests of the country, and damaged the image of the United States in the world community. The Powell Doctrine only recently has given way to what may come to be called an Obama Doctrine featuring a more subtle

warfighting design based on small, special military forces working closely with allies and indigenous fighters.²

Designs of warfare and peace are central to successful outcomes, but they are not the only factors we must consider. Effective designs need to be embedded in larger, more comprehensive strategic designs that knit together the various elements of statecraft and military affairs in service to broad national aims. Beyond narrow considerations in the realm of military affairs, which focus on gaining a clear sense of the current—and

WE MUST LINK DESIGN TO THE “CONTEXT OF CONFLICT”

possible future—technology of war and associated unit structures and fighting doctrines, we need to link our designs for war and peace to the “context of conflict” where civil authority, diplomacy, and other political factors come into play. The envisioned post-conflict environment is key here. So much so that, as the strategist B.H. Liddell Hart once put the matter: “Victory in the true sense

implies that the state of peace, and of one’s people, is better after the war than before.”³ It should be understood that, whatever might happen in battle, or even at the conference table, all must be carefully aligned with the public’s opinions—domestic and international, to varying degrees.

It is interesting to note that our foregoing design framework tracks fairly closely the famous “trinity” of which the eminent philosopher of war, Carl von Clausewitz, wrote. He advanced the argument that the careful combination of military professionalism, political acumen and, as he formulated it, “passions of the people” formed the foundations of national power, as well as the basis for any realistic hope of achieving victory in war. Indeed, for Clausewitz these three elements had to be joined in an optimal—yet admittedly unstable—mixture that, as he put the matter, “maintains a balance between these three tendencies, like an object suspended between three magnets.”⁴

While this study focuses on design factors associated with the first element of Clausewitz’s trinity—military matters—the other legs of his triad are important as well. For

in the high politics of statecraft, allies are generally very good to have; and in domestic politics the support of the people matters quite a bit as well. But without a competent military, a country, even one with very reliable allies and a steadfast public, faces defeat. Thus our principal focus in this overview is on those warfare design factors—*technological, doctrinal, structural, and informational*—that shape military affairs and determine war outcomes.

Even our narrow focus on the design of war poses daunting challenges, for each of the factors we have delineated is complex; any effort to align them greatly increases the complexity of the task. That said, there are conceptual “handholds” that allow us to attempt to scale such a height. In the realm of *technology*, for example, the age-old linkage between weapons range and accuracy continues to be the *sine qua non* of success in battle. The key today is—and no doubt will continue to be the case tomorrow, too—

WE FOCUS ON THOSE WARFARE DESIGN FACTORS—TECHNOLOGICAL, DOCTRINAL, STRUCTURAL, AND INFORMATIONAL—THAT SHAPE MILITARY AFFAIRS AND DETERMINE WAR OUTCOMES

that sensory and guidance systems make it very likely that weapons can substantially increase their range and still enjoy great accuracy. Indeed, if there is a distinct advance in weaponry wrought by the ongoing information revolution, it is as Colin McInnes described the matter early on: “With precision terminal guidance, accuracy is no longer a function of range. If a target can be ‘seen,’ visually or electronically, then it can probably be hit.”⁵

In terms of *military doctrine*, there really are just a few dominant themes to keep in mind. The first has to do with the interplay between an emphasis on mass and the resort to maneuver. The abovementioned Great War was a classic case of overemphasis

on mass at a time when the destructive power of weapons routinely defeated offensives that relied upon sheer weight of numbers. Late in that war, however, efforts to maneuver arose, particularly in the form of the Allied forces' mobile tank units and the German *Stosstruppen*. Each effort had quite profound implications for *military unit structures*. For the tanks to be effective they should have been concentrated in a given area to break through the front, then to fan out beyond the opening. For the small groups of storm troops, the structural implication was to have many small units, widely dispersed.

Neither of these attempts to shift to maneuver warfare succeeded in ending the stalemate on the Western Front. Tanks were employed too early and were too widely dispersed when their numbers were few; and so the Germans had time to concentrate artillery against them.⁶ Despite these limitations, the potential was clear, and just a generation later in World War II armored maneuver swiftly came to dominate the face of land battle. With regard to the German effort to achieve a maneuver capability by means of redesigning their infantry units into small squads whose goal was to find or create, then infiltrate small gaps in the enemy line, the initial results were astonishingly



An early German tracked-vehicle design

successful in the March 1918 “Michael” offensive—which very nearly won the war. Disaster only befell them when their commander, General Erich Ludendorff, strayed from his own stated emphasis on finding and exploiting gaps. Instead, he became too focused on the capture of Arras, and reverted to the old way of relying on mass. As Correlli Barnett described the disaster that soon ensued, soldiers in “[w]ave after wave, in some places shoulder to shoulder six lines deep, advanced through a pouring rain, in full view of their enemies, and were decimated.”⁷ All hope of victory was lost that day.

The second major theme in *military doctrinal and related unit design* has to do with the division between conventional and irregular warfare. This doctrinal dualism can be seen from earliest times. Roman legions had to fight many traditionally massed opposing armies in their day; but they also found themselves deeply embroiled in a guerilla war in North Africa against Jugurtha late in the Second Century B.C.E., then two centuries later against the Judaeen Sicarii (“dagger men”) who prefigured what we call terrorist networks today. And in almost all the centuries since, war-fighting has featured both conventional and irregular doctrines. Most of the time, the conventional approaches have been dominant—thus massed forces and firepower have always been much-sought-after commodities. But over the past seventy-plus years since the end of World War II, insurgency and other forms of irregular war, including terrorism—have diffused widely. In these conflicts, the preferred unit structures have been small and supple, like the German storm troops.

CONVENTIONAL AND IRREGULAR WARFARE REQUIRE DIFFERENT DOCTRINAL AND UNIT DESIGNS

The last major element in the design of war that we will examine closely in this monograph is *informational*—a broad multidimensional concept when it comes to pondering the design of war-fighting capability. For our purposes, the components of the informational dimension fall into categories that encompass sensing and communicating. Each of these component areas should be examined from both offensive and defensive


perspectives. For example, while it is important that a “sensory system”—which can be comprised of technological gadgets *and* people—has the capacity to keep an eye on the opponent’s forces, it is just as crucial to be able to prevent the adversary from detecting and tracking one’s own dispositions and movements. In terms of the signals systems that form the backbone of communications, they should be fast, secure, accurate—and tightly coupled with sensors. Another aspect of communications is the challenge to maintain the morale of one’s own fighting forces while undermining the opponent’s—and at the most appropriate moment, exploiting enemy cognitive and motivated biases with skillful deceptions.

SIGNALS SYSTEMS SHOULD BE FAST, SECURE, ACCURATE – AND TIGHTLY COUPLED WITH SENSORS.

In the following sections we shall explore some historical examples of competing designs with the abovementioned factors in mind. Our hope is that this sort of preliminary analysis will give the reader a solid sense of how to think about warfare design, and what patterns, if any, might be associated with suc-

cess—or failure. More importantly, as our reexamination of the Vietnam case illustrates, not only do we have to align our technological, doctrinal, structural, and informational design factors but we also need to craft our warfare designs in light of our adversaries’ designs. In design competitions, adversaries always get a ‘vote’ on the most effective design.

Given our unique depiction of war as a “design challenge,” we believe it is particularly appropriate to explore this concept with an equally unique (to military affairs, at least) framework for analysis. Thus, in the last section, we depict warfare design as the centerpiece of a large, complex, adaptive defense system that supports and resources it. Although our primary focus is on the design of war that guides combat operations, we acknowledge that it is necessary and useful to understand how warfare design is embedded in larger system designs at the organizational and strategic levels.

John Steinbeck once wrote, “All war is a symptom of man’s failure as a thinking animal.” This is no doubt true to some degree—perhaps to a great degree—about the onset of war. But once at war, there can be no excuse for a failure to think deeply or fight wisely. Our hope is that the concept of warfare design may not only inform and guide effective action in wartime, but it may also offer redesigns at the organizational and national levels that improve our ability to prevent the very outbreak of war. 

NOTES

1. The classic study of the unraveling of the interwar period’s design for peace is Edward Hallett Carr’s *The Twenty Years’ Crisis, 1919-1939* (New York: Harper Perennial, [1939]1964).
2. See especially Jeffrey Goldberg, “The Obama Doctrine,” in *The Atlantic* (April 2016) on the doctrine’s broad, statecraft-oriented themes. For specifics on military design elements, see John Arquilla, “An Obama Doctrine?” *The San Francisco Chronicle*, January 31, 2016.
3. B.H. Liddell Hart, *Strategy* (New York: Frederick A. Praeger, 1954), p. 370. Fred Iklé, *Every War Must End* (New York: Columbia University Press, revised edition 2005) offers a profound meditation on the design of peace—and perhaps even the redesign of the notion of “victory.”
4. Carl von Clausewitz, *On War*, edited and translated by Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), p. 89.
5. Colin McInnes, “Technology and Modern Warfare,” in J. Baylis and N.J. Rengger, eds., *Dilemmas of World Politics* (Oxford: Clarendon Press, 1992), p. 148.
6. The best account of tank operations during World War I is still J.F.C. Fuller, *Tanks in the Great War, 1914-1918* (New York: E.P. Dutton and Company, 1920). Fuller had developed a well-articulated armored doctrine at the time, one that combined maneuver and concentrated units skillfully; but his ideas were over-ruled in favor of a much less innovative approach—one that achieved much less.
7. Correlli Barnett, *1918: Gamble for Victory* (New York: Macmillan, 1964), p. 66.



II. Warfighting Design Vignettes

A MAJOR STRAND OF STRATEGIC THOUGHT HAS ALWAYS EMPHASIZED the tools of war as *primus inter pares*. Major General J.F.C. Fuller, who was the first great advocate of tanks a century ago, even went so far as to state: “Tools, or weapons, if only the right ones can be discovered, form ninety-nine percent of victory.” But the use of armor during the latter part of World War I was of little moment, as key issues about force structure and doctrine had yet to be resolved.² Debates about these matters raged during the 1920s and 1930s. In retrospect—and to some extent as early as the fall of France in 1940—it became quite clear that what worked in terms of unit structure was concentrating tanks in purpose-built armored (that is, panzer) divisions rather than simply parceling them out equally across the force.

Ironically, French General Charles de Gaulle made one of the earliest and most eloquent cases in favor of such a war-fighting design,³ but his radical suggestions strayed too far from the preferred standard practice of the time and were rejected. The Germans, as is so well known, were more willing to depart from standard practices, built panzer divisions, then swiftly outdueled a larger (and better) French tank force, inflicting upon the Third Republic what one very perceptive historian labeled its “strange defeat.”⁴

THERE IS A SUBTLE INTERPLAY OF TECHNOLOGY, FORCE STRUCTURE, DOCTRINE, AND INFORMATION FLOWS.

With regard to the doctrinal dimension during this period, the most incisive thinking was done by another British strategist, B.H. Liddell Hart, who came up with a concept of operations, “the indirect approach,” that neatly aligned the technology of the time with the preferred force structure in a way that allowed and soon empowered military maneuvers of a sweep and on a scale hitherto unseen in the history of warfare. Liddell Hart’s basic idea was to avoid the typical slugging matches featuring massed forces in

favor of wide, sweeping movements primarily aimed at disrupting the entire enemy system by striking deeply at unexpected points, often where both administrative and logistical centers were located. His major survey of the history of warfare drew him to one key conclusion: “throughout the ages, effective results in war have rarely been attained unless the approach has had such indirectness as to ensure the opponent’s unreadiness to meet it.”⁵

This doctrinal concept lay at the heart of the German *blitzkrieg* successes from 1939–1942. Beyond the fall of France in 1940, it must be noted that the invading panzers, just in the initial invasion period in Russia, from June to December 1941, inflicted losses of *five million* troops on the Red Army. Most of these losses took the form of prisoners captured in large “cauldrons” created by the indirect approach of the German armor. Cut off from their higher commands and logistical supports, these millions of troops had little choice but to surrender *en masse*—though a tiny minority did sometimes fight their way out, or retreat to the forests to act as partisans. Interestingly the German successes during this period were gained despite the fact that the



Russians had more and better gunned and armored tanks—to a far greater extent than those the French had put in the field the prior year.

