THEORY, DOCTRINE, AND BALL BEARINGS: APPLYING FUTURE TECHNOLOGY TO WARFARE

A MONOGRAPH
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ABSTRACT

This study examines factors influencing the development of theory and doctrine based on emerging and future technology. It uses the air power theory of Giulio Douhet and the unescorted daylight strategic bombing doctrine of the US Army Air Force to illustrate hazards in projecting into the future as a means of constructing theory and doctrine.

This study begins with Douhet's strategic bombing theory. It traces the difficulty in applying the rigor of scientific method to future-based theory as compared to conventional military theory. The analysis focuses on two aspects of the dangers in developing theory based on future or emerging technology along this rational methodology: extrapolation of recent experience into the future and the inherent perishablity of assumptions based on technological advancement. Douhet's theory formed the intellectual foundation for two major US air offensives in World War II.

The evolution of strategic bombing doctrine by the AAF demonstrates the impact of two institutional influences that shaped doctrinal development: internal organizational pressures and a slide from doctrine into dogma.

The AAF experience in developing its strategic bombing doctrine from Douhet's air power theory holds lessons for today's effort to in crafting a way to wage war in the next century.

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Introduction

The United States armed forces are aggressively seeking to operate, improvise, and evolve in a rapidly changing world. Recent changes in mission, force structure, and technology have made the once familiar Cold War defense posture an increasingly dim memory. Adjusting to change is nothing new for the US military. However, the rate of change today is so explosive that reaction to change is dangerously insufficient. A leader in institutional future thinking, the Army has undertaken an impressive endeavor to prepare for the defense challenges of the next century in its series in its comprehensive "Force XXI" concept.

Within a broad view of engaging future technology, Force XXI thought specifically considers the possibility of exploiting opportunities created by the onset of a profound shift in the perception of warfare. It has embraced the idea of a potential revolution in military affairs (RMA) in its conceptual foundation for preparing for the future, *Force XXI Operations* (TRADOC Pamphlet 525-5). *Force XXI Operations* describes RMA occurring: "...when the application of new technologies into military systems combines with innovative operational concepts or organizational adaptation to alter fundamentally the character and conduct of military operations."[1] Advances in weapon and information technology appear to be opening the door to the next RMA. The impact of such a revolution can be staggering.

Any forward looking military organization views such major change with the trepidation reflected in Army Force XXI thinking: "The implications of moving from concept to reality to describe how the Force XXI Army will operate on future battlefields are tremendous, especially given the unpredictable, rapidly changing world environment."[2]

Institutionally, the Army maintains a vehicle for transforming itself. It adapts to its environment through doctrine; it is its engine that drives change. Though doctrine does not predict the future, in an era of constantly accelerating change it must build upon careful predictions to maintain its relevancy. Combining doctrine with prophecy is difficult and hazardous preceding the wave of an emerging RMA, but the US military has done it before. That experience reveals looking inward is as important as looking forward. As relevant today as it was over fifty years ago, its story ended on Black Thursday.

BALL BEARINGS: A HISTORICAL EXAMPLE

Colonel Budd Peaslee, from the lead aircraft the 92d Bombardment Group (BG), called to the bombardiers in his formation over the radio "Let's make it good. We've come a long way for this."

His plane, controlled now by his bombardier, moved relentlessly toward the ball-bearing plants even though fighters were assaulting it "from all directions." Peaslee had expected the fighters to break off when the flak began, but they kept coming. He never encountered braver men than those German pilots.

When Peaslee and the 92d BG landed back in southeast England, with eleven of the original twenty-one B-17 heavy bombers, his wing commander asked "Where's the rest of the group?"

"You've just watched the group land" Peaslee said. "All that's left of it."[3]

October 14, 1943, over the ball-bearing factories at Schweinfurt, was a turning point in US strategic bombing doctrine. Of the 291 heavy bombers that flew toward Schweinfurt that day, 227 stuck their target. The bombing results were excellent. The raid delivered 500 tons of bombs and destroyed 60 percent of Schweinfurt's capability to

produce a critical industrial component. On the other hand, German air defenses shot down 60 of the B-17's. That loss rate of 20 percent per mission was unsustainable by the Eighth Air Force.[4] Well coordinated and executed *Luftwaffe* attacks, using high performance fighters, shattered the viability of the Army Air Force (AAF) doctrine of unescorted daylight precision bombing. AAF bombers would wait for the development of long range escorts before again striking targets deep in Germany.

Budd Peaslee was right when he said "We've come a long way for this." The flight plan to Schweinfurt began as a new vision of warfare, a true RMA, over twenty years before.

THE STRATEGIC AIR OFFENSIVE: FUTURE-BASED THEORY AND DOCTRINE

The AAF experience in developing its strategic air offensive against Germany grew out of theory and doctrine based on future technology. The overall impact of the Combined Bomber Offensive bombing on the course of World War II is still a source of debate and interpretation. By any comprehensive accounting, the British and American "Bomber Barons," their planners, and crews were a key factor in the Allied victory. The men who dared to look into the future and prepare for the extraordinary nature of the next war had equally extraordinary insight and faith in their beliefs. What they got right is more remarkable than what they got wrong. However, a study of some specific shortcomings of early air power theory and its expression in doctrine demonstrates key hazards that will likely affect the development of current future-based doctrine.

This study begins with the air power theory of Giulio Douhet. It traces the difficulty in applying the rigor of scientific method to future-based theory as compared to conventional military theory. The analysis focuses on two aspects of the dangers in

developing theory based on future or emerging technology along this rational methodology. Douhet's method of theoretical construction used extrapolation and estimation and illustrates the danger in over-simplifying complex causal relationships. His more accurate analysis shows the inherent perishablity of assumptions based on technological advancement. Douhet's theory provided the intellectual foundation of the AAF strategic air offensive in Europe and provides a smooth transition to an examination of some hazards of developing doctrine based on future technology.

The evolution of strategic bombing doctrine by the AAF demonstrates the impact of two institutional influences that shaped doctrinal development. The organizational pressures generated by the AAF's informal drive for autonomy as a separate service found a natural vehicle for advancement in the independent nature of strategic air operations. In a related dynamic, doctrine began a slide into dogma due as the idea of strategic bombing became identified with the goal autonomy coloring the interpretation of evidence contradicting key assumptions.

The AAF experience in developing it s strategic bombing doctrine from Douhet's air power theory holds lessons for today's effort to in crafting a way to wage war in the next century.

CHALLENGES AND HAZARDS IN MILITARY PROPHECY

DOUHET'S AIR POWER THEORY

Those who develop theory based on emerging or future technology merge the role of philosopher and prophet. Their work is an act of faith as much as an intellectual enterprise. Classic military theorists such as Clausewitz, Jomini, Corbett, and Fuller built their theory upon a foundation of historical study and interpretation. They advanced their

thought along a methodological path and drew lessons from history through rigorous critical analysis. Theorists attempting to establish a foundation in the future follow a different path. They build upon what may be possible and their fashion their framework for interpretation from the hypothetical. In developing theory based on the future capability of aviation technology, Giulio Douhet provides some examples of the challenges and hazards that different path presents.

Douhet began his career as an artillery officer where he demonstrated an interest in applying technology to military matters. He eventually found his way to command Italy's fledging air arm before World War I. By 1915 he envisaged a form of total war from the sky and advocated "destruction of nations" through military aviation.[5] By 1916 he was court-martialed and imprisoned for repeatedly sending memoranda to the Italian cabinet criticizing the Army staff's conservative air policy. Rehabilitated by 1918, he was promoted to head Italy's Central Aeronautical Board. By 1921, he attained the rank of general and began drafted his thoughts regarding the future of air power into written form. Douhet built his theory within the political and geographic realities of industrial interwar Europe and made little attempt to apply his ideas outside of that experience. He fully acknowledged the central place of technology in his writings and began and ended his arguments on technological capability. His theoretical construction described a specific idea of the nature of air power in his day, with projections into the future, and put his conception of strategic bombing in that context. His journey began with an appreciation of the role of theory.

"An Independent Air Force? What for? What was it supposed to do, and how will it work? What is it worth?"[6] Douhet developed his air power theory along this practical

line of inquiry. Any theory seeks to explain how something works. Dr. James Schneider, Professor of Military Theory at the US Army's School of Advanced Military Studies, describes theory as a "blueprint" and "a causal description: an explanation describing interactions."[7] The theorist organizes knowledge within a set of assumptions or scheme of conjecture. His purpose is to provide an interpretation of facts and events, of cause and effect, that can be generalized to describe similar situations. Military theory grapples with the complexities of war and attempts to arrange its physical and moral elements within a description that explains the overall dynamic. By way of a practical definition, Dr. Schneider continues to describe military theory as: "...a reliable system of beliefs, causally sustained and justified by professional and personal understanding, about the nature of war."[8] Military theory is, ultimately, an estimation of a truth, a statement of belief. Its reliability can be measured only in interpreting its applicability to the perceived world. Sound, reliable military theory is the product of disciplined thinking. The rigor of the scientific method provides that disciplined approach to the development of theory.

