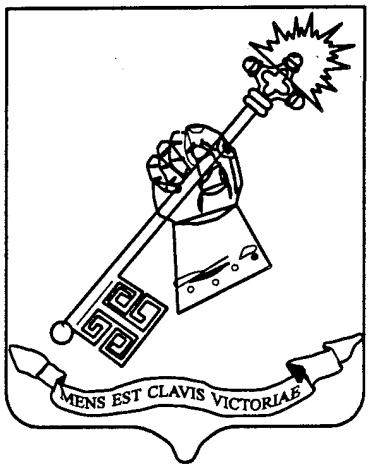
THE PROBLEMS OF PEACETIME INNOVATION:
The Development of US Army Antiaircraft Artillery During the Interwar Period- - A Case Study in Preparing the Army for the Future

A Monograph
By

Major Bryon E. Greenwald
Air Defense Artillery



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ABSTRACT

THE PROBLEMS OF PEACETIME INNOVATION: THE DEVELOPMENT OF U.S. ARMY ANTIAIRCRAFT ARTILLERY DURING THE INTERWAR PERIOD--A CASE STUDY IN PREPARING THE ARMY FOR THE FUTURE by Major Bryon E. Greenwald, USA, 55 pages.

Military organizations are normally quite resistant to change the way they operate. As Eliot A. Cohen and John Gooch note in *Military Misfortunes,* militaries have failed on occasion to anticipate, learn, and adapt to changes in the nature of warfare. This failure has usually led to defeat on the battlefield. Currently, the U.S. Army faces the daunting task of adjusting its organizational and doctrinal foundation to meet the demands of the post-Cold War world. In order to meet this challenge, senior leaders must win support for their efforts from the people and the nation's political leaders. Moreover, the Army's leadership must also compel those within the institution to alter the way they think about their traditional roles and branch missions.

This monograph examines several external and internal factors that influence innovation as they apply to military organizations in general and to the development of the American antiaircraft artillery establishment between World War I and World War II specifically. A child of World War I, the antiaircraft artillery fought against external and internal post-war pressures to emerge as an accepted member of the family of arms by 1941. The emergence of the antiaircraft artillery during this period represented a shift within its parent branch, the Coast Artillery Corps, away from the traditional mission of seacoast defense. Over the course of this shift, the antiaircraft artillery fought against not only the purveyors of the status quo in the seacoast artillery who sought to shield their organization from technical and political obsolescence, but also the other combat arms within the Army, in particular the Air Corps, which disagreed with the Coast Artillery over the need for antiaircraft artillery. For these reasons, the history of the antiaircraft artillery is an excellent vehicle through which to examine the phenomenon of military innovation.

One of the benefits of the study of history is that it informs contemporary conceptual thought. While the similarities between the Interwar period and today are not exactly parallel, they are nonetheless asymptotic. From 1919-1941, the nation abjured international involvement, endured widespread economic turmoil, and curbed defense spending. Some of the same trends currently exist and influence the ability of the U.S. Army's senior leadership to adapt today's force to the exigencies of future war. By analyzing the theoretical structure of military innovation as well as the external and internal factors that affect modernization in the military, this monograph offers today's leaders a historical perspective on the dynamics of change in military organizations.

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TABLE OF CONTENTS **PAGE**

Introduction..... 1

Chapter 1: A Theoretical View of the Factors Affecting Peacetime Modernization, Innovation, and Reform in the Military..... 3

The Dialectic Nature of War..... 4

Military Revolutions..... 5

Revolutions in Science..... 6

Scientific vs Military Revolutions..... 8

Punctuated Equilibrium..... 10

Theory vs Practice: The Case of American Antiaircraft Artillery Development..... 11

Chapter 2: External Factors that Influence Peacetime Military Innovation..... 14

National Strategy and the Direction of Innovation..... 15

The Level of External Support and the Open Mind..... 18

The Military as an Ocean Liner..... 19

The Effect of Social and Technological Currents..... 20

Chapter 3: Internal Factors that Influence Peacetime Military Innovation..... 22

Military Conservatism..... 22

The Military: A Pluralistic Community..... 23

The Difficulty of Achieving Consensus..... 24

Chapter 4: One Path to Successful Military Innovation in Peacetime..... 37

Timing..... 37

Continuity and Protection for Agents of Change..... 39

Consensus, Incrementalism, and Distributed Action..... 40

Intellectual Surf Rider or Irrelevant Institution..... 40

Endnotes..... 41

Bibliography..... 51

INTRODUCTION

Military organizations are normally quite resistant to change the way they operate. As Eliot A. Cohen and John Gooch note in *Military Misfortunes,* militaries have failed on occasion to anticipate, learn, and adapt to changes in the nature of warfare.[1] This failure has usually led to defeat on the battlefield. Currently, the U.S. Army faces the daunting task of adjusting its organizational and doctrinal foundation to meet the demands of the post-Cold War world. In order to meet this challenge, senior leaders must win support for their efforts from the people and the nation's political leaders. Moreover, the Army's leadership must also compel those within the institution to alter the way they think about their traditional roles and branch missions.

Several external and internal factors, however, combine to retard efforts to adapt the organization to the needs of the future. Some of the external factors that inhibit change include the level of popular and political support given to the military as represented by the nation's willingness to pay for and employ its armed forces. These are derived from a complex set of interrelated strategic determinants that include geography, threat perception, history, ideology, culture, and economics.

The internal factors affecting the ability of the military to change are equally complex. They include aspects of historical experience, a naturally conservative outlook toward change, an inability to evaluate adequately new ideas, an awareness of the tremendous cost of defeat, and a desire by some within the organization to preserve the status quo for fear of losing either personal or professional power and prestige within the organization. At times, any combination of these factors may prevent meaningful change from occurring in a military organization in time to prepare the force to win the next war.

This monograph examines the external and internal factors as they apply to military organizations in general and to the development of the American antiaircraft artillery establishment between World War I and World War II specifically. A child of World War I, the antiaircraft artillery fought against external and internal post-war pressures to emerge as an accepted member of the family of arms by 1941. The emergence of the antiaircraft artillery during this period represented a shift within its parent branch, the Coast Artillery Corps, away from the traditional mission of seacoast defense. Over the course of this shift, the antiaircraft artillery fought against not only the purveyors of the status quo in the seacoast artillery who sought to shield their organization from technical and political obsolescence, but also the other combat arms within the Army, in particular the Air Corps, which disagreed with the Coast Artillery

over the need for antiaircraft artillery. Unfortunately, the scope of this monograph does not permit an in-depth examination of the entire history of antiaircraft development during the Interwar period. In its place, this monograph cites several examples from that history to explain some of the external and internal factors that affect peacetime military innovation. Two longer vignettes are also included. The first example about the attempt to make antiaircraft artillery battalions organic to the maneuver division exemplifies the historically recurrent struggle against those who would preserve the status quo. The second example concerning the intellectual and doctrinal revolution in the Coast Artillery Corps in the 1920s educates us all about from whence innovation and revolution may come.

One of the benefits of the study of history is that it informs contemporary conceptual thought. While the similarities between the Interwar period and today are not exactly parallel, they are nonetheless asymptotic. From 1919-1941, the nation abjured international involvement, endured widespread economic turmoil, and curbed defense spending. Some of the same trends currently exist and influence the ability of the U.S. Army's senior leaders to adapt today's force to the exigencies of future war. By analyzing the theoretical structure of military innovation as well as the external and internal factors that affect modernization in the military, this monograph offers today's leaders a historical perspective on the dynamics of change in military organizations.

CHAPTER ONE

A THEORETICAL VIEW OF THE FACTORS AFFECTING PEACETIME MODERNIZATON, INNOVATION, AND REFORM IN THE MILITARY

The effectiveness of peacetime modernization is central to the future success of the Army in battle. Unfortunately, military modernization is never easy and never cheap. It often runs afoul of bureaucratic prerogatives both inside and out of the Army. Moreover, modernization normally costs more than a peacetime society may deem appropriate to spend when not threatened or aroused to some passionate cause. This in turn may force decision makers inside the Army to choose between dedicating funds to maintain current readiness or proceeding with plans to modernize the Army for the future. Finally, even after navigating through the shoals and sandbars of professional, political, and popular opinion, there is always a chance that the proponents of reform are all wet. As in the case of the French Army prior to World War II, there are times when those advocating reform misdiagnose the conditions of the next war and prescribe changes to doctrine and equipment that exacerbate the potential for future asymmetry between forces.

Military modernization is an oft-invoked, but ill-understood phrase. Within the context of this analysis, the terms innovation, modernization, and reform are synonymous. Each connotes an action that represents a new and improved method or procedure for doing business and implies a clear break with the practices of the past. To avoid confusion, when used in a military context these terms characterize actions that result in one or more of the following: a change in the way an arm of the service fights; the creation of a new arm; a change in relative worth between arms of a service; the reduction or disuse of an older concept or formerly dominant weapon, or the addition of a new weapon.[2] The doctrinal and organizational changes necessitated by the inclusion of antiaircraft artillery weapons in Coast Artillery units, the creation of the Air Corps, the emergence of armored warfare, the demise of horse cavalry, and the addition of the tank and airplane are all examples of military innovation. For the purpose of this analysis, the terms military innovation, modernization, and reform do not refer to smaller changes in organizations or weapons such as the addition of a man to an infantry squad or a new telescope to a rifle. These represent evolutionary changes that are often imperceptible to others in the organization and normally do not run counter to the institutional status quo.

The Dialectic Nature of Warfare

In a general sense, any changes that occur in doctrine, technology, and force structure during an interwar period are driven by a desire on the part of the military to perfect its ability to defend the nation and defeat the enemy on the next battlefield. Unfortunately, warfare is not a one-sided affair, but as Clausewitz remarked, "the collision of two living forces."[3] This increases the difficulty of correctly identifying future operational requirements on which to base changes in military doctrine, technology, or organization. Hardly ever does the enemy conform to the friendly plan or sit idly by while one side enhances its capability to defeat the other. On the contrary, military innovation in both peace and war resembles a tennis match where the opponents engage in a deadly game of serve and volley, each side seeking to overpower the other through a series of technological and doctrinal actions and reactions.

Within the realm of science, Isaac Newton defined this phenomenon in his third law of motion--"every action has an equal and opposite reaction." Philosopher Georg Wilhelm Friedrich Hegel expressed it in terms of an action-reaction dialectic, thesis acted upon by antithesis only to result in synthesis. Militarily, Clausewitz classified this process in war as an activity directed "against a living and reacting force."[4] The confluence of these descriptions yields a process where each action--be it a technological advancement or doctrinal adaptation--causes a reaction. The reaction then becomes the catalyst for another reaction. This dialectic continues unabated until friction (both Clausewitzian and scientific) retards the action-reaction cycle and eventually wears the forces down until motion ceases, ideas and technology cannot progress any further, or one side defeats the other.

While the development of nuclear weapons and nuclear strategy during the Cold War is perhaps the most vivid manifestation of this phenomenon, this dialectic relationship has been a recurrent theme throughout the history of warfare.[5] Several notable works--including *From Crossbow to H-Bomb* by Bernard and Fawn Brodie; *Technology and War* by Martin van Creveld; *Of Arms and Men* by Robert O'Connell; *The Pursuit of Power*, by William H. McNeill; *Guns, Sails, and Empires* by Carlo Cipolla; and *Gunpowder and Galleys* by John Guilmartin--discuss various aspects of this ongoing relationship.

Military Revolutions

Almost as a subset of this dialectic process, some scholars contend that certain changes in warfare are so acute from one period to the next as to constitute a revolution in military affairs. The concept of a "military revolution" first appeared in 1955 during a lecture by historian Michael Roberts on the impact of the military reforms of Swedish King Gustavus Adolphus on seventeenth century warfare. Roberts' ideas went relatively unchallenged until 1976 when another historian of the Early Modern period, Geoffrey Parker, questioned several aspects of his thesis.[6] Since then, several books and articles have used this concept to explain the dialectic nature of warfare during several periods of history. Of these, the most noteworthy works are: Geoffrey Parker, *The Military Revolution: Military Innovation and the Rise of the West, 1500-1800*; Jeremy Black, *A Military Revolution? Military Change and European Society, 1550-1800;* Clifford J. Rogers, "The Military Revolutions of the Hundred Years War"; and Andrew F. Krepinevich, "Cavalry to Computer: The Pattern of Military Revolutions".[7]

The concepts of the dialectic and military revolution are central to understanding why some military organizations seize upon opportunities to improve their warfighting capability, while others reject efforts at peacetime modernization. Assuming that a change does occur to alter the way wars are fought--the development of rifled weapons or the emergence of the airplane are two technological examples--the issue then becomes one of recognition and acceptance. If a military organization identifies the nature of the change, then it must decide if adopting elements of the new way of warfare will improve its military effectiveness. Often, however, military organizations neither perceive the nature of the change nor accept the need to change despite ample evidence to the contrary. If a change in warfare does occur, but goes unnoticed by the organization, then the chances are strong that the organization will not undertake any meaningful modernization prior to the next war starting. A similar outcome may obtain if the military recognizes that a change has occurred, but chooses for whatever reason--political, bureaucratic, or economic--not to pursue it. The danger, of course, is that an adversary may recognize and accept the change in warfare, modify its existing military organization, and capitalize on this new way of fighting when the next war starts.

Revolutions in Science

An analysis of the nature of revolutions in scientific thought may help explain why some military organizations fail to recognize or subsequently accept changes in the conduct of warfare. While the environments within which scientific and military thought operate vary dramatically, an examination of the progression of revolutions in science offers a worthwhile starting point for further discussion concerning the process of military innovation. Thomas S. Kuhn and I. Bernard Cohen propose two models of scientific revolution which exemplify the dialectical nature of warfare and highlight how the scientific community recognizes and adapts to changing conditions.

Kuhn in his seminal work, *The Structure of Scientific Revolutions*, used the term "paradigm shift" to characterize what historians and military scientists have labeled a revolution in military affairs. According to Kuhn, paradigms are the "entire constellation of beliefs, values, techniques and so on shared by members of a given community." Kuhn contends that a paradigm represents a set of "concrete puzzle solutions" which the associated community employs as "models or examples" to "replace explicit rules as a basis for solutions of the remaining puzzles of normal science."[8] Refining Kuhn's somewhat obtuse definition, noted military historian and theorist James J. Schneider suggests that a paradigm is simply a set of "shared professional beliefs that aid in the solution of problems and, therefore, guide action."[9]

As Schneider explains in *The Structure of Strategic Revolution,* however, a paradigm is not a theory, but a conceptual framework around which scientists of all types organize the data from their experiments and observations.[10] "A theory is a coherent statement about reality. Theories rely on the content and structure of paradigms." Theories provide scientists with a "reliable blueprint of reality" to guide engagement with it. "When theories no longer accord with reality," a "paradigm shift" has occurred.[11] A truly valid theory is timeless and expansive enough to accommodate changes in the underlying reality. It provides the framework for a coherent critique of its associated discipline. Finally, it offers a "guiding vision to change reality to the advantage of the...practitioner."[12] In this respect, the paradigm of the airplane flying over stalemated front lines in World War I spawned Guilio Douhet's theory of airpower.