The well-known history of armored operations as they emerged late in World War I and blossomed in World War II is very useful for exemplary purposes in highlighting issues regarding the subtle interplay of technology, force structure, doctrine and information flows. The importance of these four elements being well aligned with

each other can hardly be overstated. Witness the French debacle in 1940 when their excellent, numerous tanks had neither the correct structural form nor the right doctrine for their employment—which also can be said of the Russians in 1941. But their omissions in these areas would not have been fully exploitable had the Germans not developed an information system that encouraged lateral communications within and among their tank formations—and, literally, vertical radio links with attack aircraft providing “flying artillery” close support from above. Neither the French nor the Russians had similar information systems—which cost them dearly. Still, those familiar with World War II will recall that, from late in 1942—counting from the big battles that led to Russian victory



at Stalingrad and British triumph at El Alamein—the *blitzkrieg* had become a blunted sword.

How? Why? The simplest, best answer to these questions is that the Russians in the East—and the British in the North African campaign—had finally become willing to give up on standard practices and began to organize, fight, and communicate like the Germans. With both sides using such methods, attrition began to assert itself again—but there were still remarkable, deep thrusts in the *blitzkrieg* style, now mounted by skillful generals like the Russian Zhukov and the American Patton. Yet it took a willingness to depart from standard practices to make *their* winning campaigns possible.

THIS SECTION USES HISTORICAL VIGNETTES TO ILLUSTRATE EXAMPLES OF GOOD AND POOR WARFARE DESIGNS

With the four factors of warfare design (technological, doctrinal, structural, and informational) in mind, this section uses historical vignettes to illustrate examples of good and poor warfare designs. We begin with consideration of three paired vignettes drawn from different eras, each providing insights into what makes for design success—or failure. The first explores the differing design solutions the Roman and Byzantine Empires developed in response to external pressure from barbarian peoples. The second, drawn from the Hussite Wars that arose in the late Middle Ages, examines a bitter struggle between aristocratic forces of armored knights following centuries-old standard military practices, and a peasant “rabble” that had an appetite for embracing innovative designs. Our third paired vignette explores the design dimensions of the Anglo-German naval rivalry in the two decades prior to the outbreak of World War I.

Rome and Constantinople

One of history's more fascinating military puzzles has to do with why the Byzantines outlasted the fall of Rome by a thousand years. At the time Diocletian divided the Empire in half in 285 C.E., it seemed clear that the legions of the West (i.e., Rome) had retained far more of the traditions and staying power of their military ancestors. And over the course of the next century, this conclusion seemed ever more clearly borne out. As historian Arther Ferrill has observed, "it was primarily the eastern armies that had suffered the great defeats in Persia (363) and at Adrianople (378) ... The simple fact is that the western army was better."⁶ As to the leading line of argument, about the increasing numbers of uncontrollable "barbarians" who were recruited into the legions, took them over, and eventually brought down the Empire, Ferrill notes that this was only true in the case of Rome, despite the fact that the Byzantine armed forces "had been much more barbarized than the army of the West."⁷ Thus, with a weaker army and many more barbarians in the East, one would have expected to see disaster engulf Constantinople long before the end in Rome. That the opposite result unfolded suggests that other important factors were afoot.

WHY DID THE BYZANTINES OUTLAST THE FALL OF ROME BY A THOUSAND YEARS?

We find it useful to contemplate this puzzle from a design perspective. At the internal level, both the eastern and western imperial militaries arose from the same infantry-heavy legionary roots in terms of structure and doctrine. Both also shared the external concern that barbarian peoples—Huns, Goths, Germans, Avars, Bulgars and Vandals, among others—were putting sharp pressure on the edges of empire. These hostile forces tended to field more cavalry and relied to a much greater extent on missile weaponry than did the legions. In terms of their strategies, both the East and West began this period (the late Third Century C.E.) with the inherited goal of holding on to virtually all of imperial territory by preventing penetration of the frontiers. The notion

of “preclusive security” made sense given that, as noted strategist Edward Luttwak observed, the Empire “did not face a single enemy, or even a fixed group of enemies, whose ultimate defeat would ensure permanent security ... the frontiers would always remain under attack.”⁸

Eventually, though, domestic manpower pools diminished, making it ever harder to station troops in sufficient numbers at all the imperial frontiers, and the sheer cost of maintaining such a force structure became too great. Thus a major shift in strategy, from perimeter protection to defense-in-depth emerged. Early in the Fourth Century, Emperor Constantine reduced the number of forces on the frontiers to the point of their simply being able to provide early warning of invasions and to hold on to fortified

**THE GOTHS, THE HUNS,
AND THE ALANI EASILY
OVERWHELMED ROME’S
‘NAKED AND TREMBLING’
LEGIONS.**

outposts. The idea being that smaller numbers of troops were to be assembled into larger bodies of mobile legions, stationed well in from the frontiers, but at sites that would enable them to respond quickly to threats wherever they might arise, at many varied points. The key to success, it was thought, was an information system that could consistently raise a timely alert.

Another challenge for the defense-in-depth concept was to achieve speed of legionary movement, so that the damage done by invaders could be limited. Roman infantry, known more for their deliberate pace of advance—and for building fortified camps at the end of each day’s march—simply could not improve upon their speed without some change that lightened the load of the average legionary. Emperor Gratian gave much thought to the problem, and believed that he had found a solution: if the infantry simply discarded their body armor, sharply reducing the amount of weight they carried—with ever greater reluctance—the legions could then move to trouble spots much more swiftly. True enough, the Romans now moved at a pace that allowed them to engage invading forces before they penetrated the imperium too deeply. The problem was that, in the effort to improve speed, the fighting power of the legions was fatally



Re-enactors in Roman legionary battle dress

compromised. For the barbarian enemies, so often defeated in the past by Roman steadiness in close-quarters combat, could now loose their arrows with greatly damaging effect into the tightly packed, unarmored imperial formations.

Edward Gibbon, in his classic *History of the Decline and Fall of the Roman Empire*, put the matter succinctly: “the Goths, the Huns and the Alani ... excelled in the management of missile weapons. They easily overwhelmed the naked and trembling legions.”⁹ This, Gibbon argued, was the proximate cause of Rome’s fall.¹⁰ In our words, this was a design flaw that arose out of the reasonable desire to improve mobility that went awry because of the unintended consequence of making the legions easy targets of highly mobile barbarian horse archers. In the East, perhaps because of the difficult time and poor results the longstanding standard legionary practices were having in the field, there was a much greater willingness to experiment with new force structure and doctrine.

Faced with the same external threat—literally, “barbarians at the gates”—and with similar manpower strains internally, the Byzantines also shifted from preclusive frontier protection to a defense-in-depth design. But they did so with an important twist. Instead of trying to figure out how to keep the infantry structure of the legions and increase their rapidity of movement, the Byzantines changed the very character of their army by making it much more a cavalry-centric force. And in addition to now having units that could swiftly move to trouble spots, the Byzantine cavalry arm introduced two new concepts: the armoring of the horse and man; and the equipping of each caval-ryman with a mix of missile weapons—javelins, composite bows and darts—as well as various close-quarters combat capabilities (especially short stabbing lances, maces, and swords).

Defensive armor and the multiplicity of weapons opened up the possibility of introducing innovative tactical concepts of operations as well. Instead of the long-standing Roman cavalry practices of hurling a javelin, or charging just for shock effect, then fighting at close quarters, the Byzantine cavalry emphasized use of successive charges in waves, unleashing missile weapons each time. Military historian Martin van Creveld described the operations of these *cataphracts* as “horse archers employing their typical hit and run ‘swarming’ tactics.”¹¹ This proved a highly effective design that thwarted barbarian incursions in the Fifth and Sixth Centuries—and was exceptionally useful in the Seventh Century and after against highly mobile Muslim field forces. The goal being, as the Emperor Nikephoros argued in his classic *De Velitatione* (*Skirmishing*), to raid, trap, and ambush enemy forces, keeping always on the move. As Edward Luttwak has summed this concept up, it operated “with a deterrent purpose: instead of trying to preclude incursions—much too hard to do—enemy columns [were] to be trapped.”¹² It was a system that worked well, for centuries.

As in the West, imperial defense-in-depth strategy in the East was highly dependent upon a swift, reliable information system that could accurately detect and continue

to track enemy movements—virtually in what is today called “real-time.” The Byzantines created such a system with an optical telegraph as their primary piece of “critical information infrastructure.” It worked for many centuries. Medieval historian J.B. Bury noted that “the signal service introduced, or perfected, under Justinian [in the 500s], was carried so far that a Saracen raid in the Taurus, four hundred miles straight away, could be signaled *almost at once* to Constantinople by a series of beacon fires.”¹³ Needless to say, swift and accurate communications were necessary for the Byzantine system to work—but the forces in the field still had to have a concept of operations that gave good chances of prevailing once battle was joined.

**THE KEY TO BYZANTINE SUCCESS
WAS AN INFORMATION SYSTEM THAT
CONSISTENTLY RAISED TIMELY ALERTS.**

However, it must be noted also that the durability of the Byzantine Empire was not solely the result of cavalry-related innovations in structure and doctrine, or the supporting, lightning-speed information system. Aside from the triple walls that secured Constantinople—at least until siege artillery had become strong enough to batter them down in the 15th Century—there was a great deal of creative design in eastern naval affairs as well. Ship speed was of crucial importance, so the Byzantine *dromon* (“runner”) emerged.

Instead of following the classic Roman concept of ramming and boarding—so as to have an infantry fight at sea—the Byzantines emphasized firepower. At first this was defined in terms of archery, at which the Byzantines drilled their squadrons to act in concert with over-lapping fields of fire. Later on, they introduced “Greek Fire,” an incendiary weapon shot from metal tubes, and which was used both by ships at sea and shot from towers in the defense of the capital as well. Greek Fire could not be extinguished by water. For centuries the sleek *dromons* and this most advanced weaponry dominated the seas. How very different from the Roman navy, which kept to its

The Hussites: Triumph and Tragedy

In 1517 Martin Luther nailed his Ninety-Five Theses to the church door at Wittenberg Castle, the opening shot of the Protestant Reformation. But over a century earlier, the Czech churchman Jan Hus had, as Luther would later, protested the sale of indulgences and other pecuniary practices of the Church that he held to be unseemly, if not outright corrupt. Hus developed quite a following among the Czech people, causing much concern in Rome. Thus he was invited to a “council”—with guarantees as to his personal safety—to discuss Church reform. Hus arrived to find that there was little interest in reform, and far more in his incarceration. Soon after he was burned at the stake. But the spark he had ignited spread, supported for the most part by peasants. To extinguish what was becoming a full-blown Hussite movement—driven by calls for religious reform, and increasingly by rising Czech nationalism as well—the Pope launched a “crusade” against them in 1419.

At first blush, it seemed likely that Hussite infantry, many lightly armed with scythes, flails, and other light weapons crafted from farm implements, would be quickly crushed by a holy army of mounted knights. But a minor Czech nobleman who was sympathetic to the Hussite beliefs and nationalist cause, one Jan Ziska, chose to help the peasants fight against the flower of Christian knighthood. Ziska, a man already in his sixties, had fought against the Teutonic Knights in the Battle of Grunwald in 1410, and became deeply interested in the emerging technologies of “hand cannons” and larger pieces of artillery. As



he readied the Hussites for action against the crusading army of knights, he scraped together the resources—largely by raiding Catholic monasteries of their treasures—to acquire some of these new weapons, then skillfully blended them with what the peasant farmers *all* had: wagons.

