



SCHOOL OF ADVANCED AIRPOWER STUDIES

WHAT WILL DOUHET THINK OF NEXT?

**An Analysis of the Impact of Stealth Technology
on the Evolution of Strategic Bombing Doctrine**

By

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on the Evolution of Strategic Bombing Doctrine**

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**School of Advanced Airpower Studies
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DISCLAIMER

The views reflected in this paper are solely those of the author and do not reflect the opinions of the United States Air Force, Air University, or the School of Advanced Airpower Studies. This paper is unclassified and does not contain any classified information.

ABSTRACT

This paper analyzes the evolution of strategic bombing doctrine in order to identify the basic doctrinal tenets and then evaluate their compatibility with emerging stealth technologies. Current doctrine is an evolution of existing doctrine, theory, and experience. Therefore, to comprehend fully the meaning of doctrine, it is necessary to trace its lineage. As airpower arrived only recently in the doctrinal arena, no previous doctrine existed. Therefore, this analysis begins with the early airpower theories which provided the roots of evolution. Giulio Douhet is the most famous of the early theorists and his work provided a basis upon which to build. Following World War II (WWII), Bernard Brodie modified Douhet's theory to incorporate atomic weapons and the experience to date. As theory evolved, so did early Air Corps "unsanctioned" doctrine. Despite a lack of approval at the Department of the Army, the Air Corps Tactical School developed and taught strategic bombing concepts which later provided the basis of WWII aerial planning and execution. The Korean and Vietnamese conflicts provided impetus for slow and gradual change to the basic tenets of strategic bombing doctrine. The USAF reinforced the validity of these basic tenets when it promulgated the 1992 version of Basic Aerospace Doctrine. By testing each tenet against the demands of emerging stealth technologies, the paper finds that existing doctrine is basically sound, but incomplete. Therefore, the paper proposes and tests additional tenets to accommodate stealth and the increasing rate of technical advancement.

BIOGRAPHICAL SKETCH

Lieutenant Colonel Silvanus Taco Gilbert III was commissioned from the United States Air Force Academy in 1978. Following a tour as a T-38 instructor pilot and flight examiner, he received an Olmsted Scholarship to the Peoples Republic of China. As the first Air Force officer to study in the PRC following the successful communist revolt, Lieutenant Colonel Gilbert completed over two years of graduate study in Beijing and Shanghai. He also had the opportunity to travel extensively throughout the PRC and Asia, meeting with senior political, military, and economic leaders. Lieutenant Colonel Gilbert is a senior pilot with over 2000 flying hours in the T-38 and FB-111A aircraft. He has a bachelor's degree in Civil Engineering from the USAF Academy and a Masters degree in International Relations from Harvard University. Beginning in June 1992, he will be assigned to the Chief of Staff's Operation Group, Headquarters United States Air Force, Washington, DC.

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CHAPTER ONE

INTRODUCTION

"The bias toward the offensive creates special problems in any technologically new situation where there is little or no relevant war experience to help one reach a balanced judgment"

--Bernard Brodie.¹

The concept of aerial strategic bombardment predates the airplane, finding its roots in lighter-than-air craft of the 1800s. During the 1849 siege of Venice, the Austrians used balloons to carry explosives over the city. However, when the wind shifted they ended up bombarding their own troops.² The fear of explosives drifting helplessly with the wind led to treaties precluding such developments, pending the development of dirigible craft.³ World War I saw the first true exploitation of both the German Zeppelin and airplanes to attack deep into enemy territory in the third dimension. Yet even as early aviators struggled to control their temperamental craft, early theorists grappled to understand this new aerial power. Their pioneer efforts to codify airpower doctrine initiated an evolution which continues to this day. With each major bend in the tapestry of airpower, the question of strategic bombing doctrine has reemerged.

This paper will retrace the weave of strategic bombardment doctrine through the evolution of its basic tenets in order to understand the latest wrinkle in its fabric--stealth technologies. But before there was bombing doctrine, there was theory. Therefore, the paper will first examine the evolution of strategic bombing theory. Starting with the first comprehensive theory of airpower, that of Italian Air Marshal Giulio Douhet, it is possible to see the roots of subsequent concepts of strategic airpower. But Douhet and others found problems with his ideas. Nonetheless, theory evolved through the years until it collided with the nuclear age. The atomic bomb marked a major delineation in aerial warfare, for its destructive ability suddenly propelled the airplane to the forefront of strategic defense. Dr. Bernard Brodie was the first to integrate this new weapon with the previously existing theory of strategic bombing. The mix provided a new set of tenets to guide the further development of strategic bombing

doctrine.

That doctrine, like theory, evolved with time and experience. Beginning with their World War I (WWI) experiences, the pioneers in military aviation tried to codify what they felt was the best way to employ the airplane in war. Their ideas ran head-first into War Department Field Manuals--the official Army doctrine. Therefore, the flyers developed their own unofficial doctrine over time, advocating their own employment concepts and incorporating the evolving theory. Their ideas matured at the Air Corps Tactical School in the interwar years despite, and because of isolation within the Army bureaucratic structure. World War II, with the first massive aerial bombardment fleets and later the atomic bomb, challenged existing tenets and brought change to the basic doctrine.

Yet the end of WWII also brought independence to the United States Air Force. Therefore, the air arm was now responsible for development of its own doctrine. Published manuals now reflected the aviators' own sanctioned doctrine, and the evolution of their thought is traceable through the texts. Those texts contain the fruits of earlier theory and experience, but also reflect the challenges of emerging technologies. Conflicts in Korea and Vietnam similarly tested doctrinal foundations. Though the enemy in battle provides the ultimate test of doctrine, challenges also come in times of peace from other sources such as technology.