In military affairs, Kuhn's concept of paradigm equates to military doctrine. Among its many functions, military doctrine provides a guide for action on the battlefield. It facilitates communication between officers, defines terms, and provides concepts which enable the various branches and military services to act in concert. Given this definition it is not surprising that the French Army used the term "harmony" to

explain the purpose of its doctrine. As Robert Doughty writes in his study of the French Army during the Interwar period,

> the analogy of harmony within an orchestra seems particularly appropriate. In the symphonic form, it represents everyone playing his instrument differently but still following the directions of the conductor....Without the direction of the conductor, without the unity of doctrine, the variety of instruments being played differently can only result in a harsh cacophony of noise.[13]

Doctrine, as published in field manuals and training circulars, is not considered a *vade mecum* requiring strict adherence and forbidding initiative or individual thought. On the contrary, doctrine constitutes the common conceptual framework by which an army conducts itself in war. It provides the broad guidelines within which the individual initiative and intellect of the soldier are free to operate. Finally, doctrine establishes the foundation and functional criteria for the design of weapon systems and military organizations. Thus, given its impact on military affairs, one can see that a change in doctrine amounts to a shift in the military paradigm.

Although Kuhn wrote *The Structure of Scientific Revolutions* to educate scientists about the history of scientific discovery and not to provide scholars with a scientific model applicable to historical analysis, his four-stage model of scientific revolution--Crisis, Adaptation, Solution, and Instability--is an excellent point of departure for further examination of the theoretical nature of change in military organizations.[14] According to Kuhn, the process of change begins when the underlying reality no longer agrees with the conceptual paradigm. At the point where old methods and doctrine fail to explain current observations and experiences, a paradigm crisis occurs. As anomalies arise to question the acceptability of the current paradigm, scientists increasingly recognize the paradigm crisis and seek new ways to adapt their model to the new data. Once they arrive at a solution, the scientists employ the new paradigm as a guide for solving other problems. For a while, stability returns to their scientific world. Like Hegel's dialectic, however, new anomalies eventually occur to call the established model into question. This results in instability, a subsequent crisis, and the reinitiation of Kuhn's cycle.[15]

In his 1985 work, *Revolution in Science*, I. Bernard Cohen offered a complementary four-stage progression for revolutions in scientific thought. The first stage involves an "intellectual revolution" or "revolution-in-itself". This occurs when a scientist or group of scientists develops a radical solution to a major problem, introduces

a new method or framework for using information that leads to unexpected predictions, or proposes a theory or set of concepts that changes the character of existing relationships.[16]

In the second stage, the scientist affirms his or her commitment to the revolutionary idea by recording key observations in a diary, notebook, letter, report, or a draft of an article for publication. This action denotes privately an individual break with the old paradigm and a point of no return for the researcher.[17] The third stage, a "revolution on paper," moves the initial intellectual revolution and commitment into a public forum. During this stage, the scientist's ideas enter into general circulation among other members of the scientific community through the publication of a scientific paper or book. Often it is only during the process of preparing his logic for public scrutiny that a scientist tranforms his conceptual thoughts into a formal theory.[18] Anyone familiar with the history behind Carl von Clausewitz's writing of *On War* will agree with this contention. While revising his *magnum opus* in 1827, Clausewitz wrote that he regarded "...the first six books...merely as a rather formless mass that must be thoroughly reworked once more."[19]

The last of Cohen's four stages is one of acceptance and practice. While a revolution in science may fail at any point during the first three stages, Cohen emphasizes the decisive nature of the fourth stage. Once the community of scientists accepts the new paradigm and alters its actions to operate according to the precepts of the new paradigm, a revolution in science has occurred.[20]

Although the character of revolutions in scientific thought differs from revolutions in military affairs, in a general sense the broad outlines of Cohen's model mirror changes in military thought. One obvious example is the progression of Alfred Thayer Mahan's ideas on seapower. Mahan met Cohen's stage one and two criteria with the early intellectual development of his concept of seapower and his lectures to students at the Naval War College. With the 1890 publication of *The Influence of Sea Power upon History, 1660-1783*, Mahan stepped into stage three. As the British, German, and American naval communities sequentially embraced his ideas, Mahan's concepts of seapower advanced through Cohen's fourth stage.[21]

Scientific vs Military Revolutions

As closely as the development and subsequent apotheosis of Mahan's concept of seapower parallel Cohen's four stages of scientific revolution, it is important to remember that revolutions in science are different from revolutions in warfare in two important ways. First, as Schneider emphasizes, military revolutions contain a critical

"zeroeth" stage. Prior to the first stage in either the Kuhn or Cohen models, a qualitative, revolutionary change in the underlying reality must occur. "The revolution in war entails a revolution in military thought."[22] As Schneider points out, the Galilean and Copernican revolutions only looked at the universe differently, they did not restructure it. Contrary to revolutions in science, "military and political revolutions are historically mediated, that is, qualitative changes in the underlying reality are induced by man himself."[23] For instance, with the advent of the Industrial Revolution, commanders adopted certain technological devices--the railroad, telegraph, and mass production techniques--to transform qualitatively the very substance of their military reality.[24] Similarly, during the Interwar period Germany applied advances in tank, aircraft, and radio technology in a synergistic fashion to create a new concept for maneuver warfare, while France, for geographical, economic, and political reasons, used the same technologies in a less effective or complementary manner. In these examples, the various changes in communication and transportation technology constituted a "zeroeth" stage and, in turn, established the initial conditions for military theorists to grapple with when attempting to understand and integrate the new advances into their methods of warfare.

The second difference between revolutions in science and military affairs concerns the "period of incubation between thought and action, theory and practice."[25] In the natural sciences, scientists may test many of their theories in their laboratories almost immediately. As Kuhn notes, the rejection of one paradigm occurs nearly simultaneously with the acceptance of another.[26] Theories of warfare, however, are much harder to replicate in wargames or simulations and therefore must wait until the appropriate conditions--usually warfare--obtain.[27] In peacetime, military organizations have a very difficult time gaining "feedback" on their efforts at innovation. In essence, they operate in a void. As British historian Sir Michael Howard eloquently commented in his definitive essay "Military Science in an Age of Peace," an army, in trying to identify the conditions of the next war,

> ...is like a sailor navigating by dead reckoning. You have the terra firma of the last war and are extrapolating from the experiences of that war. The greater the distance from the last war, the greater become the chances of error in this extrapolation....For the most part you have to sail on in a fog of peace until at the last moment. Then, probably when it is too late, the clouds lift and there is land immediately ahead....Then you find out...whether your calculations have been right or not.[28]

Given these preconditions, the real task of an army, or any military organization, is to not get the interwar process of modernization "too badly wrong." For if it is only slightly off, an effective military organization can recognize its key deficiencies, adjust its way of fighting and, in the course of the war, defeat the enemy.[29] Unfortunately, the inability to replicate or prove their theories in peacetime may leave military reformers in a tenuous position and greatly handicap their chances of successfully modernizing their military forces.

Punctuated Equilibrium

Both the Kuhn and Cohen models of scienfic revolution dovetail nicely into what paleontologists Niles Eldredge of the American Museum of Natural History and Stephen Jay Gould of Harvard University call the punctated equilibrium theory of evolution. In 1972, Eldredge and Gould postulated that biological evolution was characterized not by a slow, gradual division and creation of species, but rather by species formed relatively quickly by rapid bursts of evolutionary change interspersed with long periods of near stasis. Although not all inclusive--indeed, Eldredge and Gould did not initially address the possibility of incremental change--their theory has gained ground. While still generating a great deal of controversy, many scientists have agreed that "much, though not all, evolutionary change occurs during short periods of rapid development."[30] As Clifford Rogers comments in his study of military revolutions during the Hundred Year's War, "this newer conception of punctuated equilibrium evolution, combining both incremental and 'revolutionary' change, seems to describe the process of military innovation extraordinarily well."[31] Andrew Krepinevich makes the same argument implicitly in his article concerning the pattern of ten military revolutions beginning in the Fourteenth Century. After a period of near stasis, a rapid change occurs in the conduct of warfare that alters the way wars are fought. This change dominates warfare, albeit undergoing and giving way to incremental change, until supplanted by another rapidly emerging method of warfare.

Thus, on one level, it seems that the conduct of warfare has evolved over time and been punctated by rapid military revolutions that altered the dialectic relationships of offense to defense and missile weapons to shock warfare. On another level, however, the theory of punctuated equilibrium may also characterize what occurs within a revolutionary cycle. In that regard, the theory of punctuated equilibrium postulated by Eldredge and Gould equates to the percolation of anomalies described by Kuhn and the rapid focus on developing solutions to the new problems explained by both Kuhn and Cohen.

Theory vs Practice:
The Case of American Antiaircraft Artillery Development

Within the context of this analysis, the development of antiaircraft artillery during the Interwar period accords in a general fashion with the theories of Kuhn, Cohen, Schneider, Eldredge, and Gould. The development of the internal combustion engine and the invention of the airplane changed what Schneider calls the underlying reality that formed part of the paradigm for warfare prior to World War I. Prior to the war, military aircraft underwent slow incremental development and were used primarily for observation. With the onset of war in 1914, the design and employment of military aircraft changed rapidly, adding pursuit and bombardment to the original task of observation.[32] The loss of air superiority and the danger of bombardment created a paradigm crisis for all armies. In response to this crisis, each combatant established air defense techniques and antiaircraft artillery commands employing ground artillery pieces and machine guns in an anti-air mode in an attempt to prevent attack from the air. For the American Expeditionary Forces, this crisis-adaptation-solution cycle was particularly acute. Elements of the A.E.F began air and antiaircraft planning in March and April, 1917. By the end of the war in November 1918, the A.E.F. had established an antiaircraft service, assembled and trained a 12,000 man force, fielded two machine gun battalions, supplied gunners to man French antiaircraft guns, and shot down 58 airplanes.[33]

During the rapid reduction of forces that followed the war, the American antiaircraft artillery establishment virtually diappeared. Although narrowly surviving organizational extinction and suffering from varying degrees of institutional neglect within the Coast Artillery Corps and the Army, the antiaircraft establishment developed its doctrine, technology, and organizational structure incrementally over the next two decades. Beginning almost immediately after World War I, a few visionaries within the Coast Artillery Corps and the Army recognized the change that the emergence of airpower had brought to warfare. These individuals had experienced Cohen's "intellectual revolution" and in the ensuing years reinforced their commitment to the development of antiaircraft artillery by writing articles for professional military journals citing the importance of establishing a credible antiaircraft establishment and by including an antiaircraft artillery force structure in Army organization documents. The development of antiaircraft artillery progressed through Cohen's third stage with the writing and publication of antiaircraft artillery doctrinal manuals beginning in 1930 and the inclusion of antiaircraft considerations into Army manuals in a substantial manner beginning in 1939.

This two decade evolution proceeded slowly, at times almost imperceptibly, until the late 1930s when events in Europe shocked the world and brought the impact of airpower and the need for antiaircraft artillery to the fore again. At this point, the nagging anomalies attendant to the parallel, but asynchronous development of airpower and antiaircraft artillery erupted in another paradigm crisis. Reports from military attaches in Spain and China in 1938 and Western Europe beginning in 1939 extolled the importance of airpower and antiaircraft artillery. This propelled antiaircraft artillery equipment to the top of the War Department's procurement list for the next three years and resulted in a recognition and acceptance of antiaircraft artillery by the defense establishment and the Army (Cohen's fourth stage). As in World War I, the Army and defense contractors responded to the crisis of 1939 by adapting existing technology and developing new systems like radar and the proximity fuse to solve the vexing problem of attack from the air.

Like most solutions, however, these were only partially effective, as the soldiers of the II (US) Corps at the Battle of Kasserine Pass found out in mid-February 1943. Similar to one of Kuhn's anomalies, the difficulties experienced in early 1943--inadequate combined arms training, lack of antiaircraft equipment suitable for a doctrine of mobile defense, a shortage of antiaircraft units, and poor air-ground coordination--spurred the Army and the Coast Artillery Corps to seek further solutions. While the Army was correcting the way it defended against air attack, the Army Air Forces were destroying the Luftwaffe and the Japanese Air Force in the air. The combined effect of the actions resulted in Allied air superiority by late-1944, making many antiaircraft units superfluous. The Army deactivated many of these units and used their soldiers to fill a critical shortage of infantrymen in the front lines.

Following this war, the Army and the antiaircraft artillery establishment reduced the size of their forces accordingly. Unlike the early period following World War I, however, this time antiaircraft artillery did not disappear entirely. In a move akin to the punctuated development postulated by Eldredge and Gould, the Army in 1947 acquiesced to earlier Interwar period requests by the Coast Artillery Corps and made antiaircraft artillery battalions organic to maneuver divisions. With the onset of nuclear weapons and jet propulsion--indeed, another change in the underlying military reality--antiaircraft artillery entered the missile age and moved to the forefront of the Army. During the same period, the Army, recognizing the obsolete nature of the seacoast artillery, disbanded the Coast Artillery Corps and integrated the antiaircraft establishment into the Field Artillery branch. In 1968, the antiaircraft artillery became a separate branch of the United States Army.

While the development of antiaircraft artillery that began in 1917 with America's entry into World War I and ended with its separation from the Field Artillery in 1968 accords very broadly with the theoretical concepts outlined above, the half-century of growth relects much more accurately the effects of a variety of factors that influence the course of peacetime military innovation. The next two chapters examine those factors with respect to military organizations in general and the development of antiaircraft specifically. Chapter Two analyzes the impact that external factors have on the progress of change in the military, while Chapter Three investigates several internal factors that influence the course of military innovation.