In a penetrating insight to the foundations of military science, J. F. C. Fuller insisted on adhering to the ordered thought prescribed in the scientific method. He quotes T. B. Strong in support of the value of the scientific method applied to developing military thought:

> It consists in strengthening, solidifying, and rendering conscious and coherent the ordinary process of knowledge. The scientific man...claims to clear away fallacies, to bring into clear light the real principles by which all man's knowledge is acquired, and to use it.[9]

The scientific method begins with observation, proceeds to the development of a hypothesis, and continues with experimentation to verify the assertions of the hypothesis. Similarly, the development of mainstream military theory begins with empirical observation of war, through contemporary experience or historical record, then progresses to an explanation for the observed dynamics. The study of history creates a laboratory for challenging the validity of the theory and refining its framework. Conversely, future-based theory must to attempt to use the future as a laboratory.

Theory based on future technology necessarily follows a different pattern of evolution than does conventional military theory. Where the conventional approach can conform, to a great degree, to the rigors of the scientific method, future based theory adapts that logical progression to its assumptions and estimations. Contrasting the process of observing, hypothesizing, and testing in conventional military theory with that of Douhet illustrates the challenge and hazards in developing future based theory.

OBSERVATION OF THE FUTURE

An obvious challenge in developing theory based on future technology is overcoming a lack of factual observations. Future observations are available in the present only by prediction. Douhet met the challenge by extrapolating into the future based on very few observations from the present. He stretched contemporary trends into predictions of future war. His extrapolations focused on two broad areas: in the social, political and economic implications of modern total war and in the tactical implications of advancing aircraft technology. From his vantage point in time, Douhet could rationally argue the validity of his projections. Two examples, his idea of bombing populations centers to undermine enemy morale and his faith in the unstoppable air offensive, show the

appeal of his logic. These examples also demonstrate two specific hazards in developing theory based on future technology: over-simplifying complexity and the effect of parallel technology.

Over-simplifying complexity. Perhaps the most well known of Douhet's ideas is that of attacking directly the morale of an enemy nation. He asserted that under a massive, sustained air attack on enemy populations centers: "The time would soon come when, to put an end to the horror and suffering, the people themselves, driven by the instinct of self preservation, would rise up and demand an end to the war."[10] Douhet's assertion rested on a bold set of simple extrapolations based on limited wartime observations of complex political, economic, and social dynamics.

The terror induced by aerial bombardment was known throughout Europe during and after the war. Both sides in the war had an appreciation for its psychological dimensions. Civilian populations already steeled against the news of high losses from the front lines panicked at the thought aerial attack. On the Western Front at least 2500 soldiers were dying every day--a fact people met with grim determination since 1914. However, the first Gotha bomber raid on London, in the summer of 1917, killed 162 civilians and caused a public furor. That fall, a night Gotha raid of less than 20 bombers chased almost 300,000 people into the subway for refuge and thousands more out into the countryside resulting in complete chaos.[11] Torrential public outcry forced an immediate overhaul of British air defense measures and the momentum was large enough to overwhelm army and navy institutional resistance to an independent Royal Air Force. Basil Liddell Hart, in 1937, sums up the general post-war impression of the moral effect of air attacks on populations centers:

> To anyone who analyzes the comparatively light material results of the air raids in 1914-1918, it is remarkable to find what a profound psychological impression they made....The effects have not disappeared with the cessation of the cause; they are traceable in the general tendency among the public, whenever, they think of war, for the thought to be associated immediately with the idea of being bombed from the air. And from this apprehension springs a natural exaggeration.[12]

Based on these observations, Douhet assumed that a large scale air offensive focused on destroying social infrastructure and inducing civilian panic would magnify the psychological reaction to the primitive bombing operations of World War I. However, shattering morale in a city was a springboard a greater effect in Douhet's argument. Adding another link to his chain of reasoning, he took the next step in extrapolation.

Douhet seized upon the limited experience of aerial attacks on cities and projected the effect of much larger scale raids on the morale of a nation. He posited that a methodical use of improved weapons could deliver a decisive effect. After a vivid description of the catastrophic combined effects of a sequential explosive-incendiary-gas bombardment upon the center of a large population center, he asked the readers to contemplate the potential national psychological impact of terror bombing:

> What could happen to a single city in a single day could also happen to ten, twenty, fifty cities. And since new travels fast, even without telegraph, telephone, or radio, what, I ask you, would be the effect upon civilians of other cities, not yet stricken but equally subject to bombing attacks? What civil or military authority could keep order, public services functioning, and production going under such a threat?. . . In

short, normal life would be impossible in this constant nightmare of imminent death and destruction.[13]

Douhet generalized this estimation of the impact on a city to the overall national effect: "A complete social breakdown cannot but take place in a country subjected to this kind of merciless pounding from the air."[14] From this breakdown of will would come victory. Continuous, high tempo operations would induce a measure of insurrection: "The time would soon come when, to put an end to horror and suffering, the people themselves, driven by the instinct of self-preservation, would rise up and demand an end to the war—this before their army and navy had time to mobilize at all!"[15] Of course, in 1921 there was no empirical evidence to support this assertion. The idea was truly new. Douhet relied exclusively on an extrapolation of a limited historical experience to predict intuitively the reaction of a national population to large scale, methodical direct attacks on their morale. His argument had an intuitive resonance in interwar Europe. The RAF adopted his rationalization and tested it in earnest during the next war. Douhet miscalculated.

Douhet's projection of national moral collapse due to aerial bombardment illustrates a basic hazard of developing future based theory: over-simplification of complexity. He based his argument on too narrow a view. Accurate extrapolation into the future requires an appreciation for the immensely complicated interaction of a myriad of factors involved. In dealing with currents of political, economic, and social dynamics, neither Douhet's intuition nor mathematical estimation could provide the clarity required to predict the reaction of an entire nation to the shock he envisioned. The first experiences with air attacks on cities gave a distorted view of the moral resiliency of

civilian populations engaging in total war. The intense bombing of civilian population centers in Britain, Germany and Japan, more brutally executed than Douhet originally conceived, failed to induce the panic he assumed it would generate. His perception of the national population's ability to influence its political leadership was fundamentally flawed. Subjected to sustained devastation and privation from air attacks, neither the German nor the Japanese Government felt compelled to capitulate due to popular pressure. Douhet correctly dismissed as impractical any move to "bomb-shelter" an entire city, though he failed to consider the possibility of reconstruction programs, dispersion of industry and underground production centers.[16] The incredible capacity of modern national population to suffer while maintaining political and social integrity surprised nearly everyone. To the credit of the Army Air Corps officers struggling with the viability of this approach to strategic bombing in the mid 1930's, they recognized the unfathomable depth of the proposition. They took a part of Douhet's argument and maintained a degree of skepticism about the potential for breaking civilian morale from the air.[17] However, they did believe in the efficacy of Douhet's assertion that a national war economy was vulnerable to a strategic offensive and refined his idea of targeting to achieve that end. Still, this adaptation of Douhet's theory addressed a similarly complex dynamic, though superficially more quantifiable and subject to analysis.

The complex interaction of the dynamics involved defied prediction and illustrates the hazards of over-simplifying the basis of key predictions in developing future based theory. Comparing Douhet's theory to empirical evidence highlights the extraordinary difficulty, and low probability, of gaining a truly clear view of the future. A major, and likely, hazard of any future-based theory is building upon the wrong estimations. One

hazard in theorizing about the future ends with getting it wrong, another begins with getting it right.

Parallel technology. A main assertion in Douhet's air power theory is the irresistible force of the offensive. He predicted that no effective defense against an organized aerial offensive would be practical due the highly mobile nature of air operations and the inherent nature of the aircraft as "preeminently an offensive weapon." Again projecting into the future, he relied on the limited experience of the First World War as the basis for his prediction. He pointed to the difficulty in detecting raiding formations as giving an overwhelming advantage to the aerial offensive. In this area, Douhet had clearer vision. His predictions proved largely correct, but only for a brief period in time. Before the next great war, parallel technological developments would contradict his assertions.