The wagon-fort concept itself—fighting defensively from the protection of circled wagons, in modern times a trope of film Westerns—was not new, having been used for centuries by nomadic steppe peoples, whose methods were then imitated by the Russians. Even farther back there are references to wagon-forts.¹⁵ But Ziska took matters to a whole new level. He built up the wagon sides, and notched loopholes for firing cross-

bows and handguns. Artillery came along with the Hussites as well, and was posted between their wagons. All moved at speed, compared to the typical army of the time. The historian Lynn Montross put the matter thus: “The Hussite wagon-fort bore little resemblance to its crude military ancestor. It might more accurately be described as an armored car.”¹⁶ That is, the wagons gave the Hussite forces a degree of overall mobility to go with their firepower and protec-

tion that rival forces simply could not match—moving as the latter did at the pace of their infantry. Ziska also had the idea of using the wagon-forts *offensively*—at least strategically. He would drive his wagon-fort train very close to a crusader camp, halt, line up the wagons abreast and start bombarding the enemy, whose only choices were to attack or give ground. Needless to say the crusaders generally chose to attack, and were slaughtered—much as French knights were being decimated by English longbowmen at the same time over in Western Europe.

When the crusaders tried to attack Hussite forces in flank, they found that Ziska had drilled his men to circle their wagons quickly on the defensive, and chain them together so that the knights could not separate them and penetrate within. Given the Hussite reliance on firepower, and the good protection against enemy crossbows and guns

x THE HUSSITE
WAGON-FORT
MIGHT ACCURATELY
BE DESCRIBED AS AN
ARMORED CAR.

provided by their wagon-forts, the challenge for the crusaders—drawn in large numbers from knights all over Europe—was to engage the Hussites more closely. In pursuit of this goal, crusading forces were first increased in number, the idea being that enough attackers would be able to get through the Hussite curtain of fire to overrun the wagon-forts. Firepower prevailed, however, and the Hussites, never more than 25,000 in the field, routinely defeated larger forces—on one occasion an army five times their size.



Hussite Wagon Circle

Next up was a solution aimed at making the knights' armor heavier, so much so that it could now protect against arrows and bolts. Ziska's response was simple and effective; he increased the proportion of handguns, reducing the number of archers and cross-bowmen. Slaughter of the crusaders continued. And when, finally, the choice was made to build wagon-forts to fight against them, it turned out, unsurprisingly, that the Hussites maneuvered them more skillfully and *still* won. The crusades were given up, but at that point the Hussites sadly turned on each other in a bloody civil war that erupted over niggling theological differences—like something out of Jonathan Swift's description of the origins of the war between Lilliput and Blefuscu, or Dr. Seuss's *Butter Battle Book*. Thus skilled wagon-fighters were going at it on each side—and soon brought a suicidal end to their remarkable movement.

It is important to note that one of the greatest strengths of the Hussites was their favorable asymmetry of motivation. Their narrative was simple: they were fighting against a corrupt Church and overbearing imperial control. It was a compelling story, one that galvanized virtually all Czechs. Against this, the crusaders—often dragooned into service or enticed by promises of plunder—on many occasions fled before the approach of

the wagon-forts. They had not the stomach for the kind of hard fighting that lay ahead. Yet it must also be noted that the zeal that enlivened and empowered the Hussites in battle, when turned inward against rival factions, wrought bloody disaster.

Interestingly, the French at this very time were grappling with the same problem of how to come to close quarters with the deadly English archers who had decimated them at Crécy and Agincourt, two major battlefields of the Hundred Years' War. They, too, strove to improve the armor of their knights, to little effect. What turned the tide



Jeanne d'Arc

against the English was the vision of a teenage girl, Jeanne d'Arc, who claimed that "voices" gave her instructions on how to defeat the invaders: swift movement from march to assault on the English before they could properly set up the angled stakes that were there to protect their longbowmen. The answer was not to become heavier, but rather quicker, mounting, as Edouard Perroy put it, "surprises, sudden attacks, and deep raids."¹⁷ It proved to be the first part of a war-winning answer—in later years the French also embraced field artillery.

Whatever the source of Jeanne's visualizations, spiritual insight, or however else one might characterize them, she played a key role in overturning the longstanding French military practice of marching, massing, then launching a long-anticipated frontal assault. The old ways simply allowed the English too much time to set up a line of anti-cavalry stakes in front of longbowmen, who then just kept firing away until the attackers had been decimated. The genius of Jeanne d'Arc was in her emphasis on striking before the English had time to set up—which put having information about their movements and dispositions at a premium.

The matter of visualization is no doubt a key element in the warfare design process. To return to Jan Ziska, he had lost one eye earlier in his military career; an arrow wound took the other at the outset of the Hussite Wars. Yet he continued in command, blind but still a true prodigy of warfare design, fully endowed with visualization skills sufficient to meet and master the succeeding waves of crusaders.¹⁸ As the great historian Hans Delbrück once observed, Ziska pioneered an “effective and *unprecedented* method that aroused the amazement of all his contemporaries.”¹⁹ And though Ziska died midway through the Hussite Wars, his methods survived and his successors continued to win signal victories against the flower of Christian knighthood. The key to Hussite success: a willingness to reject the leading military doctrinal practices of the time, while hearkening to an old wagon-fort structural concept and revitalizing it with the most

THE KEY TO HUSSITE SUCCESS WAS A WILLINGNESS TO REJECT THE LEADING MILITARY DOCTRINAL PRACTICES OF THE TIME.

modern advances in weaponry. These elements, coupled with religious and nationalist zeal, gave the Hussites a warfare design far superior to that of the Crusaders who opposed them. Indeed, only Hussites could defeat Hussites.

As to the early stirring of Czech patriotism, this can and should be seen as a harbinger of the “nation in arms” notion that arose to energize the wars of the Napoleonic era. Clausewitz considered this factor so important that he made “the passions of the people” a key element of his famous trinity of war. But he also cautioned that “[n]o matter how brave a people is, how warlike its traditions, how great its hatred for the enemy, how favorable the ground on which it fights: the fact remains that a national uprising cannot maintain itself where the atmosphere is too full of danger.”²⁰ The wagon-fort design’s genius was in giving the Hussites a real sense of security in battle—or at least a sense that the atmosphere was not “too full of danger.”

The Great Anglo-German Naval Arms Race

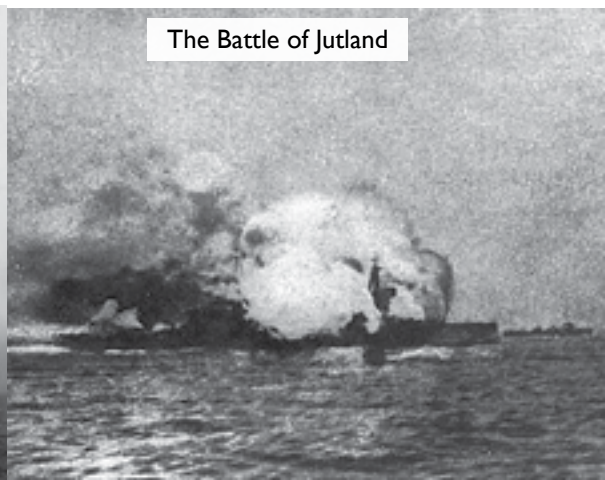
The ability to visualize proved to be a central factor that served to inform and guide warfare design in our third vignette as well, which covers the remarkable naval arms race between Britain and Germany that unfolded in the quarter century between 1890 and 1914. It pitted the world's long-standing leading navy against a fleet that was being built from scratch by a continental rather than a maritime rival. This race was conducted against the backdrop of fast-moving technological advances and growing geopolitical tensions that contributed to the outbreak of World War I in August 1914. Britain's Royal Navy pursued a strategy based on the notion of sustaining its command of the sea to blockade its enemies, ensure the safe passage of friendly maritime commerce along trade routes, and to safeguard the ferrying of the British Expeditionary Force onto the Continent at the outset and throughout the course of any war.

The strategy of the German High Sea Fleet was more complex and, to some degree, confusing and contradictory. Although the principal rationale for fleet-building was to have sufficient naval combat capability to deter Britain from joining a Continental conflict, the very fact that Germany was pursuing such deadly sea power fed an Anglo-German

SMS Scharnhorst



The Battle of Jutland

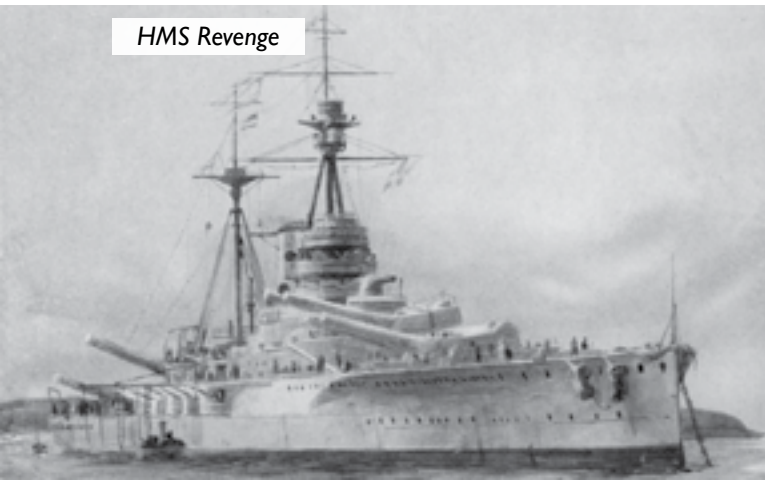


antagonism that only increased the likelihood that Britain would be on the enemy side in wartime.²¹ Given that the Germans began the naval arms race well behind the Royal Navy, as long as the British kept building warships the High Sea Fleet could never catch up. This dynamic led to a situation that resulted in, as Paul Kennedy has put it, “Germany never improving its strategic position but so alarming her rival that many Britons increasingly identified the new Reich as their most formidable single foe.”²²

Aside from pursuing an effective deterrent—an aim never achieved, given early British entry into the war—the Germans felt the need for a swift naval force that packed a fairly heavy punch in battle. There was vague hope that elements of the High Sea Fleet could help defend German colonies in East, West, and Southwest Africa, along with far-flung holdings a hemisphere away, ranging from Tsingtao in China to the Solomon Islands and other holdings in the Pacific. Thus a *Kreuzergeschwader* (cruiser squadron) was created, with most of its warships based in the Far East. But these forces spurred a British response—and caused a reaction in Japan as well—negating the value of the squadron. So there was very little hope that these cruisers could receive reinforcements in

**GERMAN NAVAL STRATEGY WAS
COMPLEX, CONFUSING, AND
CONTRADICTORY.**

HMS Revenge



HMS Iron Duke



wartime, and fuel—coal in this case—and all other logistical supports were vulnerable to disruption. This was a problem for the lone raiders that the Germans also sent out to harry British and other enemy trade.