The latest challenge to strategic bombing doctrine has been the emergence of stealth, or "low observable" technologies. These technologies have not only altered the traditional shape of aircraft, but also lead to questions on the traditional employment of airpower. Michael Howard warns that doctrine and weapons systems must be synchronized.⁴ If there is a disconnect between the two, the results can be disastrous. Therefore, the advent of such a major technical advancement in aircraft design demands an evaluation of basic doctrinal tenets to determine their viability.

By tracing the thread of theory through history, then following the interweave of doctrine and experience in strategic bombing, it is possible to discover the basic tenets. By examining the doctrinal

implications of stealth technology, one can understand whether or not this new technology demands a revision of our doctrinal foundations.

CHAPTER TWO

THEORY

"In warfare, the moral is to the physical as three is to one."

--Napoleon Bonaparte⁵

Theory is defined in the Oxford American Dictionary as, "a set of ideas formulated (by reasoning or known facts) to explain something," or as, "a statement of the principles on which a subject is based."⁶ Dr. Harold Winton of the School of Advanced Airpower Studies carries the concept further in his article "A Black Hole in the Wild Blue Yonder: The Need for a Comprehensive Theory of Air Power." In that paper, Winton defines theory as a "codified, systematic body of propositions." He charges that theory has a higher mandate; that it must serve "to define; to categorize; to explain; to connect; and, ideally to anticipate"⁷ These functions have been the driving force behind the development of strategic bombing theory throughout the history of airpower. Therefore, it is appropriate to use the five functions as the measure of not only theory to date, but also theory for the future. The ability to perform the five functions gives the body of propositions a life beyond the abstract--it serves as the key to application.

How do these functions apply today? First, existing doctrinal tenets should be able to define strategic bombing in the future. Will stealth require an expanded definition or a more narrow vision? Second, the tenets should be able to categorize strategic bombing. Will stealth blur the distinction between the tactical and strategic employment of airpower sufficiently to negate the value of independent, strategic bombing doctrine? Third, will doctrine as it exists today explain stealth and its application to bomber operations, or confuse the employment of this new technology? Fourth, will tenets be both internally and externally consistent with stealth to provide the connection to existing strategic bombing concepts, as well as the bridge to other applications of airpower? Finally, did the doctrinal tenets anticipate stealth and provide the necessary foundation for the evolution of stealth and strategic bombing into the future? These questions serve to clarify the five functions of theory and frame the

purpose of this paper. Early theorists sought the same answers to the advanced technology known as the airplane when they attempted to formulate the first theories of strategic airpower.

The first comprehensive theory of strategic bombing was the work of Air Marshal Giulio Douhet of the Italian Air Force.⁸ His work, Command of the Air, was an attempt to codify his thinking on the future of war in the emerging age of airpower. His prescription, though frequently taken as universal, was structured for the unique geostrategic location of Italy.⁹ Douhet based his theory on his observations of World War I (WWI). In that war, airpower had explored strategic bombing while ground forces spent much of the conflict stagnated in bloody trench warfare. With the ability to fly over static trenches, Douhet no longer saw "any need to break through the enemy's lines to reach an objective. The lines no longer protect what is behind them."¹⁰ Douhet also saw the ability of the aircraft to instill panic into the hearts of both civilians and soldiers.¹¹ He viewed the ability to generate panic among the population as one of the principal strengths of airpower. While charging that airpower had been misused in WWI as merely a means to annoy the enemy,¹² he argued that the moral element was the key to victory in the future. He stated that the most effective means of waging war was to attack the weakest element of enemy resistance.¹³ That element was the moral resolve of the population--a target that had been largely secure from the horrors of war unless in the direct path of advancing armies. However, "[a]ny distinction between belligerents and nonbelligerents is no longer admissible today."¹⁴ Future wars would target "vital centers" which Douhet defined as population and industrial centers.¹⁵ Seeing the prime target as the moral resolve of the enemy, allowing no distinction between civil and military targets, and finding no effective barrier between the aircraft and its target, Douhet formulated his theory of airpower.

From Douhet's work emerged a set of tenets to strategic bombing doctrine. Those tenets included the propositions that:

- 1) Airpower is offensive in nature.

- 2) The bomber is the basic weapon of airpower and all resources should be directed towards

bomber aviation.

- 3) The first goal of strategic bombardment is to gain command of the air. Until achieving that goal, one's own population will have to accept enemy bombardment.
- 4) The moral resolve of a nation is the weak link in its war effort.
- 5) Moral resolve is subject to direct attack through strategic aerial bombardment of vital centers.
- 6) Once a nation has command of the air, it should attack the material and moral resources of the enemy to bring about the collapse of the enemy society--although selection of targets will be the hardest part of using airpower. Target selection will be highly situational.¹⁶
- 7) The "Battleplane," or self-escorting, multi-role aircraft is the ideal form for airpower.
- 8) Airpower should be massed and aerial attack should be relentless. Surprise, or pre-emption, is extremely valuable.
- 9) Command of the air is necessary and sufficient for victory. Though ground and naval forces have a role, air forces will be the most important to early victory--and thereby, they are decisive.
- 10) Sufficient bombers will always get through. Though not explicitly stated, Douhet's scenario in "The War of 19_" demonstrates this belief. Despite large attrition en route, the bombers still manage to reach and strike their targets.