The unprecedented mobility inherent in air combat favored the attacker when accompanied by surprise. Neither side developed an effective, integrated system of detecting and reporting enemy aircraft during the First World War. British air defenses relied on unreliable listening posts and visual sighting, difficult during the day and nearly impossible at night, to provide early warning to its pursuit squadrons of impending Gotha bomber raids. Despite an urgent effort, Britain never deployed an effective counter to the Gotha threat. Less than forty percent of the German bomber losses over the British Isles (twenty-four aircraft total) were due to enemy action.[18] British air defenses failed to turn away any Gotha raids. In fact, this early air defense launched sixty-nine pursuit sorties, fired thousands of anti-aircraft rounds (some as far as twenty miles from the intruder's flight path) in response to a single bomber after it struck a railway station in London.[19] The British experience mirrored Douhet's Italian perspective:

> In spite of the most elaborate system of signals, if our pursuit squadrons were not already in the air when the enemy reached its objective—and obviously they could not remain in the air continuously—they could seldom take off in time to prevent the enemy from dropping his load of bombs on his chosen targets.[20]

Douhet saw no empirical evidence to suggest that an effective defense against aerial attack was technically practicable: "Every time an aerial offensive was carried out resolutely, it accomplished its purpose."[21] His perspective was broad enough to acknowledge the possibility of resistance to an air offensive generating attrition on attacking forces; however, taken as a whole, he was convinced the offensive was unstoppable. Air maneuvers in the United States and Britain during the interwar supported Douhet's predictions until another technology eroded its validity.

The development of practical radar detection of aircraft enhanced the ability of a nation to defend itself from an air offensive. It provided the warning necessary for pursuit aviation to takeoff, mass, and engage bomber formations. Britain's effective use of its newly established system of thirty radar stations gave its fighters the ability to win the attrition struggle in the world's first strategic air offensive. German bombers were detected over the English Channel and through a highly developed communications network of telephone and radio links very accurate bearing and range (and less accurate altitude) information flowed to Fighter Command Headquarters. Fighter Command Headquarters provided centralized control, through radio communication, of pursuit aviation and directed its engagement of incoming formations. This system allowed far more efficient use of air combat power for defense than Douhet ever imagined. It eliminated the requirement to disperse pursuit aviation across the country in an immediate

local defense of high value areas. Radar technology, together with its supporting communications network, created the ability to concentrate defensive air power from bases throughout the country and made the proposition of air defense theoretically viable. Though British fighters could not completely turn back German bomber formations, they inflicted unsustainable losses on the bomber fleet and forced the *Luftwaffe* to abandon daylight bombing and eventually end the campaign entirely. London withstood the "Blitz" and a major element of Douhet's air power theory vanished in the world's first great air battle.

The impact of radar on strategic bombing operations illustrates another hazard in developing future based theory: the effect of parallel advances in technology. It is doubtful that Douhet ever considered the implications of, if he ever knew at all about, RAdio Detection And Ranging (RADAR) technology. Radar technology grew in parallel with aviation technology with no connection until the early mid 1930's. Growing out of early radio research near the turn of the century, the first successful radio range-finding experiment occurred in 1924 in support of atmospheric testing. British physicist Sir Robert Watson-Watt determined its suitability to detect aircraft in flight and produced the first practical system in 1935. By 1939 the RAF had fielded its "Chain Home" system and the collision between aviation and radio technologies began. By 1939 Giulio Douhet had been dead for nine years.

Interaction between emergent technologies maybe impossible to recognize during the development of future based theory. Extremely rapid advances in all disciplines of science make it extraordinary difficult to make assumptions regarding the general state of technology at any point in the future. Unpredictable and imperceptible economic,

political, and social forces influence the development of modern technologies; in turn those technologies affect society. Future relationships between various technologies are difficult, perhaps impossible, to assess. Theory based on technology necessarily assumes a predictable, if not constant, relationship between relevant technologies that is not likely to exist indefinitely. The unforeseen confluence of aviation technology and radar technology upset an essential feature of Douhet's theory that previously appeared correct. In constructing the predictions, or observations in the future, to support the development of theory based on technology, even accurate prophecy is perishable.

HYPOTHESIZING FOR TOMORROW

Conventional military theorists used empirical observations of the past as a foundation for their theory. In deriving a hypothesis for cause and effect, their perspective looked toward a long and rich historical record. Douhet approached building his hypothesis in a different way. He took used recent empirical observations to extrapolate into the future, building his theoretical foundation upon predictions. He considered connection with the past as unnecessary and counterproductive.

Turning his back to the past and his theoretical orientation toward the future, Douhet plotted out his approach to developing his hypotheses:

> The World War was only a point on the graph curve showing the evolution of the character of war; at that point the graph curve makes a sharp swerve showing the influence of entirely new factors. For this reason clinging to the past will teach us nothing useful for the future, for that future will be radically different from anything that has gone before. The future must be approached from an entirely new angle.[22]

His extrapolations into the future predicted some significant causes and effects that influenced his appreciation of air power's potential. Much of Douhet's work describes how future, sometimes contemporary, aircraft design would be able act as the means within specific causal relationships. His hypotheses connect future air power with potential effects. His development of the idea of directly attacking civilian morale illustrates the point.

As we have seen, Douhet observed the panic created by primitive, small scale bombing raids of urban centers during World War I. He clearly established the relationship between the cause (direct attack on civilian populations by aerial attack) and the effect (disproportionate panic and chaos). He extrapolated that observation to predict that a large scale, well-planned aerial bombing of an enemy civilian population and social infrastructure would induce a collapse of national will. To complete his hypothesis that air power could bomb an enemy nation into submission Douhet had to build a case that it could deliver the load required.

Douhet used the persistent, but sporadic, Austrian raids on the municipality of Treviso as a historical data point to extrapolate the potential effect of future major bombing operations. His research indicated the Austrians dropped approximately 75 metric tons of bombs (each bomb weighing no more than 50 kilograms) within about one square kilometer over a period of 29 months. The raids produced only about 80 civilian casualties before authorities evacuated the town. The small scale and lethargic pace of bombing operations resulted in what the Italians called "The Martyrdom of Treviso."[23] In discussing the psychological effect of aerial bombardment on civilians, Douhet notes emotional state of another Italian town following a similar light bombing raid: "The

reader who thinks I have overcolored the picture has only to recall the panic created at Brescia when, during the funeral services for the victims of an earlier bombing. . .one of the mourners mistook a bird for an enemy plane."[24] Applying simple payload and weapon effect calculations, Douhet estimated that forty heavy bombers could destroy the entire town and most of the inhabitants in one day. He then extended his extrapolation of bombing effect to larger targets.

Douhet developed a methodology for applying the destructive potential of air power on a larger scale. He recommended creating a unit of bombardment to quantify a relationship between cause and effect. To do so, he integrated the variables of numbers of aircraft, payload, and weapons effect to create a unit of measure. Douhet believed that a circular area with a diameter of 500 meters was an optimal measure of destruction. He estimated that 100 kilograms of "active material" (that is, explosives, incendiaries, and poison gas) was sufficient to destroy an urban area within a circle fifty meters in diameter. Additionally, he estimated each kilogram of active material required about a kilogram of metal casing to make a bomb of a given size. From these two estimations he calculated that, when delivered evenly over the 500 meter diameter circular area, 20 metric tons of bombs (10 tons of active material and 10 tons of bomb casing) would be sufficient to destroy it completely. To obtain a conservative estimate, Douhet applied the payload capacity of contemporary operational bombers, then about two metric tons, to the equation. He concluded that one unit of bombardment consisted of ten bombers and would destroy over 196,000 square meters (a circular area of 500 meters in diameter) of urban area and most of the people within it.[25] Douhet made it easy to assess the scale of his vision of future war:

> In fact, we have no difficulty in imagining what would happen when areas of 500 to 2,000 meters in diameter in the center of large cities such as London, Paris, or Rome were being unmercifully bombed. With 1,000 bombers of the type described—an actual type in use today, not a hypothetical type in some blueprint of the future. . . 100 such operating squadrons [of 10 aircraft each] can be constituted. Operating 50 of these daily, such an aerial force in the hands of those who know how to use it could destroy 50 such centers every day. This is offensive power superior to any other offensive means known that the power of the latter is negligible in comparison.[26]

In this way, Douhet developed the hypothesis, with some confidence, that a large, robust bomber fleet could deliver the bomb load required to break the morale of a modern industrial nation. His coldly rational argument, supported by careful calculation and estimation, and drawing from experience produced the precisely wrong conclusion.

Douhet provides an example of how to construct hypotheses using a combination of logic, prediction, estimation, and calculation. He also illustrates the danger in developing future based theory. Douhet relied on estimations and extrapolations because they were required for the task of building a theory incorporating technology not yet fully developed. He had confidence in his method and the purpose of his theory:

> When, by the exercise of cold logic and mathematical calculation, some one was able to find out the existence of an unknown planet and furnish the astronomer with all the data necessary for its discovery; when by mathematical reasoning the electromagnetic waves were discovered, thus furnishing Hertz the means with which to carry on his experiments—then we too should have faith in the validity of

human reasoning, at least to the extent that the astronomer and Hertz had faith in it.