As matters unfolded, Admiral von Spee, commander of the cruiser squadron, fled from the Pacific quickly at the war's outset. He defeated a weak British squadron at Coronel off the Chilean coast, but his own force was wiped out at the battle of the Falklands in December 1914.²³ As to lone raiders, most were dealt with quickly—in large part due to radio reporting of their positions. Historian Paul Halpern summed the matter up: "Modern technology ... had made the conduct of cruiser warfare much more difficult. The presence of a raider could be quickly signaled by wireless."²⁴

In terms of other aspects of the technological state of play in naval affairs during the decade prior to World War I, there were improvements in engine power, the range and accuracy of guns, and clarity of wireless transmissions. The German naval effort, led for twenty years by Admiral Alfred von Tirpitz and supported enthusiastically by Kaiser and legislature, was well attuned to the increasing potency of big guns. Tirpitz inferred that his "dreadnoughts," would engage the enemy at long range. This meant shell-

INCREMENTAL CHANGE DOES NOT ALTER AN OVERALL STRATEGIC SITUATION

fire would follow extended arcs, then plunge onto decks, so Tirpitz made sure to armor the decks heavily—not just the sides—of his ships. The British didn't do this as well, and so suffered mightily for it at the Battle of Jutland in 1916, in which the Royal Navy lost fourteen ships and six thousand sailors killed. The German losses were eleven ships and less than half the number of sailors.²⁵

On the surface (no pun), the results of Jutland seem to bear out the success of the Germans' design of their naval warfighting capability. But Jutland failed to change the overall strategic situation. The Royal Navy's blockade remained, and the Grand Fleet's

greater size meant that it could absorb the losses of Jutland and remain ready to fight again. Indeed, Admiral John Jellicoe, immediately upon his return to port after the battle, signaled to the First Sea Lord that his ships “were ready to steam at four hours’ notice.” In military historian John Keegan’s assessment, the High Sea Fleet suffered big enough losses that “the German battle line could not have met the British at four weeks’, let alone four hours’ notice.”²⁶ As the naval war unfolded, the Germans never again challenged the British battle fleet, remaining in port for the next two years. In the last months of the war, German sailors mutinied.

The Royal Navy survived the German challenge because Admiral Tirpitz chose to build a fleet that, for the most part, simply mirrored its rival. And the incremental changes he did emphasize—protection from plunging fire, better optics, and improved

German U-boat and crew, c. 1915



compartmentalization—could not make up for British superiority in numbers. Nor could the High Sea Fleet serve as an effective deterrent, largely for the same reason: its smaller size. Thus the Germans failed because of their emphasis on imitating the standard practices of the leading navy of the day—though on a smaller scale, and with just a handful of improvements around the edges of naval design. Whereas, in our previous vignettes, the Byzantines and Hussites succeeded by virtue of their willingness to jettison standard practices in favor of radical changes that saw them embrace

highly innovative concepts of operations.



U-boat attack on an armed merchantman

Was there a more innovative design path open to Tirpitz? He was certainly aware of the rapid advances being made in submarine technologies. But in his *Memoirs* Tirpitz took the position that the limited range of these stealthy vessels kept him from championing them. As he put the matter, “I refused to throw away money on submarines so long as they could only cruise in home waters, and therefore be of no use to us.”²⁷ But he was being a bit disingenuous here, given that he was in a position to accelerate the pace of technological advance.

In fact, the German firm Maschinenfabrik Augsburg-Nürnberg was the world leader in diesel engine design—a decade before the start of World War I. Still, as Bernard Brodie noted, it was “only about a year before the outbreak ... that Germany acquired her first real ocean-going boats.” By the second year of the war, the Germans had only forty-one submarines.²⁸ As the U-boat war unfolded, even with these limited numbers, the Germans very nearly strangled British maritime traffic, sinking over thirteen million tons of shipping.

THE CLEAREST LESSON FOR WARFARE DESIGN IS THE NEED TO BE WILLING TO JETTISON STANDARD PRACTICES


Why were the U-boats so successful? In part because, at the doctrinal level, the British were reluctant to adopt the escorted convoy system—they waited *three years*. Convoys often took weeks or longer to assemble, and once underway moved at the pace of the slowest ship, a far more time-consuming process than the standard practice of allowing the independent sailing of merchant ships. But in addition to British dithering over naval doctrine for protecting ocean commerce, there was also the technological problem that no reliable way of detecting a submerged vessel was developed until quite late in the war. A primitive form of sonar, the asdic, did eventually emerge, though it was of limited range, and its effective use depended heavily on the individual skill of the operator.



Thus U-boats enjoyed a significant informational advantage over their foes: they could observe without being seen, and unmask their presence only very briefly during an attack—often a torpedo’s wake being the only sign—then return to hiding. Had Admiral Tirpitz and his minions thought more about the “sensing aspect” of the informational factor in design for war-fighting, they might have focused on submarine development—the radical, innovative path—rather than on imitating the dreadnoughts of the Royal Navy. If they had done so, the outcome of the war at sea, and perhaps as a consequence the outcome on land as well, could have been different. But, as Bernard Brodie noted, Tirpitz “stubbornly opposed the adoption of the submarine ... The Germans themselves never realized the tremendous potentialities of the submarine until the war was well under way.”²⁹ Too late.

Two Quick Insights from the Vignettes

The clearest lesson for warfare designs to be drawn from the vignettes is the need to be willing to jettison standard military or naval practices. The Byzantines and Hussites succeeded because they were quite willing to throw out an existing playbook. The Germans failed because they followed one too closely in naval affairs. Another interesting point has to do with the informational dimensional, which played out differently across each vignette, but which was important in each. The Byzantine optical telegraph was the key to their defense-in-depth system. For the Hussites, the power of their puritan and nationalist narrative drove them to keep fighting—and keep winning—against all odds. And German naval efforts could have succeeded if only the stealthiness of the U-boats had been properly appreciated.

But as much as designs for war-fighting depend on how a particular actor’s own warfare design aligns the technological, doctrinal, structural and informational factors, success—or failure—will ultimately depend upon how well or poorly an opponent aligns these factors. How the clash of competing designs plays out is the subject of the next section, which analyzes the Vietnam War from this fresh perspective. 

NOTES

1. J.F.C. Fuller, *Armament and History* (New York: Charles Scribner's Sons, 1945), p. v.
2. See also Fuller's *Tanks in the Great War* (New York: E.P. Dutton and Company, 1920) which outlines many of the themes that would come to characterize armored warfare.
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4. Marc Bloch, *Strange Defeat* (Oxford: Oxford University Press, 1968). Bloch did his writing soon after the fall of France, joined the Resistance, and was eventually caught and executed in 1944. Fortunately, his manuscript survived.
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6. Arther Ferrill, *The Fall of the Roman Empire: The Military Explanation* (London: Thames and Hudson Ltd, 1986), p. 84.
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8. Edward Luttwak, *The Grand Strategy of the Roman Empire* (Baltimore: The Johns Hopkins University Press, 1976), p. 137.
9. Edward Gibbon, *History of the Decline and Fall of the Roman Empire*, ed. by J.B. Bury. Vol. II (New York: The Heritage Press, 1946), p. 883.
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12. Edward Luttwak, *The Grand Strategy of the Byzantine Empire* (Cambridge: The Belknap Press of Harvard University Press, 2009), p. 343.
13. J.B. Bury, *History of the Eastern Roman Empire* (London: Cambridge University Press, 1912), p. 247.
14. See William Ledyard Rodgers, *Naval Warfare Under Oars* (Annapolis: Naval Institute Press, 1940), especially pp. 7–22.
15. For example, see Euripides, *The Phoenician Women*, v. 450.
16. Lynn Montross, *War Through the Ages*, 3rd Edition (New York: Harper & Row Publishers, 1960), p. 189.
17. Edouard Perroy, *La guerre de cent ans* (Paris: Gallimard, 1945), p. 266.
18. The Pope launched five failed crusades against the Hussites during the period 1419–1434.
19. Hans Delbrück, *History of the Art of War*, Vol. III, *Medieval Warfare* (London: University of Nebraska Press, [1923]1990), p. 483. Emphasis added.
20. Carl von Clausewitz, *On War*, edited and translated by Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), p. 482.
21. On the paradox of German naval policy, see Jonathan Steinberg, *Yesterday's Deterrent: Tirpitz and the Birth of the German Battle Fleet* (London: Macdonald, 1968).
22. Paul Kennedy, *The Rise of the Anglo-German Antagonism* (London: The Ashfield Press, 1980), p. 423.
23. The exploits, and fate, of the *Kreuzergeschwader* are well described in Edwin Hoyt, *Kreuzerkrieg* (Cleveland: World Publishing Co., 1968).
24. Paul Halpern, *A Naval History of World War I* (Annapolis: Naval Institute Press, 1994), p. 68.
25. Geoffrey Bennett, *The Battle of Jutland* (London: Batsford, Ltd., 1964) remains an outstanding study of this great clash at sea.
26. Both quotes are from John Keegan, *The Price of Admiralty: The Evolution of Naval Warfare* (New York: Viking, 1989), p. 151.
27. Grand Admiral Alfred von Tirpitz, *My Memoirs*, Vol. I (New York: Dodd, Mead and Company, 1919), pp. 179–80.
28. Bernard Brodie, *Sea Power in the Machine Age*, Second edition (Princeton: Princeton University Press, 1943), pp. 297, 316.
29. *Ibid.*, pp. 292, 295.



III. Vietnam: War as a “Design Competition”

PERHAPS THE MOST VEXING OF ALL AMERICA’S WARS, THE LONG conflict in Vietnam tore down much of the edifice of strategic thought that the U.S. military had built up in the decades after World War II. At the level of force structure, the preferred “big units” with their heavy firepower proved too balky to deal with elusive guerrillas. In terms of technology, very advanced aircraft and extensive aerial bombardment, even with the Air Force’s increasingly smart targeting and guidance systems, failed to stem the tide of North Vietnamese troops and supplies—or to break the will to fight of enemy leaders or their mass public. With regard to military doctrine, early emphasis on a Special Forces-led counter-insurgency campaign soon gave way to the massive application of General William Westmoreland’s admittedly innovative new concept of “air assault”—an approach reliant on rotary aircraft to deliver troops to the battle. But the helicopter proved highly vulnerable to ground fire, a problem worsened by the small number and predictability of good landing zones in the difficult terrain of Vietnam. So much so that more than 4,000 choppers were shot down during the course of the conflict.¹

THE VIETNAM WAR TORE DOWN MUCH OF THE EDIFICE OF AMERICAN STRATEGIC THOUGHT

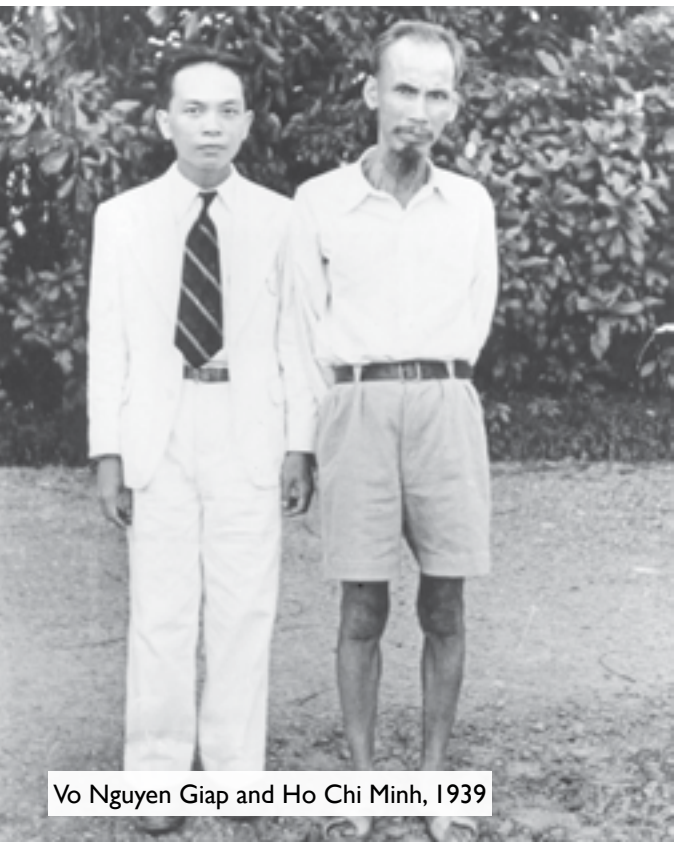
If the war was long and wearying for the U.S. military and the American public, it was even more demanding upon the Vietnamese insurgents. First, during the fight against French colonial rule, they were called the Viet Minh. Later, post-partition in 1954, the guerrillas in the South were labeled the Viet Cong, distinguishing them from the more regular North Vietnamese Army (NVA). For both of them, the decade-long “American War” that followed on the heels of the long fight for independence from the French proved to be the ultimate test of their resolve—and way of war. Success against the

French was gained by a blending of doctrinal concepts: Mao Zedong's ideas about guerrilla warfare and Napoleon Bonaparte's notions of independent yet convergent maneuvers by larger forces. And in the campaign at Dien Bien Phu sheer grit made the difference, with thousands of insurgents lugging heavy artillery high up the seemingly unscalable heights overlooking the French positions. The effect was devastating—and war-winning.²

But the struggle against the Americans was going to call for much greater effort, and a warfare design that could hold up under sustained air attack while at the same time engaging a modern military that enjoyed extensive advantages in firepower and tactical mobility. To confront this challenge, Vo Nguyen Giap, a high school history teacher

turned general, came up with a set of concepts that marked him as one of the “great captains” of modern times. For during the course of the conflict from the arrival of the first major U.S. Marine detachments in 1965 to the fall of Saigon ten years later, he and his soldiers first held off, then compelled the withdrawal, of the top-line troops of the world's leading military.