While he never doubted the decisiveness of airpower, Douhet still saw some shortcomings in his theory. In his work he had advocated the combined use of chemical, incendiary, and high explosive (HE) bombs to attack population centers.¹⁷ However, he saw that aircraft could not currently carry the necessary bombloads, and the ordnance was not powerful enough. Douhet first pursued the explosives problem with his friend the aircraft designer, Giovanni Caproni. Caproni had written to Douhet as early as 1918 to explain the technical difficulties in meeting Douhet's theoretical requirements.¹⁸ Douhet

further pursued the issue in the 1926 edition of Command of the Air when he argued for greater research to improve the "efficacy of destructive materials."¹⁹ To address the aircraft problem, he argued for all-metal aircraft to improve durability and payload.²⁰ Yet despite the problems he saw, the basic tenets of his theory remained unchanged.

These tenets defined the predominant strategic bombing theory through the pre-nuclear era. In fact, World War II (WWII), which will be discussed in more detail in Chapter Three, provided a theoretical proving ground for the major air powers of the world. However, with the detonation of the atomic bombs over Japan, strategic bombing entered a new age. Dr. Bernard Brodie was one of the first to re-examine existing theory in light of the new age, and publish his findings. In 1957, he drafted his first text, "The Heritage of Douhet," under the auspices of the RAND Corporation. It served as the basis for his larger work, Strategy in the Missile~, published in the early 1960s.²¹ The text serves as a primer for strategic bombing theory in the post-nuclear age.

With Douhet as his starting point, Brodie used his volume to recapitulate early theory and then modify it to the new technical age. His examination identified key shortcomings to Douhet's work. Though he stated that, "Douhet was proven wrong on almost every salient point he made,"²² Brodie found that emerging technologies actually buttressed the Italian's weaknesses.

Brodie criticized Douhet regarding his exaggeration of bomb damage, his assertions on bomber penetrability, his neglect for target selection guidance, and his mistake in advertising the ability to force a change in the opponents government through airpower. However, the nuclear age presented a new environment in which to reassess Douhet's ideas. Nuclear weapons now provided the level of destruction for which Douhet had searched. For in the past, destruction was hampered by both the limited power of the bombs and the accuracy of delivery. The nuclear bomb, while enjoying better accuracy than in the past, no longer needed it. It could easily destroy the targets that escaped early bombers.²³ Because of this quantum increase in the destructive power of a single bomber; Brodie eventually argued that technology

had overcome Douhet's underestimation of the power of the defense. While fewer bombers would get through because of technologies, such as radar, which Douhet had not foreseen, those that penetrated would have such awesome power that they were still a credible force. But that force must be properly targeted. Brodie was far more explicit on targeting than Douhet had been.

One of Brodie's chief complaints about Douhet was the dearth of targeting direction in the early theory. Brodie did, however, agree with Douhet that the strategic war-fighting assets²⁴ must be the first priority for any strategic attack. However, he found the distinction in priority to be merely academic. For the destruction caused by the atomic warhead not only cured the problems of firepower and accuracy, but also created such collateral damage that there was considerable overlap of targets. Whether to strike counterforce or countervalue was a moot point. A counterforce strike would also constitute a de facto countervalue strike in its wake. Any strike against military targets would effect untold damage to civilian targets. Any attack on industry would destroy surrounding cities. "'Overkilling' will be cheap and therefore, according to the military considerations normally brought to bear, no longer to be shunned."²⁵ The ability to extract such simultaneous military and societal damage raised the question of the ultimate goal of the bombing campaign.

Brodie, though faulting Douhet in many regards, agreed on the basic points of strategic bombing- it would be decisive and the ultimate target would be the civilian support for the war effort. By decisive, Douhet had meant that airpower would compel a nation to sue for peace before any other arm of the military could achieve that goal. Brodie defined decisive in a more strict sense.

"When we say that strategic bombing will be decisive, we mean that if it occurs on the grand scale that existing forces make possible, other kinds of military operations are likely to prove both unfeasible and superfluous."²⁶

The early air war would break down the entire military structure of the enemy. Whereas Douhet predicted a *coup d'etat* in the wake of bombing, Brodie foresaw complete anarchy in the total ruin left

following nuclear attacks.²⁷ While questioning the wisdom of direct attacks against civilians, he maintained that bombing would have a major impact on the war effort through the erosion of moral support.²⁸

Therefore, starting with Douhet's theory of strategic bombing, Brodie modified it to include the technical evolutions and experience base to date. From that emerged a new set of tenets.

- 1) Airpower is offensive in nature. The offense is the only valid employment of airpower.
- 2) The bomber will get through. Though defenses may extract a heavy penalty for penetration, they cannot prevent it. The cost to the attacker is justified given the destructive power of a single bomber.
- 3) The first priority of attack is the opposing strategic air assets.
- 4) The nuclear warhead will be the predominant weapon for strategic bombing campaigns in the future.²⁹
- 5) When strategic bombing is employed, it will be decisive.
- 6) Strategic bombing will break the will of the people to resist through the sheer level of destruction. The moral and political cohesion of the nation will be natural collateral casualties of the counterforce and industrial targeting.
- 7) Weapons must be sufficiently powerful and accurate to destroy the machinery of industry, beyond rapid repair. Nuclear weapons supply this need.

Thus the tenets of strategic bombardment did evolve with time, but within the basic construct first penned by Air Marshal Douhet. Despite the shortcomings he found in Douhet's work, Brodie's subsequent theory still retained the essence of the earlier's ideas. Together, their theories taught of the power of the aerial offense as practiced through strategic bombing. That theory evolved into the Post-

WWII doctrine of the American air arm.