CHAPTER TWO

EXTERNAL FACTORS THAT INFLUENCE PEACETIME MILITARY INNOVATION

The difficult and sporadic development of antiaircraft artillery during the Interwar period highlights the difference between revolution and adaptation occurring in science and those in military affairs. Although a theoretical appreciation for the importance of antiaircraft defense had existed since the end of World War I, it took another twenty years for the Army to recognize and accept the need to incorporate the antiaircraft artillery establishment into the family of combat arms. Much of the difficulty centered on the nature of the air threat and the ability of antiaircraft artillery to defend against aircraft. If the ability of antiaircraft defenses to stop attacking aircraft had been a purely scientific issue, it might have been evaluated in a controlled laboratory environment and answered with a high degree of certainty. Unfortunately, warfare is a human endeavor that largely defies attempts at high fidelity scientific analysis. The inability to replicate exactly the conditions under which antiaircraft artillery units might be expected to perform led to bureaucratic arguments about the best way to defend against air attacks. As the incubation period between conceptualization and fielding lengthened, the issue of antiaircraft modernization fell prey to the vicissitudes of human decision making and became increasingly influenced by external and internal factors that delayed its ultimate recognition and acceptance by the Army.[34]

This chapter outlines several external factors that affect peacetime innovation and modernization in the military. While up to this point much of the discussion has focused on paradigms and changes in military doctrine, it is important to remember that the process of modernization extends beyond merely identifying the future condition of the battlefield and creating a doctrine to fit the new condition. The doctrine must be technically feasible--if not immediately, then certainly at some point in the near future. It must also meet the political and strategic constraints of the nation. Finally, the cost of implementing the new doctrine--procuring new weapons and retraining the force while maintaining readiness--must be acceptable. In liberal democratic societies, each portion of this process is open for debate. Moreover, not only is every aspect of military modernization open for debate by, in this case, American society as a whole, but it is debated in the Congress and within the military. Thus, not only must each aspect of modernization be as correct as possible with respect to the future conditions of warfare, but it also must be technically feasible, affordable, and satisfy the external political and

internal military bureaucracies as well. In light of these requirements, one occasionally wonders how effective modernization occurs at all.

National Strategy and the Direction of Innovation

A nation designs its military force structure to perform tasks that fit its concept of national strategy. Consequently, the operational requirements that form the foundation of a nation's military doctrine devolve from its concept of strategy. National defense strategy, however, constantly evolves and adapts to "shifting conditions and circumstances in a world where chance, uncertainty, and ambiguity dominate."[35] While political objectives and diplomatic, economic, and military resources all play a role in determining a nation's strategy and its associated military force structure, national geography, history, ideology, and culture also exert influence on the direction of strategy formulation and by extention the shape of military doctrine and force structure.[36]

Factor #1: Geography

Several aspects of a nation's geography, particularly its location, shape the way it views its security requirements. As Williamson Murray and Mark Grimsley point out in *The Making of Strategy*, a nation like the United States was for most of its history so removed from external threats that it ignored and rejected balance of power politics and involvement in overseas disputes.[37] Even after World War I, America's separation from Europe and Asia continued to influence her attitude toward national defense. The inability of foreign powers to attack the continental United States was one of the factors that led American policy makers to limit defense expenditures. When Major General Frank W. Coe, Chief of the Coast Artillery Corps in the early 1920s, tried to use popular concerns about aerial bombardment as a springboard for increased funding for antiaircraft artillery, he was ignored because none of the professionals involved could envision an air threat capable of attacking America in the near future.[38] Indeed, for most of the Interwar period, the nation relied on naval patrols and the Army's Coast Artillery Corps and air forces to protect the coastline. Only in the late 1930s did policy makers become concerned with possible German economic and military penetration of South America and begin reinforcing the air, ground, and sea defense of the Panama Canal and the Caribbean region.

Conversely, Great Britain's proximity to the European continent has forced it to remain concerned with defense against invasion. Historically, Britain based its security on the strength of the Royal Navy and on control of the Low Countries. After World War I, Sir Basil Henry Liddell Hart even offered a concept of defense based on "limited

liability" and involvement in land warfare in Western Europe.[39] Despite the protection offered by its naval shield, however, Britain could not neglect the emergence of airpower as a weapon of warfare. Fearing a "knock out blow" by German bombers, Britain for much of the 1930s followed a schizophrenic policy that tried to "secure international conventions which would provide for limitations on aircraft production, the abolition of the bomber, prohibitions of the act of bombing, a guarantee against air attack and a convention regulating the conduct of air warfare" on the one hand, while it increased defense spending for aircraft and antiaircraft artillery on the other.[40] Interestingly, Britain's focus on the possibility of aerial attack drove her to develop technologies suitable for antiaircraft defense (particularly, radar and the proximity fuze) far ahead of the United States. The transfer of these technologies proved a significant help to American antiaircraft efforts throughout the war.[41]

Beyond mere threat-identification, geography also shapes the formation of military doctrine and procurement of specific types of weapons. As Murray and Grimsley highlight, throughout the Interwar period, both British and American airmen emphasized the belief that air power could win wars independent of action by ground or naval forces. This led both nations to devote a large portion of their defense expenditures to not only aircraft, but particularly to bomber aircraft.[42]

Per contra, faced with the threat of ground attack, Germany took the opposite approach. Instead of relying heavily on "strategic" bombing which implied some degree of sanctuary from direct land invasion, German air doctrine focused primarily on supporting the ground forces. To do otherwise might result in having German airfields, industry, and countryside overrun. Conversely, given the Channel and North Sea obstacles to direct invasion, both the British and Americans could afford the loss of Belgium, the Netherlands, or France and still keep fighting. Ironically, the Luftwaffe's focus on relatively short range fighter aircraft designed to support the Wehrmacht proved disastrous to German prospects for victory during the Battle of Britain.[43]

In the American antiaircraft artillery establishment, this focus on strategic bombing drove a corresponding effort toward the procurement of high altitude antiaircraft guns to defend against such an air attack and away from consideration of antiaircraft defense of the forward area. Between 1938 and 1940, the Ordnance Department tested, standardized the design, and began production of the 90-mm antiaircraft gun as a replacement for the now antiquated 3-inch model first used in World War I. At the same time, the antiaircraft artillery changed its forward area weapon from the .50 caliber machine gun to the 37-mm automatic weapon and finally settled on the 40-mm Bofors gun in February, 1941. By the time the conversion of Swedish plans was

complete and contracts let to the over 350 sub-contractors involved in making the gun, the antiaircraft artillery establishment's baptism under fire at Pearl Harbor had come and gone.[44]

This focus had an even more pernicious effect on antiaircraft training and doctrine during the early portions of World War II. The emphasis on strategic bombing drove antiaircraft artillery commanders to assume the majority of their missions would occur in the rear area away from front line combat units. They geared their training accordingly with the result that, despite being colocated, for example, with General George S. Patton's 2d Armored Division at Camp Young, California, antiaircraft units never participated in combined arms training prior to fighting at Kasserine Pass. Moreover, the attention given to protection of the rear area--an attention at times seconded by ground commanders like Eisenhower in North Africa--resulted in a severe shortage of antiaircraft artillery units in the forward area. In North Africa, there were a total of four antiaircraft regiments, eight automatic weapons battalions, and four separate machine gun batteries in the rear area, while only one antiaircraft regiment and a reinforced automatic weapons battalion supported the II (US) Corps at Kasserine Pass.[45]

Factor #2: History

Along with geography, history also plays a large role in coloring the development of national strategy. While individual national historical experience influences strategic decisions almost as much as geography, the effect of historic periods on decision making is just as profound. During the Interwar period, the memory of the millions of dead, wounded, and missing soldiers seared the national psyche of the Western democracies and left both their governments and peoples largely blind to the resurgence of German power. In Britain, the memory of World War I drove the adoption of the "Ten Year Rule"--a defense budget and procurement program that assumed that Britain would fight no major conflict for the next ten years. The ten year date rolled forward every year until the early 1930's and enabled the "government to evade any responsiblity for providing a minimum base from which rearmament might begin."[46]

Across the Atlantic, the historical experience of World War I drove Americans immediately after the war to call for a "return to normalcy" despite President Woodrow Wilson's contention that "there can be no question of our ceasing to be a world power."[47] For the American Army, "normalcy" meant a rapid reduction in forces, a return to prewar constabulary duties, and protection of the limited American interests in the Philippines and China. It also meant severely reduced funding for research and

procurement of weapons and equipment. In his 1945 "Biennial Report of the Chief of Staff," General of the Army George C. Marshall characterized the effect this lack of funding had on antiaircraft artillery procurement prior to World War II. He commented that the

> ...highly efficient antiaircraft of today did not materialize until long after the fighting began. The consequent cost in time, life, and money of this failure to spend the necessary sums on such activity in peacetime has been appalling.[48]

Factor #3: Ideology and Culture

Historical experience often accords closely with national ideology and culture. In Germany following World War I, the misuse of history gave rise to the "stab-in-the-back" or *Dolchstoss* myth which subsequently reinforced the National Socialist propaganda program and led to Hitler's rise and consolidation of power. In America, the history of the birth of the Republic has fueled an indigenous belief that the United States stands alone in the world as the unique "embodiment and protector of liberal democracy."[49] This view, combined with America's ideological, cultural, and social abhorrence for large standing armies, has perpetuated the Minuteman myth and the Jacksonian notion of the citizen-soldier and led to precipitous peacetime declines in military preparedness.

The Level of External Support and the Open Mind

All of these influences on strategy also affect decisions about military force structure and doctrine. In an era when the external pressures of geography, history, ideology, and culture drive decisions on strategy which diminish the need for military preparedness, the likelihood that the military will attempt to modernize or seek innovation on its own is also limited. Indeed, the military works in a social environment that "is at best indifferent and at worst hostile to [its] activities."[50] In a majority of Western liberal democracies, the degree to which the public perceives a threat to its survival or well-being dictates the level of external support for the military. Typically, during interwar periods, the public does not perceive a threat to its existence. Thus, it does not find great utility in peacetime military forces. Unfortunately, the level of peacetime external support for the military has a direct effect on the ability of the military to achieve internal innovation. In other words, the less intellectual, psychological, economic, and personal support the military receives, the less likely it will be to accept

new ideas. If the military perceives it has little or no "freedom to fail" or margin for error, then it will find intellectual, psychological, and physical sanctuary in maintaining the status quo. The less external support the military receives, the more it focuses inward and the more it fails to recognize emerging national and international political, social, and technological trends that may affect the way it should operate in the future.[51] Thus, a lack of external support may drive the military to resist innovation or to miss important opportunities to identify correctly the future conditions of battle.[52]

The Military as an Ocean Liner

The military, particularly in the United States, is a huge bureaucratic organization and like a large ocean going vessel, it changes direction very slowly. To carry the analogy further, internal efforts to change direction are a function of the azimuth established by the captain and the propulsion created by the workers in the engine room. External efforts that force a change in the direction of the ship manifest themselves in the winds and tide emanating from the will of the people and embodied in the Congress. By virtue of the Constitution, the Congress of the United States has great power to "raise and support," "maintain," and "regulate" the military. The Congress exercises this prerogative through hearings and legislation that affect the intellectual and physical development of interwar operational requirements. The Congress enforces its will through military budget appropriations.

Curiously, some scholars dismiss the impact of Congress on the process of military innovation as "at best, limited and indirect...."[53] One only has to reread General Omar N. Bradley's testimony as Army Chief of Staff before the House Committee On Appropriations to appreciate the high level of Congressional influence over military innovation. Bradley commented that

> in [its] calculations of what we shall spend for armed security and how we shall spend these funds...this committee is actually recommending to the Congress a military policy...for the long-run military plans must be reshaped within the budget allowed.[54]

Bradley went on to emphasize that due to Congressional control of appropriations "the military policy of the United States [was] shaped by the Congress and not the armed forces...."[55] In addition to enforcing its will upon the military through budget appropriations, Congress also dictates reform to the military through specific legislation.

The impact of the 1986 Goldwater-Nichols Act on the military's attitude toward joint warfare is one example of the degree to which Congress can foster innovation.

The Effect of Social and Technological Currents

While the winds and tides of popular and political opinion exert a strong force on the direction of innovation in a military organization, they are fickle and subject to change. A few more stable forces influencing the direction of military innovation are the social currents and technological trends that can speed innovation, but just as often can carry military organizations in directions they do not intend to go. The history of the interwar period offers several examples of external trends influencing change within the military. The popular disdain for attrition warfare that emerged in Britain after World War I drove military theorists and reformers like J.F.C. Fuller and B.H. Liddell Hart to seek technological and doctrinal solutions to the stalemate that plagued the Western Front. Fuller and Liddell Hart proposed their ideas on mechanization and combined arms warfare at a time when the Ten Year Rule prevented even moderate modernization and many in the British Army discounted the value of mechanized warfare. Similarly, the popular enthusiasm for the automobile that gripped America in the 1920s and 1930s came at a time when many Army officers still regarded the cavalry as truly a horse-powered force. Nonetheless, the force of motorization proved unstoppable, driving the Army to put its mounts out to pasture and make the internal combustion engine the new workhorse of the Army. Likewise, the civilian air industry provided the Army Air Service with both a public following and a technological foundation that allowed it to grow and prosper during a period when the development of equipment for the rest of the Army, including antiaircraft artillery equipment, languished because it had no civilian application. Particularly in non-totalitarian states, a large portion of professional military knowledge and growth germinates from the seeds of ideas transplanted from the civilian world. Thus, it is the responsibility of the military to understand the trends, absorb the ideas, and translate the advances found in the civilian community into something with military utility.[56]

An army, however, cannot merely superimpose technological trends upon its institution without seriously risking combat readiness. Simply possessing a superior weapon is not enough. It is essential that the military assimilate the tactical, operational, and strategic effects of innovations in weaponry. Consider for a moment the example of European forces in the latter half of the nineteenth century. As Maurice Pearton points out, at Sadowa in 1866, the Prussian needle gun was less important to the outcome of the battle than the faulty tactics and organizational defects of the Austrian command.