And how much abstruse their reasonings than the reasoning I am attempting here![27]

Douhet had confidence in the ability to determine, through calculation, experience, and logic, an accurate vision of the role new technologies would play in the future. As we have seen, the future proved more difficult to see.

TESTING THEORETICAL ASSERTIONS

The most serious danger in developing elements of future based military theory is the lack of means to test the basic ideas. Conventional military theorists can look to history to find factual evidence that supports, or contradicts their hypotheses. They could conduct experimentation using history as a laboratory. Though historical accounts may an imperfect representation of fact, they do provide an empirical connection with actual events. Analysis and study of conventional military theory centers around the interpretation of reality and maintains a strong link to the empirical world. Douhet found it necessary to use history as a springboard for his hypotheses rather than source of validation for his theory.

Key elements of Douhet's theory defied experimentation to determine their validity. Advances in commercial and military aviation validated his technical estimations of the trend of aircraft design. Interwar air combat maneuvers supported his predictions of the primacy of the offensive in air operations. On the other hand, it was not possible to produce convincing empirical evidence to test Douhet's predictions regarding the effect strategic bombing would have on the economy and population of an industrial nation. Because he forged a tightly linked chain of fact, estimation, assumption, and calculation the validity of his theory, in it totality, remained an open question. Douhet recognized the

limitations he faced in supporting the validity of his theory. His recommendation was truly prophetic: "The best way to assay the worth of a theory is to put it to the test of fire."[28]

US STRATEGIC BOMBING DOCTRINE

The role of doctrine in most large modern military establishments is multifaceted. Doctrine is an authoritative statement of a military force's approach to war: what it perceives as truth regarding warfare and how it applies that truth to the specific security challenges facing its nation. In this fundamental way, doctrine puts theory in a useful context and uses it to develop military power to support national interests. However, because doctrine must address contemporary realities theory can only serve as an anchor for a greater framework. Beyond its intellectual moorings, other forces influence doctrinal development such as evolving national security strategy, improved weaponry, the nature of potential threats, interservice rivalry, and parochial intraservice clashes.[29] Incorporating these influences, and drawing energy from them, doctrine can have enormous impact on military institutions. In the US armed forces doctrine forms the foundation of nearly all aspects of military operations. Representative of the central importance of doctrine in the US military, the US Army considers doctrine as lying at the "heart of its professional competence" and providing a framework for all of its major concerns.[30]

This central position of doctrine in US military institutions reflects a synthesis of external and internal influences that, in turn, produces authoritative guidance that redefines the institutions themselves. Clearly, the development of doctrine is a sensitive and vitally important enterprise. As the theoretical foundation and its relationship to national security challenges can form only one dimension of a doctrine's formative process other influences can take important, even dominant, roles. Potential for significant change tends to breed

powerful reaction. The experience of the Army Air Corps in developing doctrine based on future technology that suggests introduces two potentially corrosive influences: organizational pressure on new doctrine and a slide into dogma.

ORGANIZATIONAL PRESSURE

The introduction of emerging technology in new weapon system often demand organizational changes within the armed forces. The tank, the submarine, and the airplane have all precipitated controversial doctrinal innovation. This change is often viewed within the current establishment in terms of winners and losers. Paul Herbert, in his examination of the development of post-WWII Army doctrine, highlights the organizational dynamics inherent in the Army's branch system (i.e., armor, artillery, infantry, etc.) as generating powerful forces in developing doctrine. Beyond a genuine desire to create an effective fighting force, Herbert outlines the natural competition between branches for funds, prestige, career opportunities, and missions. Additionally these branches are responsible for major programs in training, weapons development, and personnel management, all of which respond to changes in doctrine.[31] Given the stakes involved, it is inescapable that doctrinal changes tend to attract sponsors and opponents. New technology has historically sparked significant doctrinal change challenged by institutional reaction. The Army Air Corps provides an outstanding example.

The belief that air power could act independently and decisively took hold in the leadership of US Army aviation after World War I. Spurred by the outspoken and controversial William Mitchell, and equally potent efforts within the War Department, the organizational trend within the Army had been a slow progression towards an independent

air force. The argument in favor of an independent air arm centered around an air power capability that did not directly support ground or naval forces: strategic bombing.

Autonomy and strategic bombing. Aerial bombardment deep behind the front lines during World War I constituted a unique aspect of the total air war. Reconnaissance and observation in direct support of the army artillery, infantry, and warships made up almost the entire effort early in the war. These aircraft proved highly effective in the uncontested air space early in the war. Pursuit aircraft evolved to control the air space over ground and sea operations, enabling friendly air power to operate and denying the use of the sky to the enemy. Light bomber aircraft performed direct tactical support of infantry attacks and harassment of enemy troops near the front lines. The mainstream thought of the day held that the obvious role of air power was as an auxiliary of army and navy forces. However, from the beginning of the war, a few air power enthusiasts directed long-range bomber aircraft along a different path.

On August 14, 1914 a French bomber attacked a Zeppelin shed near Metz. The British naval arm performed a similar strike the next month near Düsseldorf. By May 1915 eighteen French long range bombers attacked a German chlorine gas factory near Mannheim. By August 1915 sixty-two French bombers raided German steel works at Dillingen.[32] German bomber raids on London began in June 1917. Near the end of the war, the RAF built a separate force of 120 bombers specifically for deep raids on industrial targets and lines of communication.[33] These examples show the trend of an increasing scale operations and a progressive independence from supporting land and sea force leading into the interwar years. The ultimate expression of independent air operations,

however, was the decisive strategic air offensive and that idea took hold in the United States.

Air Corps leaders in the interwar period strained for the freedom to develop and employ air power to their perception of optimum effect. The establishment of an air force as separate service became an informal goal of Air Corps leadership since the mid 1920's. Their efforts toward that end worked against conventional thinking. Other major powers such as France, Germany, Italy, the Soviet Union, and Japan maintained doctrine, and built a force structure, that stressed the employment of air power in direct support of its ground and sea forces. A preponderance of the Air Service's World War I experience focused on direct air support of ground forces. This perspective tended to reinforce the integration of (and subordination of) all forms of air power within the existing War Department organizational structure. The idea of large scale strategic bombing operations pushed against this trend, stressing truly autonomous operations. The technological potential for a war winning strategic bombing campaign became the primary rationale for an organizational restructuring that established an independent air force as an equal partner with the Army and the Navy in national defense. Formally adopting a strategic bombing doctrine had significant long term organizational implications. Harold George, at the time an Air Corps bombing expert, in testimony to a special presidential commission established to evaluate civil and military aviation, summed up the informal Air Corps perspective:

> . . . Air power as a new method [strategic bombing] can only be realized when its employment as a new method of conducting warfare is understood and when it is given an opportunity to develop itself primarily for the waging of independent warfare instead of as an auxiliary of the other armed forces.

> I believe that our Navy requires Naval Aviation as an integral part of that organization. I believe, however, that all other aviation should be organized into an independent Air Force.[34]

The primary forum for a growing professional military debate regarding the future of US air power was the Air Corps Tactical School (ACTS). The ACTS faculty represented the technical and tactical expertise of Army aviation and was well aware of the air power theories of the day. The prospect of an autonomous air force shaped the ACTS faculty debate as they adapted elements of Douhet's strategic bombing theory into a model for official Air Corps doctrine. They refined his idea of bombing of enemy economic strength and the morale of its populations into a systematic destruction of critical elements of its war industry and supporting infrastructure. This new approach aimed at shattering an enemy's means to prosecute modern war and eroding its will to fight. Little debate regarding the essential premise, then a completely open question, of crippling a nation's ability to wage war by air attack ensued. The heart of the argument was largely a matter of economics and generated little controversy from the tactically oriented ACTS instructors. It fit within prevailing theoretical assumptions and conformed with internal organizational pressures advocating independence The military aspects appeared to be an issue of developing the right technology and spurred investigation into the technical challenge of achieving the requisite range, payload, bombs, and accuracy for new bomber designs. The potential for disrupting an enemy's economic web to achieve a decisive result clearly marked a path toward an independent air force. A more animated technical and tactical debate within the school appeared to block that path.