CHAPTER THREE

EARLY DOCTRINE

"New weapons when not accompanied by correspondingly new adjustments in doctrine are just so many external accretions on the body of an army."

--I. B. Holley, Jr.³⁰

Colonel Dennis Drew and Dr. Donald Snow define doctrine in relatively simple terms. "Military doctrine is what we believe about the best way to conduct military affairs."³¹ Using this definition as a foundation, the Air Command and Staff College expands in one important direction--education. The College teaches that doctrine is only what is believed about the best way to conduct military affairs, but also what is taught about the best way to conduct them.³² Given the history of the Air Corps Tactical School (ACTS) in the development of early unsanctioned air doctrine, the incorporation of education into the definition of doctrine is essential.

Drew and Snow maintain that doctrine emerges primarily through experience.³³ Air University adds to that equation by including the importance of theory to the formation of doctrine.³⁴ Given the dearth of experience in strategic bombing in WWI and the corresponding lack of theory, the two combined to limit the early doctrinal foundations of the USAF.

To become doctrine, ideas require sanction. Within the military, such sanction takes the form of field manuals and regulations. However, sanction was a difficult issue in the formation of airpower doctrine in the United States. Under the domination of the Army, sanctioned airpower doctrine conformed to traditional ground concepts of aviation--as an observation, close air support, and battlefield air interdiction asset. But contrary to the official doctrine, aviation leaders within the Army Air Corps and at the Air Corps Tactical School saw the principal role of airpower to exist in strategic bombardment. Therefore, recommendations to headquarters, training regulations, and academic lectures instead served as emerging doctrine for the growing air arm.

The United States emerged from WWI, the first conflict in which strategic bombardment was employed, with a very limited experience base. Yet looking back at their efforts, early American

aviators attempted to develop definitions and employment guidance for their earth-bound commanders. In what Major General Laurence S. Kuter would later call the "earliest, clearest and least known statement of the American conception of the employment of air power [sic],"³⁵ Major Edgar Gorrell articulated the fundamentals of strategic bombardment. Gorrell, Assistant Chief of Staff of the Air Service in the American Expeditionary Forces in WWI, defined strategic bombardment as attacks against the commercial centers and lines of communication of the German forces. Equating the German military to a drill, he argued that airpower could attack the weaker "shank," or people of the nation supporting and supplying the war effort.³⁶ The air arm should attack the support structure for the army and erode the will to resist. Gorrell demonstrated such a concept in 1918 with his analysis of German industry and design of a bombing plan to destroy it.³⁷ Others also searched their experiences for lessons to carry forward.

The first real attempt to codify the lessons of WWI was a product of Lieutenant Colonel William C. Sherman. As Chief of Staff of the First Army Air Service in November 1918, he sought to save the lessons of aerial war for exploitation in the future. In the spring of 1919, he produced a "Tentative Manual for the Employment of Air Service." His text articulated a theory of war, incorporating airpower, and provided a tactical and operational concept for the employment of airpower.

Sherman also felt that the greatest value of airpower lay in its ability to strike directly at the morale of the enemy. Such attacks yielded results "out of all proportion both to the effort expended and the material damage done."³⁸ Though he saw morale as the principal target, he did not agree with Douhet that airpower was decisive. He felt that the airplane lacked sufficient firepower and therefore was better suited to observation, close support, and interdiction.³⁹ In 1922, he wrote "The Fundamental Doctrine of the Air Service," in which he reiterated these ideas. Airpower was still merely an auxiliary to the ground.⁴⁰ Officials in the War Department agreed. Secretary of War Newton D. Baker issued his annual report in 1919 stating that bombing in WWI had no significant effect on the war. He concluded that strategic bombing had no place in modern war.⁴¹ However, slowly divisions began to emerge

between the official doctrine of the War Department and that of the Air Service.

The main locus of dissent from War Department doctrine was the Air Corps Tactical School (ACTS), first located at Langley Field in Virginia and later moved to Maxwell Field in Alabama. During the 1920s, the outlook toward aviation evolved within the school from one of ground support to one more concerned with the independent qualities of airpower. Though dissidents such as Major Claire Chennault continued to argue for pursuit aviation,⁴² the majority of the faculty of ACTS began to view the role of aviation in vastly different terms. Soon ACTS was teaching that the mission of the Air Corps was no longer just to defeat the enemy in the air. Instead, the principal mission of airpower was to eliminate the ability of the enemy to wage war by destroying his aircraft on the ground and his "vital" industrial establishments.⁴³ Though Training Regulation (TR) 440-15,⁴⁴ dated 26 January 1926 echoed the War Department philosophy,⁴⁵ ACTS published a new text in the same year which fundamentally altered the doctrinal perspective of the air arm.⁴⁶ Thomas Greer, of the Office of Air Force History, argues that the manual served as the basis for ACTS thought until the advent of WWI I .⁴⁷

The new text, "Employment of Combined Air Force," advocated an independent air operations coordinated with, but not subordinated to the Army and Navy.⁴⁸ Furthermore, the text declared the proper target of air operations to be the will or morale of the enemy rather than the field army. The most effective means of attacking this target was through deep strikes against "vital" points.⁴⁹ The destruction of these targets would lead to the collapse of the society.⁵⁰ These thoughts soon became the holy writ at the ACTS, echoed by such prominent instructors as Haywood Hansell and Laurence Kuter up to the eve of WWII.