Moreover, close integration of doctrine and technology made the Prussian artillery more effective even though it was technically inferior to that of the Austrians. The trend continued four years later against France. There again German superiority rested as much on the tactical employment of the new Krupp cannon as in its technological quality. In both wars, the "opponents of the Prussian Army failed to assert their superiority in weaponry--the Austrian cannon at Sadowa and the Chassepôt rifle and mitrailleuse during the Franco-Prussian War."[57]

Furthermore, blindly altering doctrine or force structure for the sake of technological change invites disaster. Such was the case with the Pentomic Army of the 1950s, when the Army attempted to stave off institutional irrelevance by reequipping and reorganizing to meet the perceived needs of the nuclear battlefield. In doing so, it rushed off in pell-mell pursuit of nuclear technology only to build an Army that was, in the words of General George H. Decker, Army Chief of Staff from 1960-62, "a jack-of-all-trades-and-master-of-none."[58]

Additionally, innovators must plan for countermeasures and not fall prey to Utopian beliefs in a superweapon. Military history is replete with examples of technological asymmetry and temporary advantage being offset and countered by other means. The mounted knight fell to the crossbow and pike. Surface ships suffered from subsurface torpedo attacks until the adoption of the convoy system and the invention of sonar. Soviet Hind helicopters ruled the skies over Afghanistan until the Mujahideen used shoulder-fired, American-made Stinger missiles to challenge their air superiority. These examples highlight the importance of understanding the applicability of military force within the context of its time and the need to integrate closely the development and use of new doctrine and technology. Failure to do so will result in the use of the extremely powerful, but proverbial, elephant gun to hunt fleas. Thus, it is essential that the hard thinking that defines the direction of reform occur prior to the beginning of modernization. "With inadequate thinking about operational requirements, the best technology and the biggest budget in the world will only produce vast quantities of obsolete equipment."[59] Given the high degree of institutional inertia present in large organizations, only a great deal of forethought about the direction of innovation can help the Army to not get "it too badly wrong" when the next cannon sounds.

CHAPTER THREE

INTERNAL FACTORS THAT INFLUENCE PEACETIME MILITARY INNOVATION

No effort to engender external support for innovation or any attempt to integrate emerging technological and social trends will succeed, however, unless the desired reforms pass internal military muster. Without support from within the military, most attempts at innovation will at the very least lose their effectiveness, if not fail completely. Unfortunately for proponents of modernization, the military, for reasons of organizational structure and professional culture, is largely resistant to change.

Military Conservatism

Military bureaucracies take a custodial approach toward their institutions and a conservative outlook to change. Their rigid, hierarchical organizational structure impedes the progress of new ideas. Formal information flows down the chain of command through orders and regulations and upward via reports from subordinates to superiors. In most organizations there is a tendency to protect the chief executive from undue disturbance. In the military, because formal rank and hierarchy are so clear-cut, informal access to senior leaders is cut off almost entirely. As a result, those in a position to support innovation within the organization only hear (or read) a small portion of the new ideas that exist at any moment. Moreover, because rank and seniority are the dominant characteristics of the organization, the military has great difficulty accepting outstanding original thinkers, particularly when these thinkers are young and have not "earned their spurs."[60]

Commenting on the relative difficulty between integrating changes in technology and those in tactics, Alfred Thayer Mahan wrote that "improvements of weapons [are] due to the energy of one or two men, while changes in tactics (or in this case the entire direction of modernization) have to overcome the inertia of a conservative class...."[61] Mahan's critique notwithstanding, there are valid reasons why the military as an institution hedges toward conservatism. In defense of its organizational rigidity and conservatism, the military differs from all other organizations in that its "business", its stock-in-trade, is the employment of violence in support of national policy objectives. Therefore, the dangerous nature of the military profession counsels against incorporating unverified innovations into the organization. The cost of failure to the Army and the nation is so great that it warrants a conservative approach to new ideas.

The Military: A Pluralistic Community

Although the military's rigid, hierarchical structure differs greatly from the structure of most organizations, it still reflects to some degree the pluralistic nature of the society it serves. In democratic nations, the military, like society, is not monolithic, but is a political community consisting of sub-units each with different views on how the Army or the military establishment as a whole should prepare to fight the next war. Just like other political communities, the various sub-units within the Army--during the interwar period these sub-units were represented by the different branches of Infantry, Cavalry, Engineers, Artillery, and Coast Artillery as well as the Air Service--debate which method should dominate and how the "citizens" of their community--the soldiers--should live. Therefore, military modernization does not simply occur from a transfer of resources, but is the result of an ideological struggle that redefines the way the "citizens" live or in this case, the way the Army fights.[62]

The Interwar period is replete with examples of such doctrinal debates. Following World War I, the military organizations in each of the major powers fought over the direction their military development should take in the future.[63] Commenting on the German Army's ideological struggle over doctrine, Michael Cooper concludes that not only did the German Army not wholeheartedly embrace what has since been called *Blitzkrieg* warfare, but that the entire

> ...history of the German Army from the 1930s to the middle years of the Second World War [was] essentially the record of unresolved conflict between the protagonists of a new strategy founded on the revolutionary use of armoured, motorised and air forces engaged in a mission of paralysis, and the adherents of the traditional strategy based on mass infantry armies, with the new arms at best treated only as equal partners, the cutting edge of the old decisive manoeuvre of encirclement and annihilation.[64]

In the United States, a similar debate ensued over the development of aviation, its relationship to the Army and Navy, and the ability of antiaircraft artillery to defend against it. On one side of the debate were elements calling for military aviation to remain integrated within the Army and Navy. On the other side of the issue were those supporting the unification of all air services and their separation from the Army and Navy. A key point in the debate concerned the utility of aircraft in military operations. Part of the Army's position to Congress against separating the Air Service from the Army rested on the argument that airpower could not win wars alone and that

antiaircraft artillery was a viable means to defend against air attack. At one point Army Assistant Chief of Staff, Brigadier General Hugh Drum, testified before the House Select Committee of Inquiry on the Operations of the United States Air Services that with 12 3-inch antiaircraft artillery guns he could stop "any bomber from doing serious destruction."[65]

Conversely, Brigadier General William "Billy" Mitchell, testifying before the same committee, stated that with respect to stopping incoming aircraft "the problem of antiaircraft...is almost an impossible one to solve." He commented that the United States had lost only "one-tenth of one percent of all missions" flown during World War I to German antiaircraft fire and that the "method of firing [had] not improved perceptibly" since then.[66] The tenor of this ideological struggle, however, was captured by Fiorello H. LaGuardia, then a Congressional Representative from New York. In testimony before the House of Representatives Committee on Military Affairs in 1926, LaGuardia charged the Army General Staff with being "either hopelessly stupid or unpardonably guilty" in refusing to recognize the need for a separate air service. During his testimony, LaGuardia singled out the Coast Artillery Corps as an illustration of what he called "standpatism" or the failure to yield to the logic of airpower. He rebuked military authorities for having the "audacity" to ask Congress to fund coast defenses at a time when he believed coastal surface guns were outranged by their naval counterparts and antiaircraft batteries were only capable of hitting attacking aircraft during rigged firing tests.[67]

The Difficulty of Achieving Consensus

If the plurality of the military community exists, then it follows that for innovation to succeed agreement on the new "ideology" must occur between the major parties involved. In short, the senior leadership must forge, through force of will and strength of ideas, a consensus on the future direction of the military. For a number of reasons, however, innovation in the military has usually met with strong resistance, making consensus as difficult to create there as in the civilian political community.

Problem #1: Uncertainty vs Romanticism

Modernization, as defined by an innovation which alters the status quo, is difficult to achieve because of the uncertainty created by the method of evaluation and by the need for confidence in the existing equipment and doctrine. The military is naturally reluctant to discard historically reliable equipment and doctrine before the battlefield advantages of innovations have received a full, complete, and objective test. As stated

earlier, the cost is too great if the innovators are wrong. One student of military organizations has observed that part of the rigor and realism demanded by the military in field testing innovations arises from the historical romanticism infused in the profession. The utility of military history as a vehicle for inculcating soldiers with the military's professional ethic breeds a romantic attachment to the equipment and doctrine of its history. Thus, part of the military's resistance to change may stem from its efforts to instill pride, foster unit cohesion, and improve military effectiveness. This line of reasoning assumes, of course, that soldiers and officers actually *read* military history or use it for instruction in other than specialized staff colleges. The author is probably more accurate when he states that a soldier's faith in his weapons and doctrine is essential to the maintenance of *esprit de corps* and morale. Without such faith, no soldier will venture forth in battle. As a result, soldiers are reluctant to exchange proven battlefield equipment and techniques for innovative replacements unless they are convinced of their worth. This makes the need for open, objective, and reliable field testing essential to building the consensus necessary to support changing the current doctrine or equipment.[68]

A poignant historical example of such resistance lies in the efforts of twentieth century armies to hold on to their horse cavalry despite indications for well over fifty years that there was no place for cavalry on a battlefield dominated by breech-loading rifles and machine guns. As early as 1870, when Prussian riflemen decimated the ranks of charging French cuirassiers the evidence was clear--horse cavalry served no purpose on the modern battlefield. Evidence of the collapse of cavalry appeared again in World War I as machine guns and quick firing artillery stopped cavalry charges in their tracks. The reluctance to abolish cavalry units continued, however, until it was swept aside by the onset of peacetime motorization in society and the wartime death of Polish horse cavalry in 1939.[69]

Problem #2: Protectors of the Status Quo

Resistance to modernization also comes from those who have a vested interest in maintaining the status quo. "Often leaders who see their particular weapon becoming obsolete, and who see no approach to regaining their organizational dominance, are the most ritualistic and compulsive about the older forms of military command."[70] This phenomenon occurs in most military organizations regardless of the nature of the regime they serve. The father of German armored warfare theory, General Heinz Guderian commented in *Panzer Leader* that neither the establishment of an independent air force or the development of armored doctrine was adequately studied or appreciated by the

General Staff because it was feared it might result, "in the one case, in a decrease in the importance of the Army as a whole and, in the other, in a lessening of the prestige of the older arms of that service."[71]

With respect to the development of antiaircraft artillery during the Interwar period, the issue of antiaircraft protection for the Army division offers an excellent opportunity to study this internecine struggle for functional supremacy. One of the enduring lessons the Infantry drew from World War I was its vulnerability to strafing and bombing attacks by airplanes. Mindful of the increased potential for air attack in the next war, the War Department recognized the need to improve the division's antiaircraft capability. According to the Army's *Field Service Regulations, 1923*, the solution to this problem varied with the tactical situation. When "on the march," the Infantry protected itself and received only incidental coverage from nearby antiaircraft units during bivouacs. In the defense along a stablized front, Army doctrine called for a "checkerboard formation" with "two continuous zones of antiaircraft fire" to provide a "belt" defense against incoming aircraft. Despite the "area" protection afforded by Army doctrine, the lack of "dedicated" antiaircraft artillery protection for ground troops concerned infantry commanders. These commanders understood that the limited amount of antiaircraft artillery available to the Corps Commander (one battalion of 3-inch antiaircraft guns and one battalion of machine guns) dictated that he use these assets to defend higher priority targets, many of which existed in the Corps rear area and not near the troops. The obvious solution to this problem was to add an organic antiaircraft artillery unit to the division structure. This cure, however, ran into opposition on numerous fronts because it threatened to increase the size of the division and reduce its overall mobility on the battlefield.[72]

As a result, the debate among the Chiefs of Arms centered on how to limit the size of the new Army division while still improving its defense against air attack. The argument quickly boiled down to two positions--add an antiaircraft machine gun battalion to the division or give the respective units their own antiaircraft machine guns and let them defend themselves. In his response to a War Department inquiry, Major General Frank W. Coe, Chief of the Coast Artillery Corps, advocated the addition of "one highly mobile battalion of sixteen .50 caliber machine guns organized into two batteries of two platoons each" to the organic structure of the division. He reasoned that although the "present division [was] bulky," the increased probability of air attack in the next war necessitated the addition of an organic antiaircraft unit and outweighed the disadvantages that might result from the division's increased size.[73]

The Infantry branch disagreed with this recommendation, preferring to defend itself and requested the Army add a machine gun company to each infantry battalion. The Infantry viewed the machine gun as a multi-purpose weapon, good for use against both tanks and airplanes. The Chief of Infantry argued that the addition of a machine gun company per battalion permitted the smaller infantry units to defend themselves against both "tanks and airplanes regardless of location within the Army area...." In a letter to the Adjutant General, he described the duplication of effort and confusion that would occur if two different branches attampted to provide antiaircraft protection "within the Infantry combat area." Highlighting the ability of the Infantry to defend itself if given the means to do so, the letter also included a lengthy section on current antiaircraft experiments and training conducted by the Infantry branch.[74]

With the battle lines now drawn, the equivocal comments of the other Chiefs of Arms did nothing to help resolve the dilemma facing the War Department. The Chief of Engineers supported both sides of the argument, while the Chief of Field Artillery recommended that, as "a child of the World War," antiaircraft defense be the focus of "profound and continuous study."[75] The Chief of Cavalry had an idea analogous to that proposed by the Infantry. The Cavalry wanted an Air Service observation squadron, similar to that used by the Infantry divisions, to spot incoming aircraft and alert the pursuit squadron to intercept them. The Cavalry also requested an armored car troop for each brigade equipped with multi-purpose machine guns and 37-mm guns. Like the Infantry, the Cavalry was willing to accept the responsibility for its own defense as long as its organizational structure grew accordingly. Finally, clouding the issue even further, the Commandant of the Command and General Staff School at Fort Leavenworth recommended that the Army create a heavy machine gun battalion in each infantry and cavalry division, but give overall responsibility for the development of antiaircraft artillery to the Air Service.[76]

In attempting to resolve the debate, the War Plans Division studied all of the proposals and concluded that future wars would require divisional units to possess their own organic means of antiaircraft defense. Furthermore, the study recommended that the War Department postpone a decision on the exact form of that defense until further progress occurred in the development of antiaircraft artillery weapons. The Assistant Chief of Staff, Brigadier General Hugh A. Drum, concurred with the recommendations of the War Plans Division, but added that developments in machine gun carriages might make the same weapon "suitable for both ground and aerial fire, thereby avoiding new units in a Division."[77] Despite his acknowledged support for antiaircraft artillery before

Congress and elsewhere, Drum's response implied an unmistakable desire to maintain the division at its current size and provide the Infantry with its own means of defense.