Haywood Hansell, an ACTS instructor at the time and future AWPD-1 planner and commander of the XXI Bomber Command, framed the crucial debate within ACTS in the mid 1930's:

> Bomber survivability was crucial to the whole concept of air power, for unless the proponents of [strategic] air power could count on bombers getting sufficient bombs "on target," without incurring losses that were too high to permit sustained operations, the whole idea was little more than an exercise in futility. *The weakest link in our theory of air power lay in this question. . .*[35]

Up to 1942, the prospect of an escort fighter with sufficient range and agility to protect bombers on deep penetrations was exceedingly dim. The industrial web approach to strategic bombing required the destruction of all key targets to achieve decisive effect. The new bomber designs could not assume fighter protection for the entire route to and from the target. Ken Walker, an ACTS bombardment instructor and fierce bomber partisan, asserted the invincibility of the unescorted bomber and the provoked the fiercest controversy within ACTS. He summed up the school's bomber perspective when revised the 1931 ACTS official text to read: "a well organized, well planned, and well flown air force attack will constitute an offensive that cannot be stopped."[36] The response of the school's Pursuit Section and the growth of Air Corps doctrine show the strength of organizational pressures in the development process.

The bomber versus pursuit debate at ACTS posed a dilemma of for the pursuit section at Maxwell Field. First, should the view bomber proponents prevail the future of pursuit aviation would narrow considerably. The perceived viability of air defense, pursuit aviation's primary reason for being, would deteriorate significantly. In competition for

scarce resources, pursuit aviation would take second rank. The most radical elements in the bomber camp called for the discontinuation of all fighter procurement.[37] The sole source of salvation for pursuit aviation would lay in developing a long-range escort capability that most bomber advocates agreed would be beneficial. Second, should pursuit aviation prevail in the debate it would undermine, possibly devastate, the case for an autonomous air force. In the general move towards autonomy, pursuit aviation found itself at odds with the rest of the Air Corps. In the early to mid 1930's was impossible to construct air maneuvers that could prove conclusively the technical and tactical validity of the arguments of either side. The corporate conclusion of the Air Corps regarding the controversy was predisposed toward accepting ACTS strategic bombing theory. Hansell provides the contemporary Air Corps perspective:

> The whole concept of strategic air power hung upon the validity of the rival claims [bomber versus pursuit], and there seemed little hope of a practical test which would resolve the problem. If the bombers could reach their targets and deliver their bombs with acceptable accuracy, and if they could do so with a tolerable loss rate, then a whole new vista of warfare was opened up. If they could not, then a new weapon simply had been added to the arsenal of land and sea warfare.[38]

When air maneuvers between new bomber designs and existing operational fighters tended to support the bomber faction's argument in the early to mid 1930's the Air Corps leadership began to close off internecine debate. During that time, when bomber performance temporarily outpaced that of the fighter, pursuit aviation had no constituency within the Army to weigh into the debate on its behalf.

In making a case for missions and force structure, auxiliary aviation found solid backing from elements of the traditional army. The artillery branch assured adequate capability for observation and reconnaissance aircraft. Attack aviation could count on the infantry branch to argue the value of direct tactical air support. Pursuit and bombardment aviation found themselves alone within the Army. As the Air Corps moved towards a strategic bombing doctrine and a shared vision of autonomy, internal backing for the bomber grew. Pursuit aviation, perceived as antithetical to the emerging doctrine, could not find organizational support within the Air Corps to fund required development until shortly before the next war. The organizational dynamic generated by the identification of the bomber with an independent air force became an increasingly powerful force within in the Air Corps and eventually the War Department.

The ideas of autonomy and strategic bombardment had merged by the mid 1930's. By the late 1930's the Air Corps had completely committed to a doctrinal outlook based on strategic bombardment and tolerated little internal descent.[39] By mid 1941 the Air Corps had achieved a semi-autonomous status as the Army Air Force (AAF) and key members of the ACTS faculty were using their doctrine to plan the world's greatest strategic air offensive.

The Air Corps goal of achieving autonomy as a separate service shaped the choices it made in selecting a warfighting doctrine. Natural organizational pressures are inevitable during period of significant change sparked by revolutionary technology. The uncertainty inherent in assessing the potential of new, untested technology provides intellectual maneuvering room to interpret theory and assumptions in a variety of reasonable ways. Doctrinal development, with its implications for procurement and force

structure, in such an ambiguous environment is exceptionally vulnerable to organizational influences that can shape the process and determine the outcome. The Air Corps experience in developing strategic bombing doctrine illustrates the powerful influence of organizational dynamics in developing doctrine based on future technology.

SLIDING INTO DOGMA

The identification of an independent air force with strategic bombing doctrine eventually transformed key doctrinal assertions into dogma that craved confirmation and resisted contradiction. The slide from doctrine into dogma was slow and subtle. Two key symptoms of that slide are evident in the Air Corps experience. First, the developmental process of strategic bombing doctrine generated a self-validating loop that tended to preordain evidence and support for basic doctrinal principles. Second, institutional myopia reduced the Air Corps ability to interpret equivocal evidence and created a tension between reason and faith and conflicts between professional judgment and organizational loyalty.

The self-validating loop. An early symptom of a slide into dogma was a drift to an inward looking perspective that isolated Air Corps thought regarding its doctrine and reinforced its own assumptions. The testing of the assertion of "bomber invincibility" illustrates the effect of such a self-validating loop.

The procurement pattern of the Air Corps worked to provide evidence of an unescorted bomber's ability to reach deep targets when opposed by pursuit aviation. Advocacy for funding development of a heavy long-range bomber in the late 1920's and early 1930's gained support for such an investment. Air Corps funding capitalized on a "confluence of technological currents" that featured "cantilevered wings, retractable

landing gear, and stressed skin construction" integrated with the previous advances of "streamlining, variable-pitch propellers, wing flaps, engine cowlings, and a miscellany of engine improvements" made possible a practical long range bomber.[40] The first modern all-metal bomber, the Martin B-10, emerged in 1932 beyond a watershed in aeronautical technology when compared to existing front-line US pursuit aviation.

Emphasis on bomber design came at the expense of developing pursuit aircraft. The fiscal environment of the early 1930's permitted limited spending in aircraft procurement and experimentation. Long range bomber-type aircraft had gained priority initially by providing the range to support US interests in Alaska, Panama, Hawaii, and the Philippines. The Air Corps closely tied the development effort with the requirements of the heavy strategic bomber. Investment in pursuit aviation languished until the late 1930's. Air maneuvers reflected the asymmetry in emphasis and investment.

In an attempt to gain empirical evidence to assess the validity of Ken Walker's assertion of bomber invincibility Henry "Hap" Arnold, the eventual five star General of the Air Force, conducted air maneuvers at March Field in 1934. The contest pitted the Air Corps top pursuit aircraft, the P-26, versus the newest modern bomber, the B-12 (an improved B-10). The results of the maneuvers confirmed Walker's assertion. The speed advantage of the P-26 over the B-12 was negligible. Arnold concluded that "pursuit or fighter planes operating from front line airdromes will rarely intercept modern bombers except accidentally."[41] While the tests were not a comprehensive examination of the issue, the bomber advocates at ACTS felt they had the proof they required and the Pursuit Section was hard pressed to offer a convincing rebuttal. Claire Chennault, Chief of ACTS Pursuit Section and eventual founder of the "Flying Tigers," observed that the

combination of the new bomber and Douhet's writings "stirred bomber enthusiasts to a new pitch of fanaticism."[42] These results, however, reflected US fighter technology, malnourished by attention to bomber development. The next generation of fighter technology, far superior to the P-26 biplane, was already on the drawing boards in Britain and Germany. The real threat to Air Corps bombers, the famous Messerschmitt Me 109 air superiority fighter, would prove its worth in the Spanish Civil War by the end of the decade.

The loop beginning with developing bomber technology over fighter technology and then drawing conclusions based on subsequent performance began another cycle. Thomas Greer wrote the official Air Force history of the period:

> Coupled with apparent the apparent authority in performance of the new bombers over existing pursuit, acceptance of Douhet led the bombardment enthusiasts to an extreme position. Some instructors at the ACTS believed that pursuit could be abolished altogether, and the Office of the Chief of the Air Corps adopted the slogan 'Fighters are obsolete.'[43]

Bomber programs pushed further ahead resulting in the best bomber designs in the world with the arrival of the B-17, B-24, and the ultimate expressions of Air Corps thought regarding strategic bombing, the B-29 and B-32. This bold trend of technological advance fostered increasing confidence in strategic bombing doctrine, specially when compared with the state of US pursuit aviation.[44] On the other hand, the newly established AAF would enter World War II well behind in air-to-air fighter combat technology. Ironically, while lamenting the poor state of AAF pursuit capability in 1939, Hap Arnold, a key bomber advocate and then Chief of the Air Corps, blamed ACTS's deprecation of the

fighter for the institutional neglect of pursuit aviation.[45] Not surprisingly, the long-range escort fighter that proved the salvation of the AAF's daylight strategic bombing campaign, the famous P-51 Mustang, received it developmental funding as the A-36 ground attack plane. Sustaining a closed system of criticism that reinforces its own assumptions is an indication of an organizational perspective drifting to dogma.