However, even as WWII approached, the material in the Training Regulations and the ACTS texts was still not incorporated into official doctrine. Therefore, the first war plans for the American air effort did not reflect official doctrine--it was written by the same men who had been developing the counter-doctrine at ACTS for the past decade. The first plan, Air War Planning Document 1 (AWPD-1),

prescribed victory through airpower. Haywood Hansell summed up the plan when he stated:

"[T]he basic concept on which this plan is based lies in the application of air power for the breakdown of the industrial and economic structure of Germany. This conception involves the selection of a system of objectives vital to the continued German war effort and to the means of livelihood of the German people, and tenaciously concentrating all bombing toward the destruction of those objectives."⁵¹

Hansell chose those objectives in conformity with the doctrinal tenets developed in the interwar years. Hansell selected the "vital" targets based on the synergistic effect on the war effort. The list included 154 locations whose destruction would force German capitulation. However, before attacking these targets, the first intermediate priority was the Luftwaffe to achieve command of the air.⁵²

Given that the plan violated official doctrine, the Joint Chiefs never formally endorsed it, yet it remained the plan for the air campaign.⁵³ Later updates, including AWPD-42⁵⁴ and the

Combined Bomber Offensive retained the fundamental air goal-- destruction of the enemy's will and capability to fight.⁵⁵ The actual war effort did, to a large extent, conform to this plan and the doctrinal tenets behind it.

Following the European invasion, the United States commissioned the Strategic Bombing Survey, composed predominantly of civilians, to analyze the impact of the aerial campaign against Germany and Japan. The survey considered the impact of all airpower, not merely strategic bombing on the outcome of the war. It was chartered to consider the effectiveness, efficiency, and limitations of airpower in the war, as well as to consider the appropriateness of target selection throughout the conflict.⁵⁶ It was hampered in its study by the inability to analyze fully the damage to targets within the Soviet zone of occupation. Attempts to resolve this problem in 1944 and 1945 were ineffective.⁵⁷ After 1,440,000 bomber sorties and 2.7 million tons of bombs,⁵⁸ the results were mixed. One of the most significant insights concerned the ability of airpower to destroy the will of the enemy to resist. The Survey concluded that, particularly in a totalitarian state, the population is surprisingly resilient to aerial

attack. They grow accustomed to the terror and continue to work efficiently as long as the means of production are available.⁵⁹ In sum, the European effort was effective in a limited sense. Attacks against basic industries were more important and effective than attacks on finished products. "Vital" targets did exist, but required better intelligence to identify than was available early in the war.⁶⁰ Only the attacks against the transportation systems seemed to gain appreciation.⁶¹ The war across the Atlantic questioned some of the basic tenets of strategic bombing while validating many more.

The war in the Pacific was an even greater reinforcer of existing doctrine. While operations in the Pacific Theater did not follow the high-altitude precision model of the European War, low- altitude and incendiary attacks against Japan still targeted the same elements of the political, economic, and military infrastructure. Changes in ordnance delivery methods were the result of climatic conditions (high winds at altitude for which existing bombsight could not compensate), Japanese industrial organization (highly dispersed, small factories vice large industrial complexes producing complete products), and traditional Japanese construction methods (homes and factories were made of paper and wood instead of stone and steel). This combination of factors allowed aerial leaders to devise easier means to achieve doctrinal goals than the "doctrinally" correct method of high- altitude precision bombing. High-altitude precision bombing was not incorrect; it was merely more difficult with existing technology and the unique characteristics of Japan. Though the impact of bombing was more difficult to separate from the contributions of the maritime blockade, the Survey still judged the bombing campaign a success.

"The experience of the Pacific War supports the findings of the Survey in Europe that heavy, sustained and accurate attack against carefully selected targets is required to produce decisive results It further supports the findings. ...that no nation can long survive the free exploitation of air weapons over its homeland. For the future it is important fully to grasp the fact that enemy planes enjoying control of the sky over one's head can be as disastrous to one's country as its occupation by physical invasion. ...We underestimated the ability of our air attack. ..., coupled as it was with blockade and previous military defeats, to achieve unconditional surrender without invasion. "⁶²

Noting the massive dislocation of the population and growing malnutrition,⁶³ the devastating attacks had finally fulfilled Douhet's goal of driving the people from the production centers. Aerial attacks were very successful against oil storage, textile production, and foodstuffs, but did not destroy armaments. The latter were protected in underground and dispersed locations and survived the bombardment. Still the Survey considered the campaign a success against industry with its synergistic effect with the interdiction campaign, as well as in its incremental impact on worker absenteeism and industrial productivity.⁶⁴ As the end of the campaign marked the beginning of the nuclear age, the Survey addressed the impact of the atomic bombs. After investigation, they concluded that the atomic devices could not be considered separate from the entire bombing effort. The bombs were merely a continuation of the on-going effort and not decisive in and of themselves. They were unnecessary for the ultimate results of the strategic bombing campaign.⁶⁵ The Survey was convinced of the ability of strategic bombardment to be the decisive element in warfare. While acknowledging some shortfalls, the team declared bombing to have reduced industrial production and decreased civilian and political confidence.⁶⁶ Therefore, WWII did more to solidify doctrine than to evolve it.

The next real challenge to the basic tenets of doctrine came in Korea in the early 1950s. Having depended on the emerging nuclear umbrella to deter aggression, America was unprepared to conduct a conventional bombing campaign. Finding a dearth of targets in underdeveloped North Korea, bombers soon became mere interdiction assets. North Korea simply did not conform to the German or Japanese model. Their industrial and political support structure --China and the Soviet Union --lay outside of the conflict zone and immune to attack. Similar difficulties stymied strategic bombing in Vietnam two decades later. Once again, the vital targets lay out of reach. Although the viability of strategic bombing in an American-Soviet nuclear exchange was never questioned, the ability to successfully orchestrate a conventional bombing campaign moved to the fore.