In the meantime, General Coe became irritated over the War Department's delay in reaching a decision. Claiming to need a decision in order to complete the drafting of training regulations, Coe used this opportunity to query the War Department and renew his recommendation for a separate antiaircraft artillery machine gun battalion. On 9 November 1925, after reviewing the study by the War Plans Division, the Adjutant General responded tersely that although "a means of protection for units of the Division...will be included in the Division...the method by which anti-aircraft protection will be furnished...[required] further study." He ended by stating that the Coast Artillery School should understand this position and write its manuals accordingly.[78]

Unable to let the issue lie dormant, the Coast Artillery repeated its request for resolution in early January, 1926. This time the Adjutant General was more explicit in his response. He reiterated his earlier position that the study of antiaircraft defense had not progressed far enough to make a final decision, but added that the War Department now believed that no increase in the size of the division was possible without affecting its mobility. To drive the point home, the Adjutant General expressed his desire to give the "various elements of a division...an opportunity to develop their own anti-aircraft defense...."[79] He added that the efforts of the Infantry to develop its own antiaircraft capability appeared promising and, if successful, should enable the Infantry to "deliver fire against both ground troops and low-flying attack aviation" without altering the fundamental structure of the division. Finally, he directed that Coast Artillery training regulations conform to the present Army doctrine that required the divisional combat units to provide their own antiaircraft defense.[80]

In the end, Coe pushed too hard and too fast against a War Department reluctant to tinker with the accepted shape of its Infantry and Cavalry divisions. As a result, he lost his case for the creation of the one organization that would have ensured the legitimacy of the antiaircraft artillery establishment--a divisional antiaircraft artillery battalion. In the end, the Coast Artillery Corps followed the Adjutant General's guidance and published its training regulations and field manuals without reference to a divisional battalion.

Yet, while adhering to the Adjutant General's guidance in writing the first antiaircraft doctrinal manual, *FM 4-105: Coast Artillery Field Manual, Antiaircraft Artillery,* the Coast Artillery Corps nonetheless circumvented the spirit of that guidance by highlighting the inadequate ratio of antiaircraft artillery units to maneuver units, specifically the doctrinal pairing of only one antiaircraft artillery regiment (one gun

battalion and one machine gun battalion) per corps and only one antiaircraft artillery brigade (three regiments) per army. To overcome this deficiency in antiaircraft protection, the new field manual suggested that "G.H.Q. Reserve" units reinforce the army antiaircraft artillery brigade, which in turn supplemented the fires of the corps antiaircraft regiment. While careful not to mention assigning antiaircraft units to infantry or cavalry divisions, the manual went one step further, stressing the division's inability to protect itself from air attack and advocating the attachment of corps antiaircraft assets to the division. The smallest unit recommended for attachment was a composite battalion consisting of one antiaircraft gun battery and two machine gun batteries.[81]

The difference was both subtle and significant. Planners did not break with Army guidance, they merely altered it to suit their own needs. While "assignment" meant establishing a permanent relationship between an antiaircraft artillery unit and a maneuver division, "attachment" denoted only a temporary assignment. By suggesting the "attachment" of an antiaircraft unit to a division, planners achieved General Coe's goal of providing additional protection without violating Army regulations. Furthermore, planners hoped that once this regimen became habitual, senior infantry and cavalry officers would appreciate the benefits of this relationship and petition the Army leadership to make it permanent.

Indeed, as the Army prepared for World War II that is exactly what happened. There was a significant move afoot to include an antiaircraft artillery battalion in the division structure. Alfred C. Wedemeyer, then a Major in the War Plans Division of the General Staff and the author of the "Victory Plan" of 1941, the Army's general mobilization and operational concept plan for World War II, was impressed by the power of German tactical aviation and pushed for the inclusion of .50-caliber machine guns and 37-mm antiaircraft guns in the division structure.[82]

Lieutenant General Lesley J. McNair, Chief of the Army Ground Forces, however, vetoed the idea. Fixated by the need for the division to maintain tactical mobility and wedded to the twin concepts of streamlining and pooling of units initally recommended by General John J. Pershing in 1920, McNair hoped that by reducing the size of units and removing elements (personnel, weapons, or vehicles) not needed continually, he could mobilize and ship more units to the front. To compensate for the lack of specialized units in the divisions, he created pools at corps and army level in the belief that the mobility of these forces allowed them to concentrate rapidly where needed. This technique offered "economy, mobility, flexibility, and the capacity for massed employment." Unfortunately, it also forced maneuver commanders to depend on higher echelon commanders for support at times when such support might not be

available. Additionally, units that were only temporarily associated with each other had difficulty in developing into smoothly functioning teams.[83]

Concerned about the need to protect infantry and armored division troops from air attack, several senior leaders including Robert Patterson, Under Secretary of War; Lieutenant General Jacob L. Devers, Chief of the Armored Force; and then Lieutenant General Dwight D. Eisenhower, Commander of the Allied Expeditionary Force in North Africa all petitioned McNair to make antiaircraft units organic to the division.[84] McNair countered that to defend everywhere was in essence to defend nowhere. He believed that the most dangerous enemy air attacks would occur in massed formations and therefore required masses of antiaircraft artillery held in mobile pools to meet them. Additionally, burdening divisions with "defensive "anti" weapons (antiaircraft and tank destroyers) ran counter to McNair's desire to encourage aggressive tactics and psychology in the divisions and to avoid diversion of resources to the production of mere countermeasures."[85]

Devers highlighted the need for better combined training and teamwork and emphasized the problems non-organic units had in working with divisional combat forces. He wrote to General Marshall complaining that "economy of force [was] not gained by having a lot of units in a reserve pool where they train individually, knowing little or nothing of the units they are going to fight with." Devers reasoned that if needed elsewhere antiaircraft units could be withdrawn easily and transferred to where they were needed. He closed with the admonition that "team play comes only with practice."[86]

In North Africa, Eisenhower was coming to the same conclusion. On 19 December 1942, Eisenhower wrote Marshall asking for more antiaircraft protection for his divisional units. McNair responded that each division did not need antiaircraft protection all the time, that the infantry could defend themselves, and that pooled antiaircraft units could be assigned missions in divisional areas, if necessary. Despite his reservations, Eisenhower deferred to McNair.[87]

In February 1943, after returning from a trip to North Africa to examine problems in armored force units, Devers resumed his quest. This time, however, he advocated placing antiaircraft equipment not only in the division, but as far down as the battalion. This position echoed Eisenhower's long held belief that while German dive bombers created limited material damage to front line troops, their psychological effects were devastating, especially when followed by an enemy infantry or tank attack against raw troops.[88]

When the Secretary of War, Henry L. Stimson, inquired about Devers' concerns, McNair replied that the question was really "whether these [limited] resources [were] to

be dispersed in driblets...or...organized in mobile masses which can be concentrated at the decisive point...." Indirectly commenting on Devers' lack of combat experience, McNair called Devers a "dispersionist" and held that the "artful concentration of forces at the vital point is the first essential of tactics...." Oddly, even NcNair's own G-3, Brigadier General John M. Lentz, believed that antiaircraft equipment belonged in the division. Still McNair resisted, repeating his belief in pooling and citing problems in fielding enough antiaircraft equipment to meet current needs.[89]

While McNair was responding to the Secretary of War, the few antiaircraft artillery units assigned to the II (US) Corps during the Battle of Kasserine Pass were living with the consequences of his pooling concept. The performance of antiaircraft units during the battle (19-22 February 1943) vindicated both McNair as well as those such as Devers and Eisenhower who supported the addition of antiaircraft battalions to maneuver divisions. McNair received vindication in that antiaircraft battalions were sent into the Kasserine area from the pool of available units in North Africa. Those wanting to see antiaircraft battalions organic to divisions could counter that after providing coverage to key assets in the rear area, there were only a few antiaircraft units left to cover forward combat units. Indeed, the one reinforced automatic weapons battalion and the one 90-mm antiaircraft gun battalion sent to the II (US) Corps area actually exceeded the doctrinal pairing of one antiaircraft regiment (one AW battalion and one gun battalion) to each corps. This force, however, was insufficient to cover all of the critical assets in the II (US) Corps area. Moreover, the antiaircraft forces sent forward suffered from an appalling lack of combined arms training, just as Devers had predicted.[90]

Intellectually, McNair may have understood the need to add antiaircraft artillery units to the division structure, but could not find a way to do so given his focus on mobility and the limited resources he had to work with in designing the Army Ground Forces. In an address to the graduating class of the Antiaircraft Artillery Officer Candidate School in October 1942, McNair commented that "about every combat unit insists on its own private antiaircraft unit" and acknowledged that "possibly that state of affairs will come to pass." He could not, however, disabuse himself of concern over maintaining the aggressiveness of the force for he counseled the officers not to become technicians, but "remain first and last a fighting man...."[91] Ironically, what Coast Artillery planners had written into doctrine in 1930 and what McNair predicted in 1942 did indeed "come to pass." While antiaircraft artillery units were not assigned to maneuver divisions during the war, they became so plentiful in corps and army areas that they were attached to divisions on an almost permanent basis. Their habitual relationship

with maneuver divisions and their wartime performance endeared them to ground commanders. Although the Army disbanded many of the units once the Allied Air Forces had gained air superiority and transferred antiaircraft troops to infantry divisions to make up for an acute shortage of infantrymen on the front lines, concern over the protection of ground forces from air attack lingered on after the war. Eventually in 1947, after more than twenty years of effort, the Army made antiaircraft artillery battalions organic to the division structure.

Problem #3: Age, Rank, and Reluctance to Accept Change

Military sociologist Morris Janowitz contends that the tendency to resist organizational change rests in the middle officer ranks. At the bottom of the military hierarchy, the realities of combat force leaders to adapt. At the very top, leaders are selected because of their inclination to innovate. Moreover, they are susceptible to external pressure to innovate. Janowitz believes that in the middle ranks the pressures to innovate are absent. Additionally, mid-ranking officers are often aware that their prospects for advancement are declining. Thus, these officers adopt a defensive stance. "Instead of constructive problem solving, these officers are concerned with maintaining the formal prerogatives of their rank" and position. This, in turn, "leads to organizational rigidity, ceremonialism, and a retreat from administrative responsibility."[92]

Janowitz's conclusions are that of a military sociologist, not a historian, and may reflect more than anything else his study of the US military in 1965. There is no evidence that middle grade officers are more or less innovative than senior officers or subalterns. While there may be some question as to how he defines the "middle officer ranks", however, his characterization of resistance is nonetheless accurate.

Students of military innovation understand that resistance to change can occur at all echelons, including the highest levels of military service. One has only to read the history of the Root reforms and the decade long fight against them by Major General Fred C. Ainsworth to appreciate the level at which opposition can occur. As the chief of the Army's Office of Record and Pension in 1903 and later as the Adjutant General, Ainsworth stood to lose a great deal of personal and professional prestige if the War Department centralized administrative control of the bureaus and functional control of the various arms under the office of the Chief of Staff. In an attempt to prevent this from occurring, Ainsworth fought a bureaucratic battle within the War Department until forced by General Leonard Wood and Secretary of War Henry Stimson to retire in lieu of being court martialed for insubordination. He subsequently renewed his fight from

Capitol Hill as an unofficial advisor to a sympathetic congressman. Only when the congressman retired and the nation entered World War I did the resistance cease.[93]

Norman Dixon, in his polemic *On the Psychology of Military Incompetence*, attributes the failure of senior leaders to innovate to "extremely weak egos" which result in schizophrenic behavior typified by an "insatiable desire for admiration" and the avoidance of criticism on the one hand and an equally "devouring urge for power and positions of dominance" on the other. Dixon concludes that in trying to avoid criticism, status quo leaders shy away from innovation and delude themselves and others that current methods are adequate for the situation. This delusion is reinforced by their personal and positional power within the organization which ensures that their vision, be it right or wrong, remains unchallenged.[94]

Dixon may be more accurate in his contention that resistance to innovation is often borne of ignorance or mental stultification. Although he applies it solely to senior officers, his theory works for all those who reach for and attain positions for which they are truly unqualified to hold. According to Dixon, pontification follows as nature abhors a vacuum and the ignorant move to fill the vacuum by pontificating to conceal their lack of knowledge or because they are too ignorant of the facts to feel any concern about expressing ideas to the contrary.[95] In the military realm, this often leads to oversimplification or assumptions about the future that contradict emerging trends. British Field Marshal Archibald Montgomery-Massingberd, Chief of the Imperial General Staff from 1927 to 1933, is a perfect case in point. At one point during his tenure, Montgomery-Massingberd ridiculed J.F.C. Fuller's works on tank warfare while simultaneously admitting that he had never actually read any of them.[96]

Conversely, attempts to foster change in military organizations may occur as a result of the combined efforts of several individuals of varying rank and responsibility. The early history of the antiaircraft establishment during the Interwar period is an excellent example of this phenomenon. As the Army demobilized following World War I, a relatively junior officer, Captain F.S. Clark, editor of the *Journal of the United States Artillery* (later the *Coast Artillery Journal*), recognized the impact that airpower had on that war and would have in future conflicts. In a telling comment in the May 1919 edition of the *Journal of the United States Artillery* he challenged the leaders of the Coast Artillery Corps to take the initiative and lead the way in preparing a credible defense against the airplane.[97] Largely as a result of his prodding, articles discussing the performance of the Antiaircraft Service during the war began to appear. Soon others with theoretical suggestions for organization and employment of the fledgling establishment surfaced in the *Journal*. Some of the authors were the "old men" and

"founding fathers" of the antiaircraft artillery.[98] Others were more recent converts to the cause and reflected the growing realization among Coast Artillery officers that the antiaircraft artillery was a progressive, developing element of the branch with great potential for growth, opportunity, and promotion.