To this day, just how Giap and the North Vietnamese achieved their victory remains one of military history's most challenging puzzles. The American argument that insufficient resources were employed is rebutted easily by noting the sheer size of the U.S. forces deployed—over half a million soldiers at the high point—and the fact that more bomb tonnage was dropped on North Vietnam than on Nazi Germany during



Vo Nguyen Giap and Ho Chi Minh, 1939

World War II.³ Another line of reasoning has to do with the notion that field operations went well from a warfare design perspective, but the American public could not bear its consequences—the heavy, growing casualties—so it ceased to support the military intervention. This argument is in large part contradicted by polls taken of the public during the national election surveys of the critical years 1966, 1968, and 1970. In each of the surveys, when asked whether to leave Vietnam, keep the current level of operations, or escalate the war, a significant majority of Americans indicated support for continuing the fight—or fighting even harder. Indeed, as many as 10% of Americans wanted either to invade the North or to use nuclear weapons.⁴

In our view, the American defeat in Vietnam—and the North Vietnamese victory—can be more persuasively and accurately explained by examining the conflict from a design perspective.

Analysis of the competing sides' doctrines, force structures, technologies, and information strategies will shed light from new angles on this most perplexing war. And, we hope, make the case for the importance of thinking in terms of warfare design.

HOW GIAP AND NORTH VIETNAM WON REMAINS ONE OF MILITARY HISTORY'S MOST CHALLENGING PUZZLES

The Genius of Giap

Perhaps the highest praise of Vo Nguyen Giap has come from Russell Weigley one of the leading American military historians of the modern—or any other—era. As Weigley viewed Vietnam, it was a conflict in which the doctrine employed by the insurgents contributed heavily to their victory. He focused on Giap's skillful blending of conventional and irregular operations in the field, and drew a parallel with the Revolution, a time when *Americans* were insurgents. Weigley summed up Giap's generalship as “not unworthy of comparison” with Nathanael Greene, who in his view stood “alone as an American master developing a strategy of unconventional war.”⁵

For Giap, as for Greene before him, the challenge of waging a war both in occasionally conventional and more often irregular fashion had much to do with arriving at the right force structure. Nathanael Greene was blessed by the presence of several first-class guerrilla fighters in the Southern colonies who kept the British distracted enough to allow him to advance with a main force and give open battle from time to time. Giap, on the other hand, had first to build the Viet Cong force structure of small, interconnected units all over the South and supply them, along with the regular North Vietnamese Army, with enough resources to allow them to take the field, harass the enemy and, occasionally, mount larger-scale offensives.

AMERICAN DEFEAT IN VIETNAM CAN BEST BE EXPLAINED FROM A DESIGN PERSPECTIVE

The two-fold doctrine he developed worked reasonably well during the first years of the “American war,” from 1965–1967; but in the wake of the 1968 Tet Offensive the Viet Cong were decimated. As one account put it, “the indigenous Viet Cong—who did most of the fighting and dying—suffered a grievous military setback.”⁶

At this point, Giap necessarily had to split off significant portions of NVA to continue hit-and-run guerrilla operations, and he shied from arguing for yet another attempt at major conventional battle until 1972, when U.S. ground troops were almost all gone and the South Vietnamese Army had to stand virtually on its own—but still with American air support, which proved crucial to defeating the NVA once more.

In the end, there was no climactic confrontation with American troops, as there had been at Dien Bien Phu against the French. Instead, Giap’s forces kept up the fight for long enough to wear down the will of American senior leadership—if not of the American people. And in the spring of 1975 his forces, now under the tactical command of one of his protégés, launched a massive, *blitzkrieg*-like attack that very quickly overwhelmed the South.⁷

Giap's ability to stay in the fight—and we say “Giap” deliberately, for he often stood alone while others in leadership criticized him in front of Ho Chi Minh⁸—was not just a function of the sort of blended doctrine and mixed force structure that he championed. These elements of his warfare design would have failed in the face of the overwhelming air power of the Americans, the advanced weapons they possessed, and the mobility of their ground forces. Somehow Giap had to find a way to use technology the insurgents had at hand or could acquire, and also figure out how to employ low-tech means to counter these American advantages in the tools of war.

To deal with aerial bombing, Giap early on, before the American war began, advocated going underground—literally. So factories in the North were relocated to subterranean settings from their centralized locations in Hanoi and Haiphong. As to the average soldier's preparation, Giap lengthened initial training periods so that skill at building underground outposts could be developed. Even the foxhole became more complex, as NVA were trained to dig deeper, then put in a turn at the bottom where the soldier scurried when under artillery or aerial bombardment. The turn at the end of the foxhole protected the soldier from proximity-fused



shells that exploded overhead—and from all but direct hits. North Vietnam received fighter aircraft and anti-air missiles during the war, largely from Russia, which supplied many other war materials as well. American air superiority was not broken, but its effects were very much mitigated—by digging.

The underground theme was pursued extensively all over the South, where VC and NVA regularly operated from subterranean bases that soon came to include even such vital functions as hospitals. Indeed, the South became honeycombed by tunnels and underground facilities that helped to mitigate the effects of American bombardment capabilities and allowed insurgents to keep the initiative by remaining hidden until they chose to mount attacks. A very significant effort was made to counter this underground design, and an American military specialty of “rat holing” emerged. But there were just never enough “tunnel rats” produced to deal with the problem.⁹

Even so, the extensive VC and NVA operations in the South would have withered had the North been unable to keep them supplied. This was a key low-tech task, central to the overall success of Giap’s warfare design, for which digging was obviously not a solution. Instead, a very resilient supply system had to be created that could stand up under American bombing. At the outset of the war, one idea was to take advantage of South Vietnam’s long coastline to smuggle in supplies, arms, and men to guerrilla units. But American naval forces responded quickly, blanketing the southern coast and rivers. Under operational names like “Market Time” and SEALORDS, this supply route was sharply curtailed.¹⁰

Clearly, the challenge Giap had to master was to sustain the flow of supplies by land. He chose to build upon the “strategic supply route” that had been in development and lighter use from Viet Minh days—but which had its true origins in centuries-old trade footpaths that wound through the Annamite Mountains, which range roughly north-south for over six hundred miles along the Laotian-Vietnamese border. The Americans

quickly identified activity along this route and dubbed it “the Ho Chi Minh Trail.” It wasn’t long before the Trail became a priority target for aerial bombardment. Air attack was augmented by sabotage and occasional raids mounted by Hmong, Meo, and Montagnard tribesmen friendly to the Saigon regime—and with the American Special Forces teams advising them. But it was bombing that posed the most serious threat, and required the most robust solution.

Giap’s response was simple. Early on, he relied primarily on manpower to move supplies, the size of each “packet” determined by what any individual could handle. But the big idea employed was not to have the porters simply carry their loads. Instead, they draped as much rations and ammunition as possible on a bicycle frame, *and then pushed it*. Given that a bicycle could support over 300 lbs., and that this was a weight that a porter could push steadily, it was possible to move massive amounts of supplies, bit by bit, to the forces fighting in the South. Later on, small trucks became the primary means of moving supplies—and some troops—on an expanding network of dirt-and-gravel paths. The “trail” was actually many north-south roads that stretched for hundreds of miles, initially in a design about twenty miles wide. Later in the war, the network’s width expanded to nearly ninety miles.

An official American study has described the Ho Chi Minh Trail as “one of the great achievements of military engineering of the 20th century.”¹¹ It was a very robust system, too. When American bombers came and killed porters or blew up trucks, cratering the Trail, the porters and trucks were replaced and the Trail was patched, with its alternative routes being used during repairs.



Moving supplies along the Trail

THE HO CHI MINH TRAIL WAS A TRIUMPH OF SIMPLE, RESILIENT DESIGN

Throughout the length of the war, the Ho Chi Minh Trail was never seriously disrupted—a triumph of simple, resilient design.

To cope with the massive edge American forces and the Army of the Republic of Vietnam enjoyed in firepower at the tactical level—a system supported by a network of artillery firebases augmented by fighter-bombers and helicopter gunships—the key was to retain the initiative so as to be able to choose when and where to fight. This meant keeping insurgent forces concealed for as long as possible, engaging at points outside the range of the firebases, and breaking off action before close-support aircraft arrived to strike at them. It was an approach that worked because the Americans never developed an information system that could regularly locate enemy formations. At least not to advantage, as the method employed—sending platoons of infantry into the jungle to “make contact” resulted in countless ambushes, playing neatly into the North Vietnamese design.

Against Giap’s design for conquest, South Vietnam fought hard, and often well, as did small contingents from Australia, New Zealand, the Philippines, South Korea, and Thailand. But it was the Americans who bore the primary burden of thinking through how to use the technological edge they enjoyed to best advantage, what kind of force posture to adopt, and the appropriate battle doctrine to employ. In the end, the challenge of finding the right warfare design for saving South Vietnam proved just beyond reach.

Design of the “American War”

If the Vietnam War can be described as a “design competition” between the main combatants, it also must be noted that, on the part of the Americans, there was much competition and rivalry *within* their own military and policy circles. President John F. Kennedy was very attached to the Special Forces—an almost “romantic attachment,”

as Eliot Cohen has put it, that saw JFK directly involved in equipping them, even securing their right to wear green berets. He hoped that just over a thousand of them, sprinkled about in small teams, could advise, train, and assist the indigenous troops to a point where they could keep South Vietnam safe from Northern conquest.¹² By 1965, it was clear that this approach could not stem the tide of aggression, so the Air Force and Marines joined the fray. Strategically, air power was employed against the Ho Chi Minh Trail and targets in the North. Tactically, close support was given to heliborne ground troops. But in addition to General Westmoreland's air assault concept, something akin to the Green Berets' advisory approach was also being tried by the Marines.

GENERAL WESTMORELAND OVER-RELIED ON HIS BELIEF THAT "MOBILITY PLUS FIREPOWER EQUALS ATTRITION"

Where Westmoreland relied upon a concept of operations made famous by his laconic expression, "mobility plus firepower equals attrition,"¹³ the Marines were willing to try out a very different approach to securing the coastal zones of South Vietnam. They did of course engage in some air assaults, as in the successful heliborne troop insertion at Chu Lai, where some 700 Vietcong were killed in action, with Marine losses at under fifty. But the Marines also developed a design for security based on placing just a squad—a dozen or so men—in a village, its job being to work with Popular Force local militia to shore up security.¹⁴ The "Combined Action Program" (CAP) that emerged enjoyed naval gunfire support, on-call attack aircraft, and quick-response heliborne reinforcements. It was a wildly successful warfare design that swiftly, sharply reduced Vietcong influence. In the words of the Marine commander, General Lewis W. Walt: "Of all our innovations in Vietnam none was as successful, as lasting in effect, or as useful for the future as the Combined Action Program."¹⁵

Sadly, CAP's days were numbered—and *not* by enemy action.