CHAPTER FOUR

POST WWII AIRPOWER DOCTRINE

"Given time to react, an enemy can almost always devise countermeasures to almost any given line of military action..."

Dr. Robert F. Futrell⁶⁷

Following WWII, the Air Force achieved an independent status under a unified Department of Defense. As such, the new service assumed full responsibility for its own doctrinal development. Therefore, the trace of doctrine in the post-war years is a charted path through the official doctrinal manuals. The manuals began with attempts to codify a joint, or multi-service, doctrine out of the lessons of WWII.⁶⁸ However, the need for supporting documents and the interservice rivalries eventually led to the emergence of an independent airpower doctrine with correspondingly independent ideas of strategic bombardment. Yet in 1951, the services promulgated a joint doctrine to guide future wars.

On 19 September 1951, the new Department of Defense attempted to develop a joint doctrine. The "Joint Action Armed Forces" publication, simultaneously designated Field Manual 110-5 and AFM 1-1,⁶⁹ attempted to establish doctrines, principles, and procedures to distinguish between the responsibilities of the different services and commanders. (iv) It was amended numerous times over the following years, including a final revision on 13 November 1957. The publication established strategic air operations as a USAF mission with the goal being "the progressive destruction and disintegration of the enemy's war making capacity to a point where he no longer retains the ability or the will to wage war. "(18) The Air Force took this broad guidance, combined it with the WWII experience and the inherent desire to carve a niche for the new service, and built their own doctrine.

Even as this doctrine was developing it was facing challenges in Korea in the early 1950s. Having depended on the emerging nuclear umbrella to deter aggression, America was unprepared to conduct a conventional bombing campaign. After initial campaigns to gain air superiority and stop the communist advance, the Air Force began to press for an independent mission on the peninsula.⁷⁰ With the ground war stagnated, air leaders searched for alternatives. As early as July 1951, General Weyland

proposed "all-out" strikes against Pyongyang, after first warning the civilian population. He felt that such attacks would undermine the resolve of the North Koreans and Chinese and place blame for the failure of any negotiations on their shoulders. However, the JCS disapproved seeing such a campaign as provocative in the international political arena.⁷¹ The first year of the air war saw action corresponding to existing doctrine. Strategic bombing destroyed all of the North's industrial targets. Fighters had gained and maintained air superiority.⁷² Yet still the war would not close. The North lacked the industrial infrastructure of either Japan or Germany. Instead, their economic and political support structure lay outside of the conflict zone and immune to attack. Finding a dearth of targets in underdeveloped North Korea, bombers soon became mere interdiction assets.⁷³ Air leaders proposed and eventually received permission for strikes against the vast hydroelectric resources of the enemy.⁷⁴ Proposals also urged attacks against the irrigation dams in North Korea to "result in an economic slump of serious proportions accompanied by a lowering of morale and possibly the will to fight."⁷⁵ Yet as Mark Clodfelter of the School of Advanced Airpower Studies observed, doctrine to date had not envisioned a war where the political restraints on airpower would prevent strikes against the most lucrative of targets. Therefore, the industrial support structure and the morale of the bulk of the enemy population remained off limits and airpower failed to deliver the decisive victory.⁷⁶ The limited war in Korea had little effect on the emerging Air Force Manuals. The experience was depreciated in light of the growing confrontation with the Soviet Union, the potential conflict against which the Air Force sounded doctrine.

On 1 April 1953, Hoyt S. Vandenberg promulgated AFM 1-2, "United States Air Force Basic Doctrine." He noted that its roots lay in "experience gained in war and from analysis of the continuing impact of new weapons systems on warfare."⁷⁷ AFM 1-2 stated that air forces "find their greatest opportunities for decisive actions in dealing immediately and directly with the enemy's war making capacity--both in being and potential." Targets included the industrial base, command and control mechanisms, and enemy forces presenting "unacceptable threats."⁽⁴⁾ He further stated that "Air forces alone have the power to penetrate to the heart of an enemy's strength without first defeating defending

forces, therefore, it is imperative that they be employed on the offensive at the very outset of hostilities."(8, emphasis added) Airpower, through strategic bombing, would quickly be decisive, in a mixture of the theories of Douhet and Brodie.⁷⁸ Thus despite the problems in Korea, he established strategic bombing as the premier mission of the fledgling USAF. This prescription for the application of airpower, based on penetrability and firepower, was echoed in Air University writings, which stated that "[airpower has]. ...a supreme offensive capability --the ability to penetrate. "⁷⁹

In an expansion on just how such an air war should proceed, Vandenberg discussed principles of war as they related to airpower. Even at this early date, he highlighted the importance of surprise: "Surprise may be the key element to success."(9) Though surprise could occur at any level of warfare, it quickly became enshrined as an essential part of aerial warfare.