Institutional myopia. Another symptom of a slide from doctrine to dogma is in the interpretation of evidence that challenges the validity of current doctrine. Doctrine based on future based technology is especially susceptible to ossifying into dogma because of the inherently equivocal nature of evidence that appears to support or contradict basic assumptions. Eventually, the organization is unable to perceive evidence contradicting basic doctrinal assumptions—institutional myopia. Discourse regarding the future is necessarily colored with prediction and assumptions bridge factual gaps. The result is a great deal of intellectual maneuvering room for interpretation. When evidence, particularly when part of a complex causal relationship, can be reasonably interpreted in different ways other forces can influence the analysis. These forces can act to limit interpretation to produce a predetermined conclusion and resist contradiction. Doctrine slides into dogma. The Air Corps provides an example developing such a narrow focus. Strategic bombing doctrine began its slide into dogma in ACTS and continued until a crucial element of it was shattered at Schweinfurt.

The Air Corps charged ACTS to act as its center for creative thinking and tactical research in 1931.[46] However, the implications for autonomy within the idea of strategic bombing changed the school's orientation and it eventually acted as a mechanism to advocate conformity to doctrinal principles. In the mid 1930's the bomber proponents in

ACTS faculty had prevailed in establishing the primacy of strategic bombardment. The tone of the school quickly evolved to reflect the shift in thought. Historian Joe Taylor studied the institutional effect of ACTS's firm commitment to unescorted strategic bombing doctrine with about thirty years of hindsight:

> Attachment to this commitment was, however, so inflexible that it inhibited the development of tactics for escort, for air defense, for support ground forces and for reconnaissance and air transportation. Thus the school's greatest achievement as a laboratory for Air Corps thought prevented the full accomplishment of the purpose designated by the name Air Corps Tactical School.[47]

The ACTS perspective came to reflect much of the thinking in the Air Corps from the mid 1930's into World War II. The further the Air Corps proceeded in development and procurement of heavy bombers, more difficult it became to challenge the prevailing doctrine: "Bombardment and autonomy were so inextricably bound together that the questioning of bombardment by an Air Corps officer was not only impolitic, but unwise."[48] By the mid 1930's Air Corps doctrine was sliding into dogma. Questioning the feasibility of the doctrine was tantamount to rejecting the goal of an independent air force. Claire Chennault, expressing the frustration of the pursuit community, recalls the climate in the Air Corps:

> It became apparent that, just as the Navy was dominated by the "battleship admirals," so the Air Corps would be run from the bias of "bomber generals." These bomber generals has an inflexible orthodoxy all their own and were just as ruthless and unfair in squelching opposition within the Air Corps as the Army and Navy were in attempting to smoother the development if all airpower. [49]

The fast career track for bright young Air Corps officers was in flying heavy bombers and ensuring the technical and tactical viability of strategic bombing. Those who resisted the bomber tide in that crucial period found advancement limited. The most outspoken and highly regarded pursuit advocate, Claire Chennault, retired as Captain in 1937, and eventually traveled to China to fight war in the air his way. Entering World War II, the leadership of the Air Corps, as well as its influential field grade planning officers, were dedicated to bombardment doctrine and began using it to guide for a major investment in national resources. The onset of strategic air dogma created a homogeneity of thought in the Air Corps and reinforced confidence in key assumptions. More than any other factor, it set the course to Schweinfurt.

Air Corps leaders monitored air power developments worldwide. However, their interpretation of events conformed with the doctrinal template. Air Corps officers responding to dispatches from the Spanish Civil War illustrate the trend.

In 1937, the military attaché from Spain suggested that high altitude bombing was ineffective. He indicated that small tactical bombers and fighters offered the best combat capability. B. Q. Jones, a long-time Air Corps officer and then an instructor at the Army War College, used this observation to advocate a return to the use of aviation as primarily an auxiliary to ground forces in lectures in the college. The Air Corps, then in the midst of a funding battle concerning the B-17, relied on its representatives to explain to the Deputy Chief of Staff, Stanley Embick, that the logic of Jones's conclusions was simply not consistent with existing doctrine. What seemed perfectly clear to the Air Corps officers was not to Embick. He sent a philosophical warning to the Air Corps:

> Aviation is a new arm. Our present War Department doctrine has had to be based necessarily on theory and assumption rather than factual evidence. Now we are getting evidence of that character. *No doctrine is sacrosanct, and of all military doctrines, that of our Air Corps should be the last to be so regarded.*[50]

However, faith in the Air Corps doctrine exerted a powerful influence in 1937. The B-17 program received its appropriation. Jones transferred to the cavalry.

As World War II began to produce a great volume of empirical evidence regarding basic assumptions of bombardment doctrine. What had become dogma colored the interpretation.

The Air Corps greeted the performance of the *Luftwaffe* bombing approach in Poland with enthusiasm. Though heavily committed to supporting the ground force *blitzkrieg* attack, the *Luftwaffe* largely destroyed the Polish air force on the ground and show the power of aerial bombardment. Donald Wilson, still at ACTS, stated that the German air force had "voluntarily undertaken the job of demonstrating our theories." Hap Arnold, then Chief of the Air Corps, saw a different picture in the air campaign.

Arnold expressed concern over the reports of bomber loses in defensive formations. His assessment of the Germany's Polish campaign was that the idea that: "Fighter craft cannot shoot down large bombardment planes in formation . . . proven wholly untenable."[51] He instructed the GHQ Air Force to investigate the observations. The GHQ report rocked a key doctrinal assumption: "Aerial operations of the present European conflict confirm the results of the World War; that is that the present bombardment airplane cannot defend itself adequately against pursuit attack."[52] However, the influence of doctrine re-exerted itself through committee.

The Air Corps Board, composed of senior officers charged with developing uniform tactical doctrine, studied the concern over the Christmas holidays of 1939. It concluded that European bombers lacked the firepower of the US counterparts. The board recognized the increased threat to bomber formations, but suggested increasing the number of guns aboard each bomber, sighting systems, and gunnery practice would sufficiently increase bomber survivability. Additionally, the board recommended the development of a long range escort fighter. When addressing the doctrinal implications of its research the board was clear as Frank Futrell illustrates in his official Air Force study of the period:

> Despite the demonstrations of the vulnerability of bombardment aircraft, the Air Corps Board recommended that no thought should be given to reducing the importance attached to bombardment aviation in Air Corps doctrine. While pursuit escort was highly desirable for bomber penetrations into heavily defended areas in order to minimize losses of bombardment aircraft, *the absence of such pursuit protection should not justify the abandoning of important missions.*[53]

This interpretation of the impact of modern fighter attacks on AAF heavy bomber formations smoothed out the last major bump of intellectual turbulence on the flight plan to Schweinfurt. When a reliance on bomber speed and altitude eroded, the apparently insurmountable task of locating and intercepting penetrating formations preserved the assertion of bomber invincibility. When advances in microwave ground based radar emerged from secrecy in 1940 to give the capability to detect bomber formations and direct fighter interception, the estimated ability of the bombers to fight their through to the

target and back sustained the key doctrinal assumption. The Eighth Air Force was set doctrinally for war.

CONCLUSION

Giulio Douhet vigorously advocated embracing new technology and innovations in warfare. His vision of the military implications of air power produced a sense of urgency in trying to understand the dimensions of the next war and recommended preparation for national security. Douhet dealt directly with his perception of a revolution in military affairs. He would be impressed with the US Army in 1996:

> Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after changes occur. In this period of rapid transition from one form to another, those who daringly take to the new road first will enjoy the incalculable advantages of the new means of war over the old. . . . Those nations who are caught unprepared for the coming war will find, when war breaks out, not only that it is too late for them to get ready for it, but that they cannot even get the drift of it.[54]

Douhet perceived advances in aviation technology as an opportunity for profound change in the nature of war. In a similar way, influential elements of today's Army leadership sense information technology may generate the potential for a new wave of change in the form of an impending RMA. They are aggressively struggling to asses the character of this future revolution and ensures the Army maintains its edge in the next century. To anticipate the nature of the technological dimension of the next RMA and secure the advantage of developing its doctrinal component early, the Army is taking an organizational approach.

The Army's Force XXI concept integrates a variety of study and innovation across a wide organization to anticipate and exploit change in a rapidly changing world. The Force XXI campaign plan, its process for developing a focus for force modernization, embraces and manages the complexion of change in three coordinated efforts: the Joint Venture program, restructuring supporting agencies and the institutional Army, and developing information technology. The future oriented "Louisiana Maneuvers Task Force" acts to synchronize all three efforts.