For all its successes, and usefulness as a broader model for the conduct of the war, CAP displeased many senior U.S. military leaders. Westmoreland—and his political overseers—grew increasingly impatient with such a slow, defense-oriented approach. CAP, in their eyes, produced simply too low a “body count.” And so a “second act” unfolded, beginning in 1966, with the shift to a “big-unit war” aimed at taking a more offensive-minded approach that would, it was hoped, bring the war to a much swifter conclusion. This coincided with stepped up strategic bombing, both of the North and of the Ho Chi Minh Trail. But since the enemy continued to control the initiative at the tactical level—that is, Vietcong and NVA decided when and where they wanted to fight—and Hanoi had long prepared to persist even under intense strategic bombardment, neither element of the new American approach was to prove effective.

Thus a concept of operations that was working was replaced with one that, it was soon apparent, was not. The shift away from the CAP paradigm had been undertaken with the idea of forcing the enemy to engage more directly, playing into the hands of superior American firepower. The enemy was not so obliging, continuing to pick and choose his battles—in which Viet Cong and NVA suffered higher losses than South Vietnamese

and U.S. forces, but inflicted enough damage to raise costs and create doubt at the very highest political level—that of President Lyndon Baines Johnson. Cannily, Hanoi at this time held out the prospect of a negotiated peace, and talks began in Paris that would go on for years. And even though LBJ became rattled by the lackluster results of the “mobility-plus-firepower” design and



frustrated by the slow progress of peace talks, he argued against further escalation of the war effort, telling his advisors “I am sensitive about doing anything that might hinder the negotiations.” This despite the fact that he knew “Hanoi was merely using the sessions for propaganda purposes.”¹⁶ In the end, LBJ chose to step down from the presidency rather than run for re-election.

His successor, Richard Nixon, had several ideas for pursuing an endgame in Vietnam that were fresh, but also redolent of the earlier approach to the war. Nixon entered into office in January 1969, when the prospect of an endless attritional struggle had become so unappetizing that the big-unit war was discarded in favor of a “third act” to be based on leaving the fight almost entirely in the hands of the Army of the Republic of Vietnam (ARVN). This “Vietnamization” worked reasonably well—so long as American advisors remained and air power was available to provide close support.¹⁷ With this assistance, the ARVN defeated the 1972 “Easter Offensive”—although it was clear that American advisors and air power were essential to continued survival of the Saigon regime.¹⁸ Unfortunately, the design failed when, in the wake Watergate, which forced Nixon to resign from office in August 1974, his successor Gerald Ford found it politically impossible to continue to support South Vietnam. Eight months later Saigon fell.

**MCNAMARA CONCLUDED THAT
THE WAR WAS “UNWINNABLE”**


Such an ignominious ending led many—including one of the American War’s architects, Defense Secretary Robert S. McNamara—to conclude that the war was unwinnable and should not have been waged. The final assessment by McNamara is particularly vexing, as he saw that Washington

“failed to adhere to the fundamental principle that, in the final analysis, if the South Vietnamese were to be saved, they had to win the war themselves.”¹⁹

This seems quite an odd conclusion, given that the United States pursued a strategy throughout the Cold War based on helping those who were weaker to stand up to communist aggression. Certainly the Republic of Korea had not been expected to expel invaders from the North on its own. And the massive U.S. commitment of forces to Europe made clear that even these advanced countries—some of whom possessed nuclear weapons—were not to be compelled to fight and win on their own against the forces of the Warsaw Pact. Thus it is hard to see why the Republic of Vietnam was to be held entirely responsible for its own defense against the larger population of the North—and the roughly five million South Vietnamese aligned with Hanoi—along with the North’s greater armed might, which was heavily augmented by Russian and Chinese aid.

Indeed, there is an opposing school of thought to McNamara’s that rose up, one that has critiqued the warfare design pursued and offered alternatives. Most of its adherents show keen awareness of the fundamental problems posed by the challenge from the North: 1) Dealing with the Ho Chi Minh Trail; 2) Curtailing foreign aid to Hanoi; and 3) Seizing the initiative from the enemy at the tactical level. Each of these objectives, in the end, turned out to lie beyond American capacities—at least in terms of the various methods employed to deal with them. But two of these three challenges could have been mastered. Russian aid could have been curtailed by being willing to take some risk of escalation. The tactical initiative could have been seized and sustained by using existing sensing technology more creatively.

Disrupting the Ho Chi Minh Trail was the thorniest problem—most likely an insoluble one. For years the Trail was hit hard from the air, and continually raided and mined by Green Beret-led indigenous forces. Westmoreland was of a mind to hit it even harder, to the point of occupying a portion of the Trail to interdict the north-south flow of supplies. But the simple fact that the Trail was a network, not just a single path, raised the costs and risks of its interdiction precipitately. One detailed study Westmoreland



commissioned concluded that a “corps-sized force” (i.e., as many as 100,000 troops) was needed to block the Trail—including by crossing the border into Laos.²⁰

LBJ rejected this option, not only because of the inevitable rise in casualties such a move would entail, but due to concern that invasion of Laos might spark a major Chinese intervention. Some 300,000 Chinese troops served in North Vietnam during the war—though Beijing was careful about limiting them largely to manning anti-aircraft artillery batteries. An incursion into Laos might change this.²¹ Harry Summers, a retired colonel of infantry whose analysis of the war remains a Pentagon favorite, was less concerned about the costs and risks of the interdiction strategy. He believed failure to “seal off” the Trail was the “basic error” in American strategy, fed by the “myth” needing to respect Laotian and Cambodian neutrality.²² However, another officer-turned-analyst, Andrew Krepinevich, pointed out that the North Vietnamese could simply have mounted an “end run” beyond the point where any American line of interdiction stopped on its western end.²³

Given the operational difficulties and political risks involved in blocking the Ho Chi Minh Trail with ground troops, there was a considered attempt to solve the problem with technology—primarily unattended ground sensors. These were dropped by air by the tens of thousands, with many caught in high foliage, making them less useful. Sensors that made it to the ground were often spotted and exploited. One particular sensor was supposed to be a “people sniffer” focused on detecting excretions. NVA quickly learned to move them to unused portions of the Trail network, then hang bags of buffalo urine nearby, which “fetched the B-52s like flies.”²⁴ It was a simple but very effective military deception.

Despite the failure of this attempt, Westmoreland remained convinced that such an approach could work. Indeed, after his replacement in command in Vietnam by General Creighton Abrams, Westmoreland rose to become Army Chief of Staff and used this

bully pulpit to continue to advocate for technological solutions. He gave a particularly rousing speech on this theme to the Association of the United States Army in 1969:


On the battlefield of the future enemy forces will be located, tracked and targeted almost instantaneously ... I see battlefields on which we can destroy anything we can locate.²⁵

Locating the enemy, of course, is a crucially important prerequisite for the success of any warfare design. It was a condition never met in Vietnam—and remains a vexing one versus today's insurgent and terrorist networks. Even today high technology alone cannot locate the terrorist or insurgent often enough or reliably enough to achieve victory.

As to the second great problem, curtailing foreign aid, since much of it came by sea—road and rail links between North Vietnam and China were poor—the U.S. Navy

had as early as 1964 been advocating mining the port of Haiphong, through which 85% of war material transited.²⁶ Fears of bringing the communist superpowers into the war, and that escalation might nix peace talks, kept Johnson from acting. Nixon was more willing to act, but waited until 1972 to lay the mines, by which time he felt his diplomatic strategy had “succeeded in ‘detaching’ the USSR and China from their alliance with North Vietnam.”²⁷ Imports soon decreased, bombing was stepped up, and by January 1973 an “agreement on ending the war and restoring the peace” was reached in Paris.





But the terms of the agreement allowed substantial NVA forces to remain on the ground in the South, and it was clear that Hanoi was already preparing for a final push against Saigon. Giap and his colleagues were betting that the U.S. military, particularly the Air Force, would not intervene yet again to thwart an offensive as they had in 1972. It was a good bet. Besides Nixon having been crippled politically by Watergate, the Arab-Israeli Yom Kippur War of 1973 drew Washington's attention—and U.S. arms shipments—away from Southeast Asia. And, at last, even stalwart American public support for continuing the containment strategy in Vietnam had faded. In part, this disaffection grew out of release of the so-called Pentagon Papers, which as George Herring has noted, “confirmed what critics of the war had long been arguing ... that Kissinger and Johnson had consistently misled the public about their intentions in Vietnam.”²⁸

If the peace agreement came too late, and the terms were too unfavorable, it was partly due to the inability to interdict the Ho Chi Minh Trail, and partly due to taking eight years to decide to mine the harbor at Haiphong. Nixon saw this latter action as having been crucial to success: “Our most telling operation was the mining of North Vietnam's harbors ... my only regret was that I had not done it earlier.”²⁹ Indeed, this delay in taking action had grievous effects on the war effort; but it was failure to seize the initiative on the ground in the South—the third great war-fighting design challenge—that had allowed the conflict to drag on to a point beyond American willingness to continue the struggle.

And this third challenge is perhaps the most tragic, as the right formula—at least one that worked—had been identified early on: use of small American detachments in conjunction with the ARVN and local militias. Green Berets were doing this from the outset of the war, and the Combined Action Program offered a viable prospect for expansion throughout the country. But Westmoreland chose to shift to a big-unit approach that he hoped would maximize the American advantage in mobility and firepower. What he was missing, of course, was an “information system” that could reliably locate the

enemy and allow these advantages to come into play. That never happened. But it could have—and *should* have.

How might the initiative have been seized in the South? In our view, the best description of how the fight could have been taken to the VC and NVA—by being in position to locate the enemy and *start* the firefights—can be found in the war memoir of a battalion commander, Lieutenant Colonel Anthony Herbert, U.S. Army. When he arrived in Vietnam in 1968, he was appalled to see how little effort was being made to locate the

**LOCATING THE ENEMY—CRUCIAL TO
SUCCESS—WAS NEVER CONSISTENTLY
ACHIEVED IN VIETNAM**

enemy—beyond the use of platoon-level patrols that “dangled the bait” in hopes of drawing the enemy into a fight that would then allow U.S. air and artillery support to join in to decisive effect.

As mentioned above, the enemy soon learned to mount ambushes, inflict some losses, then break contact before massive firepower was brought to bear upon them. Herbert was told as well that the enemy “owned the night.” But he rejected this idea, advancing the notion that the Starlight night vision technology that every unit possessed created chances for taking the night away from the enemy.

Thus he began to send out small six-man teams to hunt for and locate VC and NVA, ambushing them or calling in other night-vision-enabled troops in his battalion to join in close combat against the enemy. In his own area of operations, Herbert was wildly successful. But he failed to spark enough interest among others at his level in trying out this concept of operations. And at higher levels of command, there was no interest whatsoever.³⁰ In fact, there was much hostility to his views, and Herbert was relieved of his command in April 1969. His concept of operations was never adopted. So Anthony Herbert, much-decorated soldier from the Korean War who had risen from the ranks, whose battalion performed, by all measures, in an outstanding manner, was taken out of the fight and soon thereafter pushed into retirement. But his concept had great potential for allowing the initiative to be seized and, if paired with a continued CAP

system, could well have turned the tables on the VC and NVA—even if the Ho Chi Minh Trail were never interdicted, and a naval blockade never enacted.