AFM 1-2 divided air operations into two types--heartland and peripheral. Peripheral operations were those actions to reduce the opponent's air and surface forces so as to secure control of the air and advancement on the ground. Heartland actions were attacks against the "vital elements of a nation's war-sustaining resources, including the enemy's long range air force."(11) Such heartland operations defined strategic bombardment and the goals thereof. Airpower, according to AFM 1-2, could effectively reduce the enemy's "will to fight while simultaneously beginning actions to neutralize the supporting aspects of power that radiate to the periphery. "(12) "No nation can long survive unlimited exploitation by enemy air forces utilizing weapons of mass destruction. "(13) Therefore, the foundations of nuclear bombardment were already codified into basic doctrine. Weapons of mass destruction would be the normal ordnance for bombers in the future. Such weapons would supply the offensive firepower that Douhet had foretold and that was missing in WWII. Yet the question of penetration/control of the air remained. This employment concept corresponded to President Eisenhower's "New Look," whereby nuclear arms were merely another weapon in our inventory.

The experiences of WWII had taught the Air Force that strategic bombardment would not be

cheap in terms of the loss rates for aircraft and aircrews. AFM 1-2 stated that the campaign for control of the air would continue through a combination of peripheral and heartland actions. "Control is achieved when air forces can effect planned degrees of destruction while denying this opportunity to the enemy. This condition, however, is relative and will occur in varying degrees. In the struggle for this control, long and extensive operations may be necessary."(13) However, once again the atomic bomb appeared the panacea. For, "[t]he use of weapons of mass destruction in air operations against the heartland will result in effects out of all proportion to the effort expended and the costs involved."(13) This feeling that the few bombers that penetrate will extract a level of destruction worth the price in lost aircraft and crews reflects Brodie's writings of the period. "Therefore, lack of control of the air must not, in itself, deter commitment of the entire striking force in order to achieve results calculated to be decisive."(13) Even in this early version of aerial doctrine, the essential elements of Douhet's theory found fertile ground. For Douhet had also predicted the large losses of penetrating bombers, yet felt that the results would justify the expenditure. AFM 1-2 went on to say that air superiority was a requirement for sustained peripheral operations in the air and on the ground, as well as for naval operations. However, heartland operations could continue in absence of such an advantage. (14)

Therefore, the real thrust of airpower remained in strategic bombardment.(16) Such heartland operations attacked two broad components of a nation's strength. The first was the enemy military structure and its sustainment. Those targets included weapons, fuel, and ammunition. The second broader group of targets consisted of those elements of national strength necessary for an industrial and/or military society. It included utilities, transportation, command and control assets, and manpower. (15)

"Underlying the effects of attack on all target systems is a recognition that air forces can produce emotional responses in the peoples of a nation. These responses, depending upon how the air forces are employed, can be of a positive or negative nature. By careful consideration of the social structure of a nation, it may be possible to apply air forces against those parts of the structure that will tend to develop cleavages favorable for exploitation. It is, therefore, important in the selection of targets that consideration be given to the psychological effect of the attack on the enemy."(16)

The will to resist remained a primary goal.

This version of Air Force basic doctrine closely paralleled earlier theory and an unsanctioned doctrine. Any support mission was secondary to strategic bombardment. Such bombardment had could attack the military support structure of an enemy, including the will of the people. Though attack would be costly in terms of the aircraft lost, sufficient numbers would reach their targets. The devastation possible through the use of weapons of mass destruction would compensate for the attrition en route.

Leaders did not ignore the question of escort, but like the early planners of AWPD-1, found no suitable solution. The USAF experimented with composite wings of bombers and escorts. Yet range for the fighters was insufficient to accompany the bombers on their strikes.⁸⁰ In an attempt to overcome this deficiency, efforts included parasite fighters which would be carried inside the bombers until over enemy territory.⁸¹ This too failed.

Concurrent with the 1953 AFM 1-2, the Air Force also released a companion manual, AFM 1-3, "Air Doctrine: Theater Air Operations." The manual described an operational (theater) doctrine which quickly asserted that "Heartland actions are conducted by strategic striking forces;...[and that] strategic forces can be used in theater."⁸² It reiterated that heartland actions were intended to be decisive, and defined decisive as loss of enemy war-fighting capability, will, governmental control, or support structure. (1) This definition corresponded to the Douhetian goal of victory through direct attacks on the enemy's war-making capacity and will. It also incorporated the Italian's desire to create social disruption through aerial attack. Towards that goal, the manual identified air superiority as the principal objective of the theater air force, including bombing. It was a prerequisite for any further action. (5) Both AFM 1-2 and AFM 1-3 were re-released on 1 September 1954 with hardly a word changed.⁸³

However, on 1 May 1954, the Air Force released yet another doctrinal manual, AFM 1-8, "Air Doctrine: Strategic Air Operations." The manual quickly proclaimed, "Strategic air warfare is the primary offensive manifestation of national power in war..."⁸⁴ and proclaimed that certain key targets did

exist within modern societies. However, it was also quick to add that identification of proper targets required superior intelligence. (4) Like AFM 1-2 and AFM 1-3, AFM 2-8 addressed the air superiority/escort issue. It saw air superiority as a necessity for prolonged action, but not for the initial strategic attacks of any war.⁸⁵ Drafters realized that the global mission of strategic aviation placed it beyond the support of existing escort fighters. The manual simultaneously argued for global reach, or world-wide power projection capabilities, (3) and for forward bases to provide operational and logistic support. (3, 10)

The manual recognized the need for both conventional and nuclear capability in strategic bombing. However, the manual concentrated on the ability of nuclear strikes to achieve high levels of destruction with very few sorties. In fact, smaller targets were a liability because the explosive power of existing weapons was too great. (5) The collateral damage to communications systems and social cohesion during larger strikes were seen as bonus effects. (5) On the whole, the manual provided more explicit guidance which closely paralleled AFM 1-2.