One of the most significant developments in this regard was the inclusion of a published course of instruction on antiaircraft artillery in "The Beaten Zone" section of the *Journal*. Heretofore, "The Beaten Zone" served as a forum for officers to present problems and solutions to the more technical aspects of surface-to-surface coast artillery. In a move initiated by Clark, the *Journal* interrupted its surface-to-surface instruction and began a course on antiaircraft artillery. This action received immediate support from Brigadier General Johnson Hagood, the Commanding General of the Coast Artillery Training Center at Fort Monroe, Virginia. Hagood assigned Major O. L. Spiller, a veteran of the World War I Antiaircraft Service and current antiaircraft artillery instructor at the Coast Artillery School, to prepare an extensive written version of his course.[99]

Clark, Hagood, and others realized the impact that airpower and antiaircraft artillery had on the conduct of World War I. Moreover, they had the foresight to envision the great impact these forces might have in the next war. Contrary to the prevailing belief at the time, they concluded that "anti-aircraft artillery will occupy a place in the future development of the Corps which will be far greater than most of our readers imagine." Clark hoped to familiarize these readers with the "fundamentals of a subject which is now an essential part of the professional equipment of every Coast Artillery officer." He also wanted to supply the Coast Defenses with a text for the equipment they now employed and focus attention on antiaircraft artillery "with a view to encouraging discussion and development."[100] Hagood, in a letter to General Coe requesting materiel assistance for Major Spiller, was more direct. He believed that it was "exceedingly important" to educate those officers "who are nearly or altogether ignorant" of antiaircraft artillery techniques. To that end, he directed Spiller to modify his text and illustrate "every piece of equipment with sufficient clearness" so that any officer could follow along.[101]

Spiller's contributions to "The Beaten Zone" ran continuously from December 1920 to May 1921, covering every aspect of antiaircraft artillery from general information to specific instruction on fire control operations and crew drills. The series supplemented the instruction occurring at the Coast Artillery School and was, for officers in the field, the first doctrinal information available on antiaircraft artillery.[102]

The success of the antiaircraft artillery instruction in "The Beaten Zone" convinced General Coe of the need for a comprehensive field manual on antiaircraft artillery. Unfortunately, it was difficult to publish a comprehensive manual when the field was in a state of constant development. As an interim solution, The Office of the Chief of Coast Artillery published a monthly bulletin on antiaircraft artillery beginning in November 1922. This "Anti-Aircraft Series" ran until June 1929, updating the Corps on all facets of antiaircraft artillery. Designed to "coordinate the development and progress" of the widely distributed antiaircraft units, the bulletin supplemented the *Journal* as a means to foster institutional knowledge and disseminate information.[103]

By the end of the decade, the combined effect of these publications together with continued education at the Coast Artillery School and the fielding of antiaircraft equipment and units propelled the antiaircraft artillery establishment to a position of equality with, if not primacy over, its seacoast artillery counterpart. In 1929, the War Department recognized this fact and changed the mission of the Coast Artillery Corps to include serving as the nation's "first line of ground defense against enemy aircraft at sensitive points and vital areas." The War Department also required that, "in addition to [their] permanent assignments...to fixed defenses, railway, or tractor artillery," the Coast Artillery Corps train all troops to "serve skillfully and effectively [on] antiaircraft armament...[and]...equipment...."[104] By mid-year, the intellectual and doctrinal revolution within the Coast Artillery Corps had progressed to the point that the Assistant Commandant of the Coast Artillery School was telling his various Department Directors that "[w]e must have another hour (day or week) out of your course for antiaircraft instruction." The *Coast Artillery Journal* reported that "directors and instructors weep as their pet courses are slashed and belittled by ruthless antiaircraft-minded authorities."[105] Concerned about the impact of these developments on his officers, Major General John W. Gulick, the new Chief of the Coast Artillery Corps, issued a statement denying the superiority of the antiaircraft artillery and telling seacoast artillery officers that their neither their careers nor their sub-discipline within the Corps were in jeopardy of becoming obsolete.[106] Such was the impact of a small, but varied group of visionaries on the psychology of the institution.

Problem #4: Mavericks as Agents of Change

Finally, reluctance to change the status quo manifests itself in hostility toward the agents of change. This is particularly true when the agents become mavericks and operate outside of the normal channels of communication. During the interwar period, three well known mavericks sought to modernize their militaries and alter the status quo.

In England, Basil H. Liddell Hart and John Frederick Charles Fuller argued that mechanized warfare and combined arms formations would restore mobility on the battlefield and return the offensive to the dominant place in warfare. In America, Billy Mitchell polemicized for an independent air service to replace the Navy as the nation's first line of defense. While all began their efforts as mavericks railing against the established vision of their services, only Liddell Hart softened his rhetoric and endeavored to work within the system to achieve the changes he believed necessary. Conversely, Fuller retired in disgust and joined with Britain's Fascist Party, while Mitchell was court-martialed for insubordination and left the US Army in 1926.

Interestingly, some scholars theorize that military mavericks lend expertise to civilians who then push the military toward innovation.[107] In reality, these mavericks do more harm than good to the cause of innovation. By going outside of the military, the mavericks alienate those within the organization who subsequently dig in their heels. Insulted and seething with indignation, the orthodox military becomes intransigent, defying or retarding civilian efforts to force innovation on the military.[108]

CHAPTER FOUR

ONE PATH TO SUCCESSFUL MILITARY INNOVATION IN PEACETIME

Given the numerous internal impediments to innovation, one may wonder how any modernization occurs within the military. Despite indications to the contrary, modernization does indeed occur. When it happens, however, it is usually the product of several important elements brought together in a single, coherent strategy for change.[109]

Timing

Assuming that a bonafide need for change exists and that the change in question is appropriate for the organization's future success, the first element of successful modernization is timing. As General Coe's continued harping to the Adjutant General about making antiaircraft artillery battalions organic to divisions demonstrates, poor timing can prevent even the most patent innovations from happening. While there is no optimal time to begin innovation, there are three periods that have served as stimuli for change in the past. Some authors contend that the period immediately following a defeat offers the best chance to initiate modernization. Capitalizing on the weakened preconceptions of senior leaders, the demonstrated fallibility of traditional methods, and the lack of confidence of the established order, innovators in these armies use their recent defeat as a lever with which to press for reform.[110] In this sense, defeat represents the greatest, most visible collection of anomalies to the current military paradigm and serves as a ready example of a paradigm crisis. The impact of Prussia's loss to Napoleon in 1806 on the military reform movement led by Scharnhorst and Gneisenau is a case in point.[111] Not all armies, however, recognize the need to reform following a defeat. Andrew F. Krepinevich, in his trenchant study, *The Army and Vietnam*, considers the Army derelict in its duty because after its defeat in that low-intensity conflict "the Army made little effort to preserve the learning that had occurred during the war; rather, it expunged the experience from the service's consciousness."[112]

Although less frequently observed, another period when history indicates innovation has occurred is following a major victory. Far from resting on their laurels, successful armies have used this occasion to modernize their doctrine and equipment both to deter potential aggression by an adversary and to ensure future battlefield readiness. Napoleon's development of *La Grande Armée* during the relative period of peace between 1802 and 1805 is one example of a army introducing a new doctrine and organization after a major victory--in this case Marengo.[113] Again, however, not all

armies feel compelled to attempt innovation during the period following a major victory. As discussed earlier, war weariness and isolationism prevented modernization from occurring in the British and American armies for over a decade after their victorious conclusion of World War I.

A third point in the life of an interwar army when conditions may support successful modernization occurs during the period immediately prior to a potential conflict. This is particularly true when leaders perceive the nature of war has changed and their force is not capable of meeting the new challenges ahead. As such, these leaders are attempting to alter their organizations to cope with a recognized crisis in their military paradigm. As Friedrich von Decken, a Hanoverian staff officer who later distinguished himself under Wellington in Spain wrote in 1800,

> Change encounters less obstacles shortly before the outbreak of a war....A danger sensed by all muffles the voice of intrigue, and the innovation appears as a smaller evil that must be accepted to avoid a greater.[114]

Such was the case in both the United States and Great Britain in the mid-1930s as storm clouds formed over Europe. Of course, the danger in waiting until the period immediately prior to a new conflict to modernize is that the army may get caught in a doctrinal, organizational, or technological "Midway", having completed only a portion of the planned change and operating with a mix of old and new methods when the next war starts. Shortly before its defeat in 1806, the Prussian Army reorganized along the divisional lines. While desirable, the reform came before anyone learned how to operate the new system.[115]

What all of these time frames have in common is that they occurred when there was a period of what one author has called organizational slack or organizational distress in the life of the institution. Slack obtains when an organization possesses resources (money, personnel, time, political support) in excess of what it needs to meet its daily mission requirements. Slack supports innovation because it allows the organization to divert resources to develop, test, and implement new ideas. Of the examples above, perhaps only Napoleon enjoyed the overabundance of resources necessary to foster modernization. Conversely, distress occurs when an organization faces budget decrements, a diminishing threat, and an uncertain operational future. Under these pressures the organization must look for innovative methods to preserve its institutional vitality. It sets new goals, adopts new values, and creates new supporting power

structures. The U.S. Marine Corps is one example of a military organization changing as a result of distress. Until rearmament began in the mid-1930s, the Marine Corps was under acute organizational stress. It adapted to the conditions of the time, developed innovative ideas concerning amphibious warfare, and sustained its organizations in the face of overwhelming pressure. The Coast Artillery Corps, its adoption of the antiaircraft artillery mission, and development of supporting doctrine, organization, and technology is another example of an institution adapting in times of distress to meet changing operational needs.[116]

Continuity and Protection for Agents of Change

The second element of successful modernization concerns the architects of change. "The reform of any military organization...requires multiple paternity, a coalition of senior and junior officers who share a common vision" of both the past and the future.[117] Moreover, these officers must possess the intellectual and political staying power to see the innovation through to implementation. Frequently, military innovations take a long time to complete. They represent more than anything else great campaigns against the status quo. Unfortunately, in the modern military personnel turbulence virtually guarantees a rapid turnover of the individuals charged with stewardship of the innovation. At a minimum, career progression dictates the departure of key people before the changes are complete. Thus, it is essential that senior leaders establish continuity among the agents of change.[118]

Equally important is the need for the current leaders to ensure the succession of like-minded officers into senior leadership positions within the military. If the intellectual and political chain of authority supporting the innovation is broken, then modernization will fall victim to traditional beliefs--the long threads that tether institutions to the past--and fail. Without a patron to shield the innovation from attack and shepherd both it and the innovators through hard times, the effort will collapse. Similarly, modernization will require a spokesman to sell the innovative ideas to the Army at large. While the spokesman should not be a "maverick", he should be either an individual with credibility both inside and out of the Army or, as General Donn Starry contends, an institution such as a staff college like the US Army Command and General Staff College or a staff agency like the Training and Doctrine Command that can carry the innovation forward from within the bureaucracy.[119]

Consensus, Incrementalism, and Distributed Action

The third and most important ingredient to successful modernization is the creation of a consensus in support of the change. The architects of change must build support within the Army using the irrefutable logic of their ideas backed by empirical evidence obtained through realistic, objective trials. Only when the field Army accepts the benefits of change and believes it has a stake in the modernization will the rank and file tear down the bureaucratic barriers impeding the progress of innovation and support the change.[120] In part, the non-linear nature of military innovation assists in consensus-building. Friedrich von Decken offered the following analysis:

> Such a close relationship exists among the separate components of the military estate...that in order to achieve anything many wheels must be set in motion that often seem far removed from one another.[121]

Thus, several groups of innovators can work independently to build consensus for various elements of a planned modernization which if combined would alarm the purveyors of the status quo. By taking an incremental, distributed approach to modernization, innovators can avoid the kind of all-out ideological struggle that polarizes the military and retards reform.

Intellectual Surf Rider or Irrelevant Institution

Combined, these elements of successful modernization--good timing, continuity, patronage, salesmanship, non-linearity, and consensus building--give the agents of change a fighting chance to defeat the traditional elements of resistance and see their modernization reach fruition. As demonstrated by the development of the antiaircraft artillery during the Interwar period as well as other examples, successful innovation is the product of a diverse set of external and interal factors that continually intervene to alter the nature of any long range modernization as well as the path taken to achieve it. Given the broad similarities between the Interwar period and today, the lessons of past attempts at innovation bear consideration for the future. To return to the analogy of the ocean liner, the U.S. Army can no longer see itself as a large, lethargic vessel, fighting against the currents and winds of change and turning ever so slowly at the direction of the captain. Instead, to borrow from Sir Michael Howard, the Army must see itself as an "intellectual surf rider spotting the essential currents on which to ride" the crest of the breaking wave of social, political, and technological trends that would dash a less flexible, versatile, and adaptable organization on the rocks of irrelevance or beach it in the shallow waters of impotence.[122]

ENDNOTES

[1]Eliot A. Cohen and John Gooch, *Military Misfortunes: The Anatomy of Failure in War*, (New York: The Free Press, 1990).

[2]Stephen Peter Rosen, *Winning the Next War*, (Ithaca, NY: Cornell University Press, 1991), 7-8.

[3]Carl von Clausewitz, *On War*, ed. and trans. by Michael Howard and Peter Paret, (Princeton, NJ: Princeton University Press, 1976), 77.

[4]Carl von Clausewitz, *On War*, ed. Anatol Rapoport, (London: Penguin Classics, 1968), Bk. II, Chpt 3, pp. 202-203; The Paret and Howard edition of *On War* says "In War, the will is directed at an animate object that *reacts*." (Italics in original), p. 149.

[5]For more on this phenomenon during the Cold War, see Lawrence Freedman, *The Evolution of Nuclear Strategy*, 2d ed. (New York: St. Martin's Press, 1989). For the effect of nuclear weapons and strategy on US Army doctrine, particularly in the 1950s and early 1960s, see A.J. Bacevich, *The Pentomic Era: The U.S. Army between Korea and Vietnam*, (Washington, DC: National Defense University Press, 1986).

[6]For a slightly amended version of Roberts' lecture see, Michael Roberts, "The Military Revolution, 1560-1660," in *Essays in Swedish History*, (Minneapolis: University of Minnesota Press, 1967), 195-225; For Parker's initial response see, Geoffrey Parker, "The 'Military Revolution,' 1560-1660--a Myth?" *The Journal of Modern History*, vol. 48, (1976): 195-214.

[7]Geoffrey Parker, *The Military Revolution: Military Innovation and the Rise of the West, 1500-1800*, (Cambridge: Cambridge University Press, 1988); Jeremy Black, A *Military Revolution? Military Change and European Society, 1550-1800*, (Atlantic Highlands, NJ: Humanities Press, 1990); Clifford J. Rogers, "The Military Revolutions of the Hundred Years' War," *The Journal of Military History*, vol 57., no. 2., (April 1993): 241-278; Andrew F. Krepinevich, "Calvary to Computer: The Pattern of Military Revolutions," *The National Interest*, (Fall 1994): 30-42.

[8]Thomas S. Kuhn, *The Structure of Scientific Revolutions*, (Chicago: University of Chicago Press, 1970), 175.

[9]James J. Schneider, *The Structure of Strategic Revolution: Total War and the Roots of the Soviet Warfare State*, (Novato, CA: Presidio Press, 1994), 163.

[10]Paul Davies and John Gribbin, *The Myth Matter*, (New York: Simon and Schuster, 1992), 7 quoted in Schneider, *The Structure of Strategic Revolution*, 163.

[11]Schneider, *The Structure of Strategic Revolution*, 163.

[12]Ibid., 209.

[13]Robert A. Doughty, *The Seeds of Diaster: The Development of French Army Doctrine, 1919-1939*, (Hamden, CT: Achon Books, 1985), 7-8. See also Robert A. Doughty, *The Evolution of US Army Tactical Doctrine 1946-1976*, Leavenworth Paper No. 1., (Fort Leavenworth, KS: Combat Studies Institute, US Army Command and General Staff College, 1979), 1.