But, as matters stood, the Trail stayed open, supplies flowed from Russia and China by sea until 1972, and the enemy retained the initiative on the ground in the South until the end of the war. Clearly, the North's design for the war was very resilient. Still, it is interesting to note that American designs included all the right pieces that could have led to victory.

Conclusion

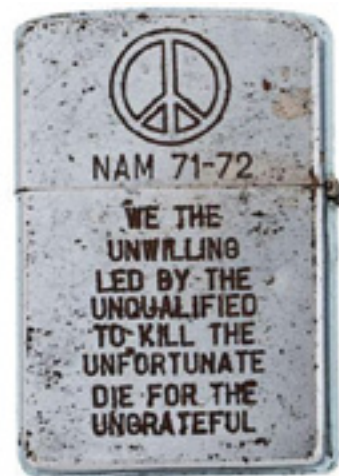
The Vietnam case provides what scholars of security studies would call a “tough test” of classical theories about war outcomes being determined by either sheer weight of weaponry or by more advanced technology. Per these measures, the United States, which enjoyed air and naval mastery and fielded massive, and massively armed, ground forces, should have been able to help the South preserve itself from conquest by the North. Failure to do so was surprising. Analysis of this failure, in our view, can be revelatory—especially when viewing the conflict through the lens of design. Seen in this way, the outcome of the war is not so puzzling. The North developed a simple, resilient design and stayed with it. The architects of the “American war,” on the other hand, went back and forth between design approaches, starting small and in a more advisory capacity, then shifting to a much more massive approach.




Dean Rusk, Lyndon B. Johnson, Robert McNamara

Then, at the very end, returning to the advisory role—with continuing air power—only to find that American public support for *any* persistent role in securing South Vietnam had finally withered.

It is possible to blame Saigon for its own fall—as Robert McNamara did. But South Vietnam’s internal failings were made more serious by the large American presence and leadership of the war effort. As Frances FitzGerald once noted, “the vast American presence merely tore those feuding groups into smaller and smaller pieces.”³¹ Yet this view still rings hollow when weighed against the fact that the ARVN met and mastered the challenge posed by the North’s great Easter offensive of 1972. Vietnamization was able to work—with continued American air support. When this resource was withheld in 1975, the South was conquered. And why was the defensive design finally worked out not followed in the end? Because by 1975 the American people had had enough of Vietnam. It had taken too long to find and stick with a workable warfare design. For many years, over half the U.S. public had expressed a willingness to keep on supporting the existing war effort—or even to escalate it. But this level of support had finally collapsed. As William Colby, an intelligence officer in Vietnam who later became director of the CIA, summed it up, Americans “will sustain a major involvement over a short term, or a minor involvement over a longer term ... What pragmatic Americans cannot support is a major involvement over a longer term where results cannot be shown.”³²




Westmoreland’s shift to a large-scale intervention, and his emphasis on “mobility plus firepower”—in the absence of an effective information system for locating the enemy—meant that Colby’s worst-case would play out: large forces committed, for a long time,



with indeterminate results. Beyond this problem, there was the major effort associated with trying to interdict the Ho Chi Minh Trail that, as noted earlier, was actually a 90-mile-wide road network in rough country. And interdiction would, among other things, require violation of Laotian and Cambodian sovereignty. When this was done with regard to the latter country, North Vietnam responded by nurturing an insurgent group there, the Khmer Rouge, who ended up taking over Cambodia and launching one of history's most grisly genocides. And the Trail stayed open.

Instead of massive military intervention and a focus on interdicting supplies, it seems quite clear in retrospect—to use McNamara's term, but with quite different inferences drawn—that the war effort could and should have been focused on fighting the VC and NVA on the ground in the South. This was certainly the goal of the Combined Action Program, a design highly praised by Marine General Walt who oversaw it—and even General Westmoreland grudgingly acknowledged CAP's effectiveness. To complement CAP's defensive orientation, Anthony Herbert's concept of operations for taking the tactical offensive by exploiting the American technological edge in night-vision capability should have been adopted. The results of his battalion's efforts using the concept were outstanding. Sadly, Herbert's influence was undermined by his ramrod-straight insistence on reporting others' violations of the laws of war—much that was wrong went on, far beyond My Lai, and Herbert's “outing” of war crimes at An Khe, Cu hoi, and elsewhere—played more than a small role in his being relieved of command.³³

But in the end, we must circle back to Vo Nguyen Giap. The war was not won simply by American mistakes. No war is waged error-free, and Giap made his own share of mistakes that sometimes led to very costly tactical defeats. Yet his warfare design—for dealing with American air power, for keeping his forces supplied, and for holding the initiative with regard to when and where to engage the enemy—survived his own errors and did the most to exploit American vulnerabilities. Truly, Vietnam was a “victory by design.” 

NOTES

1. Michael Maclear, *The Ten Thousand Day War: Vietnam, 1945-1975* (New York: St. Martin's Press, 1981), p. 205.
2. See Bernard Fall's magisterial study of this battle, *Hell in a Very Small Place: The Siege of Dien Bien Phu* (Philadelphia: J.B. Lippincott Company, 1967).
3. One of the very best studies about the failure of air power in Vietnam is James Clay Thompson's *Rolling Thunder: Understanding Policy and Program Failure* (Chapel Hill: The University of North Carolina Press, 1980).
4. On the resilience of American public opinion during the war, see Eric V. Larson, *Casualties and Consensus* (Santa Monica: RAND, 1996), especially p. 60. See also John Mueller, *War, Presidents and Public Opinion* (New York: John Wiley & Sons, 1973).
5. The first quote is from Russell F. Weigley, "American Strategy from Its Beginnings through the First World War," in Peter Paret, ed., *Makers of Modern Strategy* (Princeton: Princeton University Press, 1986), p. 409. The second quote is from his *American Way of War: A History of United States Military Strategy and Policy* (New York: Macmillan Publishing Co. Inc., 1973), p. 35.
6. Don Oberdorfer, *Tet!* (Garden City, NY: Doubleday & Company, Inc., 1971), p. 329.
7. Giap at this time was serving as North Vietnam's minister of defense and chairman of the military committee. Thus the operational design, and the factors that enabled the final offensive, bore his strong imprint.
8. Cecil B. Currey, *Victory at Any Cost: The Genius of Viet Nam's Gen. Vo Nguyen Giap* (London: Brassey's, 1999) recounts the regular criticism Giap had to face. See p. 175. Most of the attacks on Giap had to do with his willingness to incur high casualty levels in pursuit of larger strategic and political gains.
9. An outstanding account of this aspect of the Vietnam War is by Tom Mangold and John Penycate, *The Tunnels of Cu Chi* (New York: Random House, 1985).
10. For an overview of these operations, see Frank Uhlig, ed., *Vietnam: The Naval Story* (Annapolis: The United States Naval Institute Press, 1986). SEALORDS stands for "Southeast Asia Lake, Ocean, River, and Delta Strategy."
11. Robert Hanyok, *Spartans in Darkness* (Washington, DC: Center for Cryptologic History, National Security Agency, 2002), p. 94. The Australian journalist Wilfried Burchett traveled the Trail in 1964, providing an excellent, detailed description of how it was used in his *Vietnam: Inside Story of the Guerrilla War* (New York: International Publishers, 1965).
12. Eliot Cohen, *Commandos and Politicians* (Cambridge: Harvard Center for International Affairs, 1978), p. 40.
13. Maclear, *The Ten Thousand Day War*, p. 183.
14. Perhaps it is more accurate to say that this concept was a "redesign" of an approach sometimes used by the Marines in their early-20th Century involvements in Central America and the Caribbean. On this point, see Ivan Musicant, *The Banana Wars* (New York: Macmillan Publishing Company, 1990).
15. Lewis W. Walt, *Strange War, Strange Strategy: A General's Report on Vietnam* (New York: Funk & Wagnalls, 1970), p. 105.
16. Lyndon Baines Johnson, *The Vantage Point* (New York: Holt, Rinehart and Winston, 1971), citations from pp. 508, 510.
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18. See, for example, John Grider Miller, *The Bridge at Dong-Ha* (Annapolis: U.S. Naval Institute Press, 1989), the epic story of an advisor who helped defeat the NVA offensive.
19. Robert S. McNamara, *In Retrospect: The Tragedy and Lessons of Vietnam* (New York: Random House, 1995), p. 333.

20. Maclear, *The Ten Thousand Day War*, p. 213.
21. Chen Jian, "Chinese Involvement in the Vietnam War," *China Quarterly*, No. 142 (June 1995).
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23. Andrew Krepinevich, *The Army and Vietnam* (Baltimore: The Johns Hopkins University Press, 1986), p. 263.
24. Maclear, *The Ten Thousand Day War*, p. 219.
25. Cited in Frank Barnaby, *The Automated Battlefield* (New York: The Free Press, 1985), p. 1. Barnaby notes that Westmoreland's speech made clear that his optimistic vision grew out of "his experiences of new technologies used during the Vietnam War" (p. 7).
26. See John Prados, *The Hidden History of the Vietnam War* (Chicago: Ivan R. Dee, 1995), p. 265, and Admiral U.S. Grant Sharp, USN Retired, *Strategy for Defeat: Vietnam in Retrospect* (San Rafael, CA: Presidio Press, 1978), p. 3.
27. Prados, *Hidden History*, p. 268.
28. George C. Herring, *America's Longest War: The United States and Vietnam, 1950–1975*, 2d edition (New York: Alfred A. Knopf, 1986), p. 242.
29. Richard M. Nixon, *No More Vietnams* (New York: Arbor House, 1985), p. 113.
30. For a good description of this approach, and of difficulties in getting it adopted more broadly, see Anthony Herbert, *Soldier* (New York: Holt, Rinehart and Winston, 1973), especially pp. 234–6.
31. Frances FitzGerald, *The Fire in the Lake* (Boston: Little, Brown, 1972), p. 381.
32. William Colby, *Lost Victory* (Chicago: Contemporary Books, 1989), p. 365.
33. Herbert, *Soldier*, p. 430. He eventually filed a libel suit to fight the smears brought against him in the media, and the Supreme Court of the United States ruled in favor of his right to pursue relief and redress.

Ajax and Achilles strategizing during the Trojan War



IV. Some Insights into Conflict and Design

OUR GOAL IN THIS MONOGRAPH HAS BEEN TO INTRODUCE A FRESH perspective on military and security affairs, one that challenges common notions about warfare design. For the idea that sheer weight of numbers or more advanced weapons are sufficient for victory has been disproved many times over throughout history—and reaffirmed, alarmingly, in our own lifetimes. So, too, does history disprove the argument at the other end of the spectrum, that time and chance determine war outcomes and make conflict, as Clausewitz put it, “a game of cards.”¹ There *are* indeed patterns that emerge. But these patterns are subtle and nuanced. With regard to numbers, the question is not How many are they? but rather How are they structured? Not How advanced are the weapons? But How well are they aligned with the forces and their various concepts of operations? The key to understanding warfare design is that it is an enduring quest to search for alternative designs, to choose from among them those that offer improvements—whether esthetically, structurally, or functionally. And the designer is one who is willing to look at the heavens themselves with a probing eye. Alfonso the Wise, the king of Castile for almost sixty years in the 13th Century—a time of strife and great challenges in every direction—revealed his designer’s temperament when he said, “Had I been present at the creation of the world, I would have proposed some improvements.” The designer is always *seeking*. In ways of war, what is sought by the designer is not so much the big battalions, but rather the better battalions. Or perhaps a structure not based on battalions at all. Design in military affairs also extends to searching out the fighting doctrine that best aligns with the structure of the forces, the weapons most suited to the tasks to be undertaken, and the informational dimensions of war.