The first element of the Force XXI campaign, Joint Venture, focuses on redesigning the Army's operational force. It relies heavily on field maneuvers and interactive warfighting experiments to draw conclusions about current, emerging, and future weapons and information technology. These conclusions will form the basis to make informed decisions regarding changes to doctrine and organizational structure. Changes affecting its operational units suggest changes for the entire Army.

Restructuring of the supporting agencies and institutional components of the Army makes up the second part of the campaign. This effort ensures the orientation of the operational element of the Army influences its supporting infrastructure and educational system. Likewise, it maintains a link between Army operational and supporting components to field an effective, sustainable force.

An important aspect of both the operational and supporting elements of the Army centers draws upon the advent of the information age. The third part of the Force XXI campaign acquires and integrates new information technology essential to exploiting the next opportunities in the next perceived RMA.

Guided by the clarity of Douhet's theory, the AAF perceived its own RMA in its doctrinal construction of its strategic air offensive. Similarly, the Army's conceptual touchstone for growth toward the future, *Force XXI Operations* sees its impending RMA as a confluence of future weapons and "integrative" information technology.[55] The Force XXI campaign charts an even broader, more comprehensive, and far more sophisticated approach than did the AAF. The next ten years will likely see the crucial decisions that will indelibly shape the Army well into the 21st century. At this juncture, still early in the formative stages of preparation for the next perceived RMA, the Army Air Corps' experience with future-based theory and doctrine takes on renewed relevance.

Giulio Douhet provides an example of the difficulty in developing theory based on future or emerging technology. In pursuing a rational method of extrapolating contemporary trends into future he fell short of perceiving the complexity of current trends and the future environment. He grossly underestimated the ability of civilian populations to withstand systematic aerial bombardment. Establishing a credible method for estimating the complexion of future is not difficult, but making accurate forecasts in an increasingly complex may be impossible. Though highly competent study is underway today within TRADOC, the Army Staff, and the Department of Defense, to determine the shape of the 21st century, only the most basic tendencies may become apparent. Analysis of political, social, and technological patterns often relies on theory and methodology that works to make comprehensible intricate modern complexities. An attempt to over-simplify complexity may lead to dangerously wrong key assumptions. In a period of rapid change the likelihood and cost of "getting it wrong" carries progressively greater

consequences. The insight of Basil Liddell Hart just before World War II and the first strategic bombing campaigns is true now more than ever:

> Compared with the present [1937] state of flux, it was simple to make military calculations in the past. The elements of strength were to a great extent calculable. To embark on war then was no greater hazard than that of betting on the favorite—and yet the favorite has often run and lost. Today, it is like backing a horse that has never run, and whose breeding is unknown.[56]

Douhet's extrapolations into the future demonstrate that danger. Even well defined, logically developed policy construction based on assumptions regarding future trends, capabilities, or behavior is almost certainly built on an imperfect foundation.

Even where Douhet was essentially correct assessment of the future his predictions demonstrate the perishablity of assumptions based on technological advancement. His idea of an unstoppable air offensive was a viable proposition until the invention of radar made a coordinated fighter defense possible. It shows the impact of parallel technologies on future-based doctrine. Today's multidisciplinary approach to technological development renders theory and doctrine based on technology an increasingly short shelf life. Technological advances in one field more easily affect those of other specialties. The rate of obsolescence in the application of high technology increases rapidly. In fielding a military force using information technology to leverage combat power, the Army Digitization Office, a major player in the Force XXI campaign to acquire and field information technology, faces a tremendous challenge in keeping a qualitative edge in the Force XXI Army.

Another dimension of the challenge of preparing for a true RMA deals with changing a military organization. The AAF experience in developing strategic bombing doctrine demonstrates the effect of organizational pressures. Because future-based doctrine relies on hypothesis rather than proof, it is vulnerable to the influences outside the development process. Today, the Army is beginning to generate those very pressures as General Gordon Sullivan, former Army Chief of Staff, outlines:

> We are now entering what may very well be its most critical stage -- the work of redesigning the force -- the division, the corps, and echelons above corps, including the sustaining base of the Army. This work has been left undone up to this point -- undone because it was necessary to allow the turbulence to abate and uncertainty to settle, to learn more about the future environment and what could be, to set the stage by putting in place the initiatives enumerated above [Force XXI]. It is time to redesign the force to better leverage both the power of our people and the power of our technology.[57]

This type of restructuring change creates a climate of threat and opportunity for elements within the Army. The process ultimately defines winners and losers. The AAF's drive for autonomy exerted enormous influence on its doctrinal development. It pitted the bomber community versus the fighter community to the detriment of both. The Army's Force XXI effort will confront similar organizational pressures as it affects the various combat and support branches. These organizations, each with unique interests will compete for self-preservation or expansion. Organizational agendas can hijack the development of doctrine based on future technology as a vehicle for their own advancement.

Worse than inevitable organizational friction in building future theory and doctrine

is the potential for a drift into dogma. The AAF reached a point where it would not modify its key assumptions to match reality. The Army's has good reason to believe its three-pronged advance into the future may produce broad and accurate analysis and evaluation of bold innovation. It employs aggressive experimentation and simulation to examine emerging technology and put it in a relevant context. Joint Venture, uses a division sized experimentation force to test new technology and tactical employment. The Army effort to overhaul it supporting institutional structure ensures a comprehensive perspective. The integration of information technology to support the entire effort looks aggressively into a dynamic technical environment. This effort, together with concurrent efforts in the Army's innovative Battle Laboratories and Branch schools is far superior the AAF narrower approach. However, the lesson of the AAF experience deals with perspective and perception, not technical competence or accuracy. The AAF experience in sliding from doctrine to dogma warns of a mindset that accepts self-validation and colors the interpretation of reality. Doctrine turned dogma can persuade an organization to refuse to grasp flawless empirical evidence that contradicts its perception of a fundamental truth.

The hazards of constructing theory and doctrine ought not to dissuade the Army from pursuing its course toward the next century. The rate of change today demands its type of aggressive approach. General Sullivan begins his comments on *Force XXI Operations* by describing the concept as ". . .the first step of our doctrinal journey into the future—and what a powerful first step it is." He concludes "Each of us shares the responsibility for getting it right." A large part of that responsibility comes from recognizing and avoiding the factors that may lead to the next Black Thursday.

ENDNOTES

[1] Department of the Army, *Training and Doctrine Command Pamphlet 525-5 Force XXI Operations* (Washington D. C.: U. S. Government Printing Office, 1994), 2-8 Figure 2-5.

[2] Ibid., 4-1.

[3] Thomas M. Coffey, *Decision Over Schweinfurt (*New York: David McKay Company, 1977), 307, 322-323. This historical vignette is adapted from Coffey's account. Peaslee was then deputy commander of the 40th Combat Bombardment Wing. The 92d Bombardment Group losses for the raid were four aborts, six shot down.

[4] Ibid., 325, 332. Coffey computes a 19 percent loss rate. Neither rate includes the 142 bombers that returned damaged. The total of aircraft shot down and damaged was 202, for an overall loss rate of over 69 percent. German losses on this raid were between 35 and 100 fighters.

[5] Edward Warner, "Douhet, Mitchell, Seversky: Theorists of Air Warfare" in *Makers of Modern Strategy*. (Princeton: Princeton University Press, 1971), 488.

[6] Douhet, Giulio Douhet, The Command of the Air. (New York: Coward-McCann, 1942), 145.

[7]James J Schneider, "The Eye of Minerva: The Origin, Nature, and Purpose of Military Theory and Doctrine" *Theoretical Paper No. 5* (Ft Leavenworth, KS: School of Advanced Military Studies, USCGSC), 10.

[8] Ibid., 11.

[9] T. B. Strong, "Scientific Method as Applied to History" Lectures on the Method of Science, 231. Quoted in J. F. C. Fuller, *The Foundations of the Science of War* (London: Hutchinson and Co., 1926), 37.

[10] Douhet, *Command of the Air*, 213.

[11] Robin Cross, *The Bombers* (New York: Macmillan Publishing Company, 1987), 42, 47.

[12] Basil Liddell Hart, *Europe in Arms*. (New York: Random House, 1937). 24. The author begins his discussion of the military with a review of the potential power of air forces.

[13] Douhet, *Command of the Air*, 58.

[14] Ibid., 58.

[15] Ibid.

[16] Ibid., 54.

[17] Perry M. Smith, *The Air Force Plans for Peace* (Baltimore: The Johns Hopkins Press, 1970), 28.