[14]For Kuhn's view of the role of history and its importance to the process of scientific discovery see, Kuhn, *The Structure of Scientific Revolutions,* 1-9.

[15]For a discussion of the emergence of anomalies and how the scientific community responds to crisis see, Kuhn, *The Structure of Scientific Revolutions,* 52-91.

[16]I. Bernard Cohen, *Revolution in Science,* (Cambridge: Harvard University Press, 1985), 28. For an application of Cohen's model to the strategic revolution in the Soviet Union under Stalin, see Schneider, *The Structure of Strategic Revolution*, 274-276.

[17]Ibid, 29; Schneider, *The Structure of Strategic Revolution*, 274.

[18]Cohen, *Revolution in Science,* 29-30; Schneider, *The Structure of Strategic Revolution*, 275.

[19]Carl von Clausewitz, "Note of 10 July 1827," in *On War*, ed. and trans. by Michael Howard and Peter Paret, 69. Interestingly, in *Revolutions in Science,* Cohen emphasizes that many important scientific thoughts never reach the larger community of scientists because their authors do not make an effort to present their theories in a public forum. Given his contention, one can only speculate on the progress of military thought had Clausewitz's widow, Marie von Clausewitz, not published her late husband's work in 1832.

[20]Cohen, *Revolution in Science,* 31; Schneider, *The Structure of Strategic Revolution*, 275.

[21]For more on Mahan and his influence see, Phillip A. Crowl, "Alfred Thayer Mahan: The Naval Historian," in Peter Paret ed. *Makers of Modern Strategy: From Machiavelli to the Nuclear Age,* (Princeton: Princeton University Press, 1986), 444-477. Also Margaret Tuttle Sprout, "Mahan: Evangelist of Sea Power," in Edward Earle Meade ed. *Makers of Modern Strategy: Military Thought from Machiavelli to Hitler,* (Princeton: Princeton University Press, 1948), 415-445.

[22]Schneider, *The Structure of Strategic Revolution*, 273-274.

[23]Ibid., 274.

[24]Ibid.

[25]Ibid., 275.

[26]Kuhn, *The Structure of Scientific Revolutions,* 79.

[27]Schneider, *The Structure of Strategic Revolution*, 275.

[28]Michael Howard, "Military Science in an Age of Peace," *RUSI, Journal of the Royal United Services Institute for Defense Studies* (March 1974): 4.

[29]Ibid., 7.

[30]Clifford J. Rogers, "The Military Revolutions of the Hundred Years' War," *The Journal of Military History*, vol 57., no. 2., (April 1993): 277; For more on the history of punctuated equilibrium evolution see, Tim Beardsley, "Punctuated Equilibrium: Darwin Survives as the Debate Evolves," in *Scientific American* vol 262 (March 1990): 37-38.

[31]Ibid.

[32]For an excellent discussion of evolution of airpower and its impact on every facet of World War I see, Lee Kennett, *The First Air War, 1914-1918*, (New York: The Free Press, 1991).

[33]Colonel Jay P. Hopkins, "Antiaircraft Artillery," Lecture delivered at the Army Center for Artillery Studies, Treves, Germany, 21 May 1919, TM, p. 4, Dec# 666/M, Box 139, Entry #9, Record Group 177 National Archives, Washington, DC; Colonel Jay P. Hopkins, "Final Report of the Chief of the Antiaircraft Service," 28 December 1918, Historical Division, Department of the Army, *United States Army in the World War, 1917-1919*, 17 vols. (Washington, DC: Government Printing Office, 1948), 15:217; Charles E. Kirkpatrick, *Archie in the A.E.F.: The Creation of the Antiaircraft Service of the United States Army, 1917-1918*, (Fort Bliss, TX: U.S. Army Air Defense Artillery Museum, 1984), 57.

[34]Perhaps a more familiar example of the difficulty inherent in the peacetime replication of wartime conditions lies in the difference between Billy Mitchell's sinking of the *Ostfriesland* and the destruction of the initial waves of American attacks on the Japanese fleet during the Battle of Midway in June 1942. All that Mitchell's bombing of a former German battleship off the Chesapeake Bay in 1921 proved was that an aiplane could sink an unarmed, immobile ship on a clear day in calm water when the ship was incapable of fighting back. Conversely, at Midway, the Japanese Fleet equipped with air defense fighters and antiaircraft weapons downed several waves of American fighters and torpedo-bombers while suffering no damage to their aircraft carriers. Ultimately, however, American dive-bombers caught the Japanese Fleet in the middle of rearming and refueling their aircraft and sunk three of their four carriers. American planes sunk the fourth carrier later the same day.

[35]Williamson Murray and Mark Grimsley, "Introduction: On Strategy," in Williamson Murray, MacGregor Knox,and Alvin Bernstein ed., *The Making of Strategy: Rulers, States, and War*, (New York: Cambridge University Press, 1994), 1.

[36]Ibid.,1-3.

[37]Ibid., 7.

[38]Coe, in his 1920 "Report of the Chief of Coast Artillery Corps," warned that it would take $20 million to provide Boston with the same level of antiaircraft protection afforded Paris during World War I. Maj. Gen. Frank W. Coe, "Report of the Chief of Coast Artillery Corps," in *War Department Annual Report, 1920*, (Washington, DC: Government Printing Office, 1920), 308.

[39]Ibid.

[40]Uri Bialer, *The Shadow of the Bomber: The Fear of Air Attack and British Politics*, (London: Royal Historical Society, 1980),3-4. For an interesting analysis of British air policy in the decade following World War I see, Neil Young, "British Home Air Defence Planning in the 1920s," *The Journal of Strategic Studies*, vol. 11, no. 4 (December 1988): 492-508. Young contends that Chief of the Air Staff, Sir Hugh Trenchard, used the threat of air attack from France as well as a desire to "substitute" air for land units in the policing of the Empire as a means to bolster defense spending on the RAF.

[41]In late 1941, American antiaircraft units were seriously short of close-in, height-finding SCR-268 radars and intermediate range SCR-270 and SCR-271 radars. Through the efforts of Secretary of War Henry L. Stimson and the active involvement of Mr. Watson-Watt of the British Air Commission, American antiaircraft units received numerous British and Canadian ground control intercept radars allowing them to rectify the situation by mid-1942. Stetson Conn, Rose C. Engleman, and Byron Fairchild, *The Western Hemisphere: Guarding the United States and its Outposts*, The

United States Army in World War II, Office of the Chief of Military History, (Washington, DC: Government Printing Office, 1964), 425-429.

[42]Williamson Murray and Mark Grimsley, "Introduction: On Strategy," 8.

[43]Ibid.

[44]Harry C. Thomson and Lida Mayo, *The Technical Services: The Ordnance Department: Procurement and Supply*, The United States Army in World War II, (Washington, DC: Goverment Printing Office, 1960), 76-79; Constance McLaughlin Green, Harry C. Thomson, and Peter C. Roots, *The Technical Services: The Ordnance Department: Planning Munitions for War*, The United States Army in World War II, (Washington, DC: Government Printing Office, 1955), 413-414.

[45]E. Paul Semmens, *The Hammer of Hell*, (Fort Bliss, TX: USAADS, 1990), 18, 22, and 27.

[46]Willamson Murray, "The Collapse of Empire: British Strategy, 1919-1945," in Williamson Murray, MacGregor Knox,and Alvin Bernstein ed., *The Making of Strategy: Rulers, States, and War*, 407.

[47]Quoted in Eliot A. Cohen, "The Strategy of Innocence? The United States, 1920-1945," in Williamson Murray, MacGregor Knox,and Alvin Bernstein ed., *The Making of Strategy: Rulers, States, and War*, 440.

[48]George C. Marshall, "Biennial Report of the Chief of Staff of the United States Army to the Secretary of War, July 1, 1943-June 30, 1945," in *The War Reports of General of the Army·George C. Marshall and Others*, with a Foreword by Walter Millis, (New York: J.B. Lippincott Company, 1947), 299.

[49]Willamson Murray and Mark Grimsley, ""Introduction: On Strategy," 13.

[50]Howard," Military Science in an Age of Peace," 4.

[51]Ibid.

[52]I. Bernard Cohen makes a similar point with respect to innovations and revolutions in science. While "revolutions in science are inevitable," Cohen contends that the pace or frequency of such revolutions varies with the degree of financial support given to the scientific community. A paucity of funds limits the possibilities for purchasing and constructing research instruments, conducting expeditions, recruiting and training the next generation of scientists, and relieving scientists of excessive administrative and teaching duties so they can "reflect" on their discipline. For more on this subject see, Cohen, *Revolution in Science*, 21.

[53]Stephen Peter Rosen, *Winning the Next War* and "Understanding Military Innovation," *International Security*, vol 13, no. 1 (Summer 1988), 167; Michael Meese, "The Process of Organizational Change," in Richard Hooker ed. *Maneuver Warfare: An Anthology*, (Novato, CA: Presidio Press, 1993), 205.

[54]Omar N. Bradley quoted in Elias Huzar, *The Purse and the Sword: Control of the Army by Congress through Military Appropriations, 1933-1950*, (Ithaca, NY: Cornell University Press, 1950), 132-133.

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[55]Ibid.

[56]I thank Professor Roger Spiller, the George C. Marshall Professor of Military History at the United States Army Command and General Staff College, for his comments on the sources of professional knowledge and growth.

[57]Maurice Pearton, *Diplomacy, War, and Technology Since 1830,* (Lawrence, KS: University of Kansas Press, 1984), 27; Also see Michael Howard, *The Franco-Prussian War,* (London: Rupert Hart-Davis, Ltd, 1961).

[58]For a complete analysis of the Pentomic Division and an extremely cogent argument on the debilitating effect an unquestioning acceptance of technology can have on a military institution see, A.J. Bacevich, *The Pentomic Era: The U.S. Army between Korea and Vietnam,* (Washington, DC: National Defense University, 1986). Bacevich quotes General Decker on page 135.

[59]Michael Howard, "Military Science in an Age of Peace," 5

[60]Morris Janowitz, *Sociology and the Military Establishment,* (New York: Russell Sage Foundation, 1965), 102-103; Michael Howard, "Military Science in an Age of Peace," 5; Michael Meese, "The Process of Organizational Change," 202.

[61]Alfred Thayer Mahan, *The Influence of Sea Power upon History, 1660-1805*, (Novato, CA: Presidio Press, 1987), 20. This work is a combination of Mahan's classic work, *The Influence of Sea Power upon History, 1660-1783,* abridged, and extracts from his *The Influence of Sea Power upon the French Revolution.* Parenthetical comment added.

[62]Kurt Lang, "Military Organizations," in *Handbook of Organizations*," ed. James G. March (Chicago: Rand McNally & Co., 1965), 843; Stephen Peter Rosen, *Winning the Next War*, 19-20.

[63]For a superb discussion of the development of French Army doctrine during the Interwar Period see, Robert A. Doughty, *The Seeds of Disaster: The Development of French Army Doctrine, 1919-1939.* For similar discussion with respect to the development of Soviet doctrine see, James J. Schneider, *The Structure of Strategic Revolution: Total War and the Roots of the Soviet Warfare State.* Likewise, for a discussion of the development of doctrine in Britain see, Brian Bond, *British Military Policy between the Two World Wars*, (Oxford: University Press, 1980).

[64]Matthew Cooper, *The German Army, 1933-1945: Its Political and Military Failure*, (Chelsea, England: Scarborough House, 1990), 149.

[65]For a particularly interesting argument on behalf of the Army's position as well as a statement on the effectiveness of antiaircraft artillery, see testimony by Assistant Chief of Staff of the Army, Brigadier General Hugh A. Drum before the Select Committee of Inquiry into Operations of the United States Air Services, in Congress, House, Select Committee of Inquiry into Operations of the United States Air Services, *Inquiry into Operations of the United States Air Services*, 68th Cong., February 1925, 1791-1873. Drum's comment about stopping any bomber may be found on page 1868.

[66]Ibid., 1909.

[67]Congress, House, Committee on Military Affairs, *Department of Defense and Unification of the Air Service*, 69th Cong., 1st sess., 19 January to 9 March, 1926, 383-386.

[68]Lang, 857.

[69]Michael Howard, *The Franco-Prussian War*, (London: Rupert Hart-Davis Ltd, 1961), 115-119; Also see Edward L. Katzenback Jr., "The Horse Cavalry in the Twentieth Century--a Study on

Policy Response," in *Public Policy, a Yearbook of the Graduate School of Public Administration*, (Boston: Harvard University Press, 1958), 120-149.

[70]Morris Janowitz, *Sociology and the Military Establishment*, 105.

[71]Heinz Guderian, *Panzer Leader*, (New York: Ballantine, 1957), 383-384.

[72]U.S. War Department, *Field Service Regulations, 1923*, (Washington, DC: Government Printing Office, 1924), 48, 73, and 111; Brig. Gen. Harry A. Smith, War Plans Division Staff Study, "Anti-aircraft Defense," October 1925, TM, Dec #666/AM-22, Box 139, Entry #9, RG 177, National Archives and Records Administration, Washington, DC (hereafter cited as NA); Letter, Col. John H. Hughes, Office of the Chief of Infantry, to the Adjutant General (hereafter AG), 19 March 1925, "Antiaircraft Defense," Dec #666/AM-34, Box 140, Entry #9, RG 177, NA.

[73]Letter, Maj. Gen. F.W. Coe, to the AG, 26 August 1925, "Anti-aircraft Project for the United States," Dec #666/AM-18, Box 139, Entry #9, RG 177, NA; Brig. Gen. Harry A. Smith, War Plans Division Staff Study, "Anti-aircraft Defense," October 1925, TM, Dec #666/AM-22, Box 139, Entry #9, RG 177, NA.

[74]Brig. Gen. Harry A. Smith, War Plans Division Staff Study, "Anti-aircraft Defense," October 1925, TM, Dec #666/AM-22, Box 139, Entry #9, RG 177, NA; Letter, Col. Willey Howel, to the AG, 5 August 1925, "Antiaircraft Defense," Dec #666/AM-34 (Inc. 12), Box 140, Entry #9, RG 177, NA.

[75]Letter, Brig. Gen. Edgar Jadwin, to the AG, 5 August 1925, "Anti-Aircraft Defense," Dec #666/AM-34 (Inc. 11), Box 140, Entry #9, RG 177, NA; Letter, Maj. C.S. Blakely, to the AG, 26 March 1925, "Antiaircraft Defense," Dec #666/AM-34 (Inc. 12), Box 140, Entry #9, RG 177, NA.