**THE DESIGNER IS
ALWAYS SEEKING**

Is it possible to distill from the various historical cases that we have explored some broad, basic principles that apply in a general way to the design for war-fighting? We

believe so. Perhaps the most catalyzing one has to do with the need to explore alternatives that may deviate sharply from standard or traditional practices. The Roman and Byzantine cases make this point compellingly—and contrastingly. At a time when both the Western and Eastern Empires were faced with extensive, hard-to-defend territorial “edges” and the massive rise of barbarian threats, the Romans remained quite mired in traditional, infantry-based legionary practices—with the slight change that they chose to discard body armor to increase mobility—that made them prey, in particular, to swift, far-ranging horse archers. The Byzantines, on the other hand, shifted from an infantry-based core to cavalry—which they then decided to armor, both man and horse. This created something of a medieval version of the modern panzer division, and enabled Byzantium to survive the fall of Rome by nearly a thousand years.

The Byzantines also illustrated another design principle: the “power of alignment” of design factors. By this we mean that, as one key study of alignment puts it, a condition wherein “the relationship between parts becomes as important as the parts themselves.”² A good example of this is the optical telegraph network of the Byzantines, which only made a big difference on the battlefield because the information it transmitted was *usable* by commanders who possessed cavalry units structured for rapid response. Without the cavalry’s high degree of mobility, optical telegraph messages would simply have been passing the bad news of irretrievable catastrophes. At the same time, absent these rapid flows of information over great distances, Byzantine generals would simply not have known exactly *where* to send the cavalry, and would only learn of the threatened area later—in most cases too late to come to the defense of the imperiled city or sector. Taken together, however, the ability to move both information and field forces swiftly created an absolutely winning design for strategically defensive war-fighting.

Beyond the Byzantines, other successful war-fighting designs we have examined herein have also reflected a keen ability—on the part of some—to move well beyond standard practices, and to align the elements in their designs skillfully. For example, the Hussites

completely overthrew a principal pillar of medieval military affairs: the armored knight. They did so not by re-enlivening the old infantry-dominant design—that would come centuries after the Hussites with the rise of the Spanish “battles of infantry” in the 16th Century—but rather by putting war on wheels, armoring their wagon-forts, and filling them with men armed with handguns. The Hussites also embraced light artillery that they could carry along with them, reflecting the point that a successful design for war entails a great willingness to embrace emerging technologies. Their case also highlights a key point about the importance of alignment, in this instance between “tools and practices.” Hussite battle doctrine was perfectly suited to the mobility of the wagon-forts and the kind of firepower they brought to bear.

A SUCCESSFUL DESIGN FOR WAR ENTAILS A GREAT WILLINGNESS TO EMBRACE EMERGING TECHNOLOGIES

The technological and informational elements of warfare design are especially well highlighted in the more modern cases that we have explored. In the case of the German naval challenge to Britain prior to the outbreak of World War I, the primary choice made was to imitate the structure of the Royal Navy by building a dreadnought-based battle fleet and taking the same approach to war at sea—for the most part—as the British did. That is, to seek out the choicest moment for a decisive, Trafalgar-like clash. In the end, the Germans prevailed tactically at the Battle of Jutland, but could not change the strategic situation in that the British blockade remained intact. Ironically, the relatively quite small investment the Germans made in U-boats paid off handsomely in a new version of the classic *guerre de course* that nearly brought Britain to its knees. Why didn't the Kaiser, or his head of the navy, Admiral Tirpitz, emphasize submarines instead of surface battleships? From a design perspective, we suggest that U-boat development was neglected due to poor alignment of the technological and informational

factors. At the time, there was no reliable way to detect a submerged vessel. This was a key factor that, had it been heeded could have led to a better-aligned High Sea Fleet whose war-winning chances would have been excellent.


Our analysis of Vietnam as a “design competition” provides insights from the perspectives of the more technologically advanced combatant *and* the side that is striving to cope with its vulnerabilities in the face of such a foe. The key American design strength was in firepower, delivered from the air and from artillery bases; the major U.S. vulnerability was in the informational domain. The Vietcong and the North Vietnamese Army did their best to remain hidden as much as possible, creating extensive underground facilities for their forces in the field. As to supplying them, the key was a marvel of

design for war-fighting: the Ho Chi Minh Trail. The brilliance of the design was that it was not simply a trail, but rather a network of rough roads spanning a range almost ninety miles wide in many places, and some six hundred miles in length. There was no way that aerial bombardment alone was going to interdict enough supplies in transit to cripple

the insurgency in the South; and efforts to block the Trail with occupying forces would have entailed high political risks (Laos’s and Cambodia’s borders would have to be crossed) and great military operational costs. In the end, a successful American design for war-fighting in Southeast Asia depended on optimizing the advantage in sheer firepower by improving in the informational dimension. And the only way to do this would have been to move to a doctrine like the one Anthony Herbert employed—emphasizing small units, stealth, and the U.S. edge in night-vision technology, rather than larger movements via noisy, vulnerable helicopters.

While the technological, structural, and doctrinal factors come easily to mind when thinking about designs for war, it is all too easy to neglect the informational domain. And it has been especially interesting for us to see the important role that information

FIVE SIMPLE PROPOSITIONS SUMMARIZE THIS WORK IN WARFARE DESIGN THUS FAR



has played in designs for war throughout history. The communicative function is best displayed by the Byzantine optical telegraph. The matter of “sensing” was at the fore in Vietnam, where the enemy whose design emphasized hiddenness was able to prosper. This factor also played a role in its failure to be used to a sufficient degree in the German case, when the ability of U-boats to remain undetected until they chose to attack would have had profound impact on the war’s outcome had there been more of them.

With regard to our broader findings in this monograph, there are five simple propositions that summarize our work in warfare design thus far:


- War is a design challenge that requires attention to four critical design elements: doctrine, unit structure, technology, and information.
- Not only must these four elements be present in warfare designs, they also must fit together and be well aligned as a whole to increase the probability of victory.
- The absence and/or the poor alignment of the four design elements are major factors in the failures of warfare designs.
- Adversaries are subject to the same design exigencies in warfare. As we saw in the Vietnam case, not only did North Vietnam carefully attend to all four warfare design elements and their alignment, but its warfare design enabled it to turn its weaknesses into strengths. At the same time, the US was unable to capitalize on its warfare design strengths. Worse still, its strengths became its greatest weaknesses.
- Thus, adversaries continually jockey with their opponents to shift weaknesses into strengths and transform threats into opportunities. Developing a competitive advantage against one’s adversaries is a large part of the art of warfare design.

War is perhaps humankind’s most complex, vexing undertaking; and we know that there are other factors important to the success of warfare designs. Brief mention of a few of them signals there is much more to the larger design story than we have been

able to outline herein. We know, for example, that successful warfare designs also depend on people, their skills, motivations and morale. “The passion of the people,” presumably including the soldiery, forms a critical part of Clausewitz’s trinity of war. Soldier morale was a key part of the Roman Emperor Gratian’s decision to have the infantry shed their body armor—the legionaries loved the idea of marching lighter. Religious and early nationalist zeal led to the Hussites fighting harder than their Crusader opponents. With the Hussites, we also saw how religious zeal, used first to defeat the external enemy, could be suicidally turned inward. During the Vietnam War, it was the steadfastness of both the North’s people and their soldiers that endured—and finally triumphed. Beyond the cases considered in this monograph, there are many other very powerful affirmations of the importance of this “passion” factor as an element of design for war. Napoleon’s career of conquest was driven to a great extent by his being able to rely on the unflagging dedication of the “citizens” who filled the ranks of the *Grande Armée* by means of the *levée en masse*. And more than a millennium earlier, the Arab advances across vast stretches of the Middle East and North Africa were less the result of wise generalship or advanced weaponry and more the product of tremendous enthusiasm for the cause that belief in Islam generated and sustained. Thus, as one historian noted of this period—with a sly eye on the modern era—the Arabs

“swept irresistibly forward without organization, without pay, without plans, and without orders. They constitute a perpetual warning to technically advanced nations who rely for their defence on scientific progress rather than the human spirit.”³

Viewing a more recent conflict—the Russo-German war, 1941–1945, which featured the largest and bloodiest land campaign in all of human history—Alan Clark highlighted above all else the importance of soldiers in the design for war. As he put it, “[f]oremost must come the ordinary Russian soldier; abominably led, inadequately trained, poorly equipped, he changed the course of history by his courage and tenacity.”⁴ Though the



Vietcong and the North Vietnamese Army were better led, trained, and equipped, their victory, too, was to a very great extent the product of courage and tenacity. Thus has it been many times in the sanguinary history of war. These soldierly virtues also hint at the larger question of how human factors play at another level, what we prefer to call “strategic design.” By this term we mean to encompass the broader factors of societal and institutional organization, international diplomacy and, to return to Clausewitz yet once more, the greater notion of high-level politico-strategic direction. Some would call this “grand strategy”; and it most certainly fits with Clausewitz’s famous formulation that war is but a “continuation of politics by other means.”



THERE ARE MANY POWERFUL AFFIRMATIONS OF THE IMPORTANCE OF “PASSION OF THE PEOPLE” AS AN ELEMENT OF DESIGN FOR WAR




Returning to the Vietnam case, we do not see it as a war of containment fought against totalitarian control over a quiescent populace. Rather, the Vietnamese people were clearly dedicated to the cause of seeing the expulsion of foreign forces and unification of the country. This fierce spirit was hearkened to by the Hanoi leadership in references going back many centuries, to the successful resistance mounted against Mongol and Chinese invaders. Giap the history teacher was keen on this point, quick to describe the conflict in terms of “people’s war, people’s victory.”⁵ Thus it is these “other means” that form a significant part of what we intend to explore next, using the concept of strategic design as our guide.

For now, though, it is more than enough, we believe, to have highlighted the value of thinking about military and security affairs through the lens of design. We hope to have made a persuasive case that a perspective cultivated in this manner can add most

usefully to classic notions of war outcomes as driven simply by numerical or technological superiority. All too many conflicts—well beyond those we have considered herein—are able to offer contradictory evidence to undermine the conventional wisdom about war. And all confirm the importance of considering war as, above all else, a design challenge.

And at the broad level of strategic design, we close by noting that the “design for peace” should come very much to the fore as well. Peace by means of the heavy armaments that deter; by means of diplomacy able to soothe antagonisms that feed war talk; but above all else by means of believing that peace must be approached as a serious design challenge. K.K. Casey, a director of the DuPont Corporation, when testifying before the Nye-Vandenberg Committee over five years prior to the Japanese attack on Pearl Harbor, noted the high importance of taking a strategic approach to peacetime when he said, “Wars frequently begin ten years before the first shot is fired.”

In our view, this gives something of an edge to those who think in terms of designing for peace. And to those whose duties require them to craft designs for war, we note that this task too may, if undertaken skillfully enough, serve to keep and sustain peace—the ultimate goal of design. 

PEACE – THE ULTIMATE GOAL OF DESIGN.



NOTES

1. Clausewitz, *On War*, p. 86.
2. George Labovitz and Victor Rosansky, *The Power of Alignment* (New York: John Wiley & Sons, Inc., 1997), p. xi. The alignment notion is related to systems thinking as developed in early studies like C. West Churchman's *The Systems Approach* (New York: Dell Publishing, 1968), and Peter Senge's later study, *The Fifth Discipline: The Art & Practice of the Learning Organization* (Garden City, NY: Doubleday, 1990).
3. General Sir John Bagot Glubb, *The Great Arab Conquests* (London: Hodder and Stoughton, 1963), p. 359.
4. Alan Clark, *Barbarossa: The Russian-German Conflict, 1941–1945* (New York: William Morrow and Company, Inc., 1965), p. xx.
5. See Giap's *Victory of the People's War Against the War of Destruction in the Towns and Industrial Centers of Socialist Viet Nam* (Hanoi: People's Army Publishing, 1972).

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