[18] Cross, *The Bombers*, 52.

[19] Ibid.

[20] Douhet, *Command of the Air*, 17.

[21] Ibid.

[22] Ibid., 26. My italics.

[23] Ibid., note page 27-28.

[24] Ibid., 59.

[25] Ibid., 20-22. Douhet made a logical construction of this argument, however, in practice he grossly underestimated the damage these bombs would actually inflict on

urban/industrial targets. Mercifully, his estimation of the effects of poison gas weapons added to World War II explosive-incendiary raids remains conjecture.

[26] Ibid., 22.

[27] Ibid., 26.

[28] Ibid., 213.

[29] Robert A. Doughty, "The Evolution of US Army Tactical Doctrine, 1946-1976," *Leavenworth Papers no.1* (Ft Leavenworth, KS: Combat Studies Institute, US Army Command and General Staff College. 1979), 1.

[30] Department of the Army, *Field Manual 100-5: Operations*, (Washington, D. C.: U. S. Government Printing Office, 1992), v.

[31]Paul H. Herbert. "Deciding What Has to be Done: General William E. Depuy and the 1976 Edition of FM 100-5," *Leavenworth Papers no.16* (Ft Leavenworth, KS: Combat Studies Institute, US Army Command and General Staff College. 1988), 4.

[32] Cross, *The Bombers*, 15.

[33] Ibid., 64.

[34] Haywood S. Hansell Jr., *The Air Plan that Defeated Hitler* (Atlanta: Higgins-McArthur/Longino & Porter, Inc., 1973), 28

[35] Ibid., 12. My italics.

[36] Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1907-1960* (Maxwell AFB, AL: Air University Press., 1989), 64.

[37] Smith, *Air Force Plans for Peace*, 32.

[38] Hansell *The Air Plan that Defeated Hitler*, 12

[39] Smith, *Air Force Plans for Peace*, 34.

[40] Roger E. Bilstein, *Flight in America, 1900-1983* (Baltimore: Johns Hopkins University Press, 1984), 88.

[41] Futrell, *Ideas, Concepts, Doctrine*, 80.

[42] Claire Chennault, *Way of a Fighter: The Memoirs of Claire Chennault* (New York: G. P. Putnam's, 1949), 20. Chennault's views must be taken the context of a bitter professional debate regarding the future of US air power. His memoirs may be considered polemical regarding this subject, though they do provide insight to the general tenor of the times.

[43] Thomas H. Greer, "The Development of Air Doctrine in the Army Air Arm, 1917-1941 (Maxwell AFB: USAF Historical Study No. 89, 1955), 45.

[44] Smith, *Air Force Plans for Peace*, 32. Toward the end of the 1930's the performance of US fighters had increased to the point where bomber advocates accepted that they could engage and, if massed properly, disrupt bomber formations. The debate regarding bomber invincibility shifted to detection, and coordination of the penetrating bomber formations and the effectiveness of bomber defensive fire.

[45] Stephen L. McFarland and Wesley Phillips Newton, *To Command the Sky* (Washington, D. C.: Smithsonian Institution Press, 1991), 35.

[46] Futrell, *Ideas, Concepts, Doctrine*, 67.

[47] Joe Taylor, "They Taught Tactics," Aerospace Historian (Summer 1966) p. 72 quoted in Perry M. Smith, *The Air Force Plans for Peace* (Baltimore: The Johns Hopkins Press, 1970), 33.

[48] Smith, *Air Force Plans for Peace*, 34

[49]Chennault, *Way of a Fighter*, 20.

[50]Futrell, *Ideas, Concepts, Doctrine*, 85-86. My italics. This historical vignette was adapted largely from Futrell's account. Jones, a Colonel at the time, had a long and distinguished record in the Air Corps. He was a key leader in the Air Service air mail program and commanded a pursuit squadron. His credibility in air tactics added weight and exposure to his views and, perhaps, his heresy.

[51] McFarland and Newton, *To Command the Sky*, 35.

[52] Futrell, *Ideas, Concepts, Doctrine*, 97.

[53] Ibid., 97. My italics.

[54] Douhet, *Command of the Air*, 30.

[55] United States Army, *Force XXI Operations*, 7.

[56] Hart, *Europe in Arms*, 32.

[57] Gordon Sullivan, "Building the Force for the 21st Century," March 1994.

BIBLIOGRAPHY

BOOKS

Arnold, Henry H.. *Global Mission*. New York: Harper and Bros., 1949.

Bendiner, Elmer. *The Fall of Fortresses*. New York: G. P. Putnam's Sons, 1980.

Bilstein, Roger E. *Flight in America, 1900-1983*. Baltimore: Johns Hopkins University Press, 1984.

Caidin, Martin. *Flying Forts*. New York: Meredith Press, 1968.

Chennault, Claire. *Way of a Fighter: The Memoirs of Claire Chennault* New York: G. P. Putnam's, 1949.

Clausewitz, Carl von. *On War*. ed. and trans. Michael Howard and Peter Paret, Princeton, NJ: Princeton University Press, 1976.

Coffey, Thomas M.. *Iron Eagle*. New York: Crown Publishers, 1986.

Cross, Robin. *The Bombers*. New York: Macmillan Publishing Company, 1987.

Douhet, Giulio. *The Command of the Air*. New York: Coward-McCann, 1942.

Freeman, Roger A.. *The Mighty Eighth: Units, Men, and Machines*. Garden City, New York: Doubleday, 1979.

Fuller, J. F. C.. *The Foundations of the Science of War*. London: Hutchinson and Co., 1926.

Greer, Thomas H.. *The Development of Air Doctrine in the Army Air Arm, 1917-1941*. Maxwell AFB: Air University Press, 1955.

Hansell, Haywood S., Jr.. *The Air Plan that Defeated Hitler*. Atlanta: Higgins-McArthur, 1972.

Hart, Basil Liddell. *Europe in Arms*. (New York: Random House, 1937.

Hastings, Max. *Bomber Command*. New York: Dial Press, 1979.

Hurley, Alfred H.. *Billy Mitchell: Crusader for Air Power*. Bloomington: Indiana University Press, 1964.

McFarland, Stephen L and Wesley Phillips Newton. *To Command the Sky*. Washington: Smithsonian Institution Press, 1991.

Mitchell, William M.. *Winged Defense*. New York: G. P. Putnam's Sons, 1925.

Murray, Williamson. *Strategy for Defeat: The Luftwaffe, 1933-1945*. Maxwell AFB: Air University Press, 1983.

Posen, Barry R.. *The Sources of Military Doctrine*. London: Cornell University Press, 1984.

Robertson, Scott. *The Development of RAF Strategic Bombing Doctrine, 1919-1939*. London: Praeger, 1995.

Saward, Dudley. *Victory Denied*. London: Buchan and Enright, Publishers, 1985.

Smith, Perry M. *The Air Force Plans for Peace*. Baltimore: The Johns Hopkins Press, 1970.

Warner, Edward. "Douhet, Mitchell, Seversky: Theorists of Air Warfare" in *Makers of Modern Strategy*. Princeton: Princeton University Press, 1971.

GOVERNMENT PUBLICATIONS

Doughty, Robert A.. "The Evolution of US Army Tactical Doctrine, 1946-1976," *Leavenworth Papers no.1*. Ft Leavenworth, KS: Combat Studies Institute, US Army Command and General Staff College, 1979.

Futrell, Robert F.. *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force; Vol. 1*. Maxwell AFB, AL: Air University Press, 1971.

Greer, Thomas H.. "The Development of Air Doctrine in the Army Air Arm, 1917-1941," *USAF Historical Study No. 89*. Maxwell AFB, AL: US Air Force Air University, 1955.

Herbert, Paul H. "Deciding What Has to be Done: General William E. Depuy and the 1976 Edition of FM 100-5," *Leavenworth Papers no.16*. Ft Leavenworth, KS: Combat Studies Institute, US Army Command and General Staff College, 1988.

Maurer, Mauer. *Aviation I the US Army 1919-1939*. Washington D. C.: U. S. Government Printing Office, 1987.

Schneider, James J. "The Eye of Minerva: The Origin, Nature, and Purpose of Military Theory and Doctrine" *Theoretical Paper No. 5*. Ft Leavenworth, KS: School of Advanced Military Studies, US Army Command and General Staff College.

U.S. Department of the Army. *Field Manual 100-5: Operations*, Washington, D. C.: U. S. Government Printing Office, 1992.

_____. *Training and Doctrine Command Pamphlet 525-5 Force XXI Operations*. Washington D. C.: U. S. Government Printing Office, 1994.

Watts, Barry D.. *The Foundations of US Air Doctrine*. Maxwell AFB, AL: Air University Press, 1984.