[76]Letter, Lt. Col. Daniel Van Voorhis, to the AG, 11 August 1925, "Antiaircraft Defense," Dec #666/AM-34 (Inc. 6), Box 140, Entry #9, RG 177, NA; Letter, Brig. Gen. Edw. L. King, to the AG, 8 July 1925, "Antiaircraft Defense," Dec #666/AM-34 (Inc. 39), Box 140, Entry #9, RG 177, NA.

[77]Brig. Gen. Harry A. Smith, War Plans Division Staff Study, "Anti-aircraft Defense," October 1925, TM, Dec #666/AM-22, Box 139, Entry #9, RG 177, NA; Memorandum, Brig. Gen. Hugh A. Drum, to the Assistant Chief of Staff, War Plans Division, 31 October 1925, "Anti-aircraft Artillery," Dec #666/AM-22, Box 139, Entry #9, RG 177, NA.

[78]Letter, Maj. Gen. F. W. Coe, to the AG, 6 October 1925, "Antiaircraft Artillery," Dec #666/AM-18F, Box 139, Entry #9, RG 177, NA; Letter (1st End.), AG, to the Chief of Coast Artillery, 9 November 1925, Dec #666/AM-18F, Box 139, Entry #9, RG 177, NA.

[79]Letter (2nd End.), Maj. Clifford Jones, to the AG, 6 January 1926, Dec #666/AM-18F, Box 139, Entry #9, RG 177, NA; Letter (3rd End.), AG, to the Chief of Coast Artillery, 5 February 1926, Dec #666/AM-18F, Box 139, Entry #9, RG 177, NA.

[80]Letter (3rd End.), AG, to the Chief of Coast Artillery, 5 February 1926, Dec #666/AM-18F, Box 139, Entry #9, RG 177, NA.

[81]U.S. War Department, *FM 4-105: Coast Artillery Field Manual, vol. 2, Antiaircraft Artillery: Part One--Tactics*, (Washington, DC: Government Printing Office, 1930), 11.

[82]For a concise history of the "Victory Plan" and Wedemeyer's role, see Charles E. Kirkpatrick, *An Unknown Future and a Doubtful Present: Writing the Victory Plan of 1941*, United States Army Center for Military History, (Washington, DC: Government Printing Office, 1990). For comments on

the inclusion of antiaircraft artillery in the division as well as throughout the Army structure, see pages 88-114 passim.

[83]Kent Roberts Greenfield, Robert R. Palmer, and Bell I. Wiley, *The Army Ground Forces: The Organization of Ground Combat Troops*, United States Army in World War II, United States Army Center for Military History, (Washington, DC: Government Printing Office, 1987), 293.

[84]Patterson and Devers are mentioned in Kent Roberts Greenfield, Robert R. Palmer, and Bell I. Wiley, *The Army Ground Forces: The Organization of Ground Combat Troops*, 295. Eisenhower is mentioned in E. Paul Semmens, *The Hammer of Hell*, 18. Eisenhower was promoted to General on 11 February 1943 and became Supreme Allied Commander Mediterranean on 16 February 1943.

[85]Kent Roberts Greenfield, Robert R. Palmer, and Bell I. Wiley, *The Army Ground Forces: The Organization of Ground Combat Troops*, 295.

[86]Ibid., 296.

[87]Memo USW to Asst Secy Army, dtd 23 December 1942, no sub, 370/4, GNDCG, 321, CAC, NA, Box 337-55-118 cited in E. Paul Semmens, *Hammer of Hell*, 3.

[88]For Devers' comments, see Kent Roberts Greenfield, Robert R. Palmer, and Bell I. Wiley, *The Army Ground Forces: The Organization of Ground Combat Troops*, 296. For Eisenhower's comments on the effect of enemy air attack and the need for antiaircraft artillery protection, see Dwight D. Eisenhower, *The Papers of Dwight David Eisenhower, The War Years: II*, Alfred D. Chandler Jr. ed., (Baltimore: Johns Hopkins Press, 1970), entries 729, 770, and 841.

[89]Kent Roberts Greenfield, Robert R. Palmer, and Bell I. Wiley, *The Army Ground Forces: The Organization of Ground Combat Troops*, 296-297.

[90]Semmens, *The Hammer of Hell*, 29-36; see also, Martin Blumenson, *Kasserine Pass*, (New York: Jove Books, 1983) and "Kasserine Pass, 30 January-22 February, 1943," in Charles E. Heller and William A. Stofft ed., *America's First Battles, 1776-1965*, (Lawrence, KS: University of Kansas Press, 1986), 226-265; and George F. Howe, *Northwest Africa: Seizing the Initiative in the West*, U.S. Army in World War II, United States Army Center for Military History, (Washington, DC: Government Printing Office, 1957), 401-481.

[91]McNair's address reprinted in Lieutenant General Lesley J. McNair, "Our Expanding Antiaircraft," *Coast Artillery Journal* 85, (November-December 1942): 30-31.

[92]Ibid., 103; Lang, 857.

[93]For more information on the conflict between Major General Fred C. Ainsworth and Elihu Root and Major General Leonard Wood see Philip Semsch, "Elihu Root and the General Staff," *Military Affairs* 27 (Spring 1963), 16-27; Graham A. Cosmas, "Military Reform After the Spanish-American War: the Army Reorganization Fight of 1898-1899," *Military Affairs* 35 (February 1979), 12-18; Mabel E. Deutrich, *Struggle for Supremacy: The Career of General Fred C. Ainsworth*, (Washington, DC: Public Affairs Press, 1962); and Jack Lane, *Armed Progressive: General Leonard Wood*, (Novato, CA: Presidio Press, 1978).

[94]Norman Dixon, *On the Psychology of Military Incompetence*, (New York: Basic Books, 1976), 115.

[95]A phrase recently communicated to this author by a general officer--"I may be frequently wrong, but I am never in doubt"--is an excellent example of this phenomenon occurring even among the U.S. Army's rising stars.

[96]Dixon, *On the Psychology of Military Incompetence,* 112.

[97]*Journal of the United States Artillery* 14 (Fort Monroe, VA:Coast Artillery School Press, May 1919), 325-327.

[98]For an excellent discussion of the development of antiaircraft artillery during World War I, see Charles E. Kirkpatrick, *Archie and the A.E.F.: The Creation of the Antiaircraft Service of the United States Army, 1917-1918.*

[99]Captain F.S. Clark, "Archie's Gunnery," *The Journal of the United States Artillery* 53 (December 1920): 639-640; Letter, Brig. Gen. Johnson Hagood, to the Chief of Coast Artillery, 29 March 1920, "Anti-aircraft Materiel," Dec #666/L, Box 145, Entry #9, RG 177, NA.

[100]Clark, "Archie's Gunnery," 639-640.

[101]Letter, Brig. Gen. Johnson Hagood, to the Chief of Coast Artillery, 29 March 1920, "Anti-aircraft Materiel," Dec #666/L, Box 145, Entry #9, RG 177, NA.

[102]See "The Beaten Zone," in the *Journal of the United States Artillery*, vol. 53, no. 6. (December 1920) to vol. 54. no. 5 (May 1921) for specific articles by Maj. Spiller on antiaircraft artillery.

[103]War Department, Office of the Chief of Coast Artillery, Bulletin, "Anti-Aircraft Series," No. A.A. 1.001, 25 November 1922, TM, Dec #300.53, Box 3, Entry #9, RG 177, NA.

[104]Maj. Gen. Andrew Hero, Jr. "New Year Greetings from the Chief of Coast Artillery" *Coast Artillery Journal* vol. 72, no. 1. (January 1930): frontpiece.

[105]"The Coast Artillery School: Antiaircraft--'Cock o' the Walk,'" *Coast Artillery Journal* vol 72, no. 5. (May 1930): 435.

[106]"Seacoast versus Antiaircraft," *Coast Artillery Journal*, vol 73, no. 3. (September 1930): 263.

[107]Barry Posen, *The Sources of Military Doctrine*,.(Ithaca, NY: Cornell University Press, 1984), 224-226.

[108]Stephen Peter Rosen, *Winning the Next War*, 10-13. For a more positive view of "mavericks" within the military see General Donn A. Starry, "To Change an Army," *Military Review* 63 (March 1983), 22.

[109]Several senior military officers and noted scholars have offered their view on how to achieve peacetime military innovation. The ideas that follow incorporate many of them, while at the same time perhaps offering something new.

Timothy Lupfer, the author of a minor military classic on the development of German tactical doctrine during World War I, lists nine steps to change. They are: 1) Perception of a need for change; 2) Solicitation of ideas, especially from the battlefield units; 3) Definition of the change; 4) Dissemination of the change; 5) Enforcement throughout the Army; 6) Modification of organization and equipment to accommodate the change; 7) Thorough training; 8) Evaluation of Effectiveness; and 9)

Subsequent refinement. (Timothy T. Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War,* Leavenworth Paper No. 4, (Fort Leavenworth, KS: Combat Studies Institute, U.S. Army Command and General Staff College, 1981), viii.)

General Donn A. Starry, former commander of the United States Army Training and Doctrine Command and an architect of the Army's 1982 edition of *FM 100-5: Operations*, lists seven general requirements for successful military innovation. They are: 1) an institution or mechanism to identify the need for change, draw up parameters for change, describe what must be done and how it differs from past practice; 2) rigorous educational background of officers responsible for change to produce a common cultural bias toward solving problems; 3) spokesman for change, it can be an institution or an individual; 4) building of consensus and gaining of converts; 5) continuity among the architects of change; 6) support at or near the top of the organization; and 7) conduct field trails to test the validity of the proposed change. (General Donn A. Starry, "To Change an Army," *Military Review* 63 (March 1983): 20-27.)

Sir Michael Howard, an eminent military historian and strategic thinker, defined three conditions that underwrite any military innovation, particularly in peacetime--technical feasibility, operational requirement, and financial capability. (Michael Howard, "Military Science in an Age of Peace," *RUSI, Journal of the Royal United Services Institute for Defense Studies* (March 1974): 3-9.)

Dr. Richard Swain, former director of the United States Army Combat Studies Institute at Fort Leavenworth, lists five things a military force needs to keep up with changing military developments in times of peace. They are: 1) a correct strategic rationale; 2) a concept of military operations; 3) investment in research and development and procurement proportional to the likelihood of immediate employment; 4) an open-minded proponent for the whole; and 5) a convincing spokesman capable of explaining military requirements to government decision makers and, ultimately the public. (Richard Swain, "Adapting to Change in Times of Peace," *Military Review* 74 (July 1994): 50-58.)

Harold Winton, a former Army officer and one of the founders of the United States Air Force School for Advanced Airpower Studies at Maxwell Air Force Base, offered six requirements for changing military institutions. They are: 1) a close and dynamic relationship between the purposes of military institutions and the forms those institutions take; 2) the need for senior leaders to articulate continuously the vision for the future; 3) the intellectual mastery of the nature of war and development of doctrine on how future wars should be waged; 4) the validation of doctrine through field testing to check it and form the basis for changing organizations, weapons, equipment, and training methods; 5) high level support and consensus to overcome ingrained habits and branch or service parochialism; 6) the need for reformers to remain accepted by the body and not become alienated or marginalized by the mainstream of the institution. (Harold R. Winton, *To Change An Army: General Sir John Burnett-Stuart and British Armored Doctrine, 1927-1938*, (Lawrence, KS: University of Kansas Press, 1988), 239.)

Dr. I. B. Holley, in his study of the relationship between technological advancements, military doctrine, and weapons development, *Ideas and Weapons,* contends that military organizatons fail to discover and apply the best weapons and techniques in war because the fail to: 1) adopt, actively and positively, the thesis that superior arms favor victory; 2) recognize the importance of establishing a doctrine regarding the use of weapons; and 3) devise effective techniques for recognizing and evaluating potential weapons in the advances of science and technology. (I. B. Holley, *Ideas and WeaponsI,* (Camden, CT: Archon Books, 1971), 10). In developing doctrine, Holley offers a three-phase process of "assembling objective information, formulating doctrinal generalities, and disseminating the doctrine to the field." (I. B. Holley, "The Doctrinal Process: Some Suggested Steps," *Military Review* 59 (April 1979): 2-13 quoted in Harold R. Winton, *To Change an Army*, 5.

Brigadier General Huba Wass de Czege, founder of the U.S. Army School of Advanced Military Studies at Fort Leavenworth, suggests that "successful military reform comes from developing a harmony among the three elements of soldiers, ideas, and weapons." (Huba Wass de Czege, "Preparing for War: Defining the Problem," (Fort Leavenworth, KS: 1984) quoted in Harold R. Winton, *To Change an Army*, 6).

[110]Barry Posen, *The Sources of Military Doctrine*, 47; Peter Paret, "Innovation and Reform in Warfare," in *The Harmon Memorial Lectures in Military History, Number 8*, (Colorado Springs, CO: United States Air Force Academy, 1986), 8.

[111]Hajo Holborn, "The Prusso-German School: Moltke and the Rise of the General Staff," in *Makers of Modern Strategy: From Machiavelli to the Nuclear Age*, ed. Peter Paret, (Princeton, NJ: Princeton University Press, 1986), 281-295.

[112]Andrew F. Krepinevich Jr., *The Army and Vietnam*, (Baltimore, MD: Johns Hopkins University Press, 1986), 260.

[113]David G. Chandler, *The Campaigns of Napoleon*, (New York: Macmillan Publishing Co., 1966), 332-378.

[114]Ibid., 9; Friedrich von Decken, *Betrachtungen über das Verhaltniss des Kriegsstandes zu dem Zwecke der Staaten*, in Peter Paret, "Innovation and Reform in Warfare," 7.

[115]Peter Paret, "Innovation and Reform in Warfare," 8.

[116]Michael Meese, "The Process of Organizational Change," 203-204; For a complete history of the Marine Corps efforts to sustain its institutional existence see Allan R. Millett's *Semper Fidelis: The History of the United States Marine Corps*, rev. ed. (New York: The Free Press, 1991).

[117]Allan R. Millett, *In Many a Strife: General Gerald C. Thomas and the U.S. Marine Corps 1917-1956*, (Annapolis, MD: Naval Institute Press, 1993), xix.

[118]General Donn Starry, "To Change an Army," 23.

[119]Ibid.

[120]Ibid.

[121]Friedrich von Decken, *Betrachtungen über das Verhaltniss des Kriegsstandes zu dem Zwecke der Staaten*, in Peter Paret, "Innovation and Reform in Warfare," 6-7.

[122]Michael Howard, "Military Science in an Age of Peace," 8.

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