In April 1955, Air Force Chief of Staff N. F. Twining promulgated a revised AFM 1-2 which further delineated the guidance found in earlier versions. The new version proclaimed speed, range, flexibility, and penetrative ability as characteristics of airpower.⁸⁶ The penetrative ability resulted from the small size, speed, and three-dimensional nature of aircraft. (4) This penetrative ability was advantageous in maintaining the initiative and exploiting the principle of surprise. Surprise could be "achieved through speed, deception, audacity, originality, and concentration [I]t is a powerful determinant and every effort must be made to attain it. The results which are gained through surprise may be out of all proportion to the effort expended." (5) But the manual departed from earlier versions in its decreased coverage of strategic bombardment and with its new treatment of the air superiority question.

While earlier versions of the manual addressed air superiority as the desired dominant position,

the newer version identified the enemy air arm, particularly strategic aviation, as a principal target. This change reflected Soviet development of their "Bear" intercontinental bomber and mated hydrogen bomb. It asserted that the "striking capacity of enemy air forces must be minimized as a primary consideration in war." Given that elimination of the opposing strategic air force was necessary for survival in either total or limited war, such targets were given the first priority. (7) The new AFM 1-2 presented a close approximation of Douhet's earlier theories. The manual directed that enemy airpower be a primary target as command of the air would be decisive in war. It further directed that such command of the air was to be gained through attacks against aircraft on the ground. While acknowledging the limitations of aerial defense, the manual found a limited role for interceptors, (8) once again recognizing the bomber attrition that Douhet and WWII foretold. Though the manual only briefly mentioned "modern weapons with total destruction, it concluded with the Douhetian assertion that airpower was the force "most capable of decisive results." (10) The Korean Conflict seemed to have had little effect on the manual.

In 1959, the Air Force again revised the manual. Significant changes to the doctrinal outlook began with the addition of another characteristic of airpower--firepower delivery. Firepower was a function of high rates of fire, accuracy, reaction times, and "maximum power weapons."⁸⁷ However, the publication retained the emphasis on the synergistic effect of surprise. (8) Expounding on the spectrum of conflict and extending the theater of operations into outer space, air superiority remained an important goal. Realizing the potential of nuclear weapons targeted against the United States, the manual directed that opposing forces should be destroyed as far away from the American homeland as possible. In achieving air superiority, the Air Force would determine the outcome of the war--directly through aerospace power. (9) The need for superiority existed across the spectrum of conflict from peacetime to total war. (10) The manual declared, in even stronger words than its predecessors, that "the nation ...that maintains predominance in the aerospace... will have the means to prevail in conflict." (13) Thus the 1959 draft continued to move away from explicit targeting guidance, to move towards more general operating principles, and to advocate airpower as the decisive force in war. Yet while the premier

doctrinal publication began to give decreased coverage to strategic bombardment, other manuals were emerging to fill the gap.

"United States Air Force Basic Doctrine" did not specifically address strategic bombing again until 1964 when AFM 1-2 was replaced by AFM 1-1. This publication incorporated the Kennedy administration's new outlook on nuclear arms. No longer were they merely another weapon in our arsenal. Instead came a realization that victory might bring "unacceptable damage." That realization brought the demand for to "seek objectives more prudent than his total defeat." Therefore, the doctrine advocated forces that could contribute across the entire spectrum of conflict, and do so with the minimum of collateral damage.⁸⁸ Airpower contributed to the total force package of the US through its range, mobility, responsiveness, and tactical versatility. AFM 1-1 still proclaimed the penetration capability of aircraft, but added new caveats.

Penetration was no longer assured, but was "acquired" through the addition of electronic jamming equipment and the physical suppression of defenses. The manual hinted at the need for mixed force packages in order to overcome defenses and the inaccuracy of existing air weapons. Charging that the single most important factor in target destruction was accuracy, AFM 1-1 called for development of more precise munitions. (2-2) It also discussed the targeting strategies available at the different levels of conflict.

In addressing general war, AFM 1-1 discussed the advantages and disadvantages of both counterforce and countervalue targeting, realizing a time and place for each. This recognized the ability of airpower to directly target either the military might of a nation or its civilian population/will. The ultimate goal was to strike decisively counterforce, so as to achieve national objectives prior to countervalue escalation. Therefore, the destruction would have not only a military value, but also a psychological one as well. In this regard, the nuclear weapon was seen as a psychological weapon in and of itself. AFM 1-1 proposed use at the tactical level, responding at an appropriate level to the threat, yet

providing increasing escalation. Yet despite the drive toward options at all levels of conflict, the manual neglected conventional strategic bombardment. It only foresaw the possibility of nuclear strategic attacks. The 1964 manual provided the official doctrine for the majority of the Vietnamese conflict, despite its neglect of conventional operations.

However, on 28 September 1971, the Air Force released a new AFM 1-1. But rather than provide more explicit guidance, it further muddled the water. While avoiding many of the more troubling operational doctrine issues,⁸⁹ it did provide a more concise repetition of the 1964 manual with the emphasis on the flexibility of airpower and its ability to respond to any threat at an appropriate level.(1-2) To the old characteristics of airpower (speed, range, flexibility, and mobility) it added versatility. (1-4) But rather than fighting, the manual defined the primary function of forces as that of "deterrence of military actions counter to US interests."(1-2)

Thus discussion of strategic attack shrank to one paragraph. While recognizing that conventional strategic attacks during mid- and high-intensity conflict were possible, it asserted that such missions were normally associated with high-intensity nuclear war. AFM 1-1 identified the goals of such attacks as those of destroying the enemy war-making capability or will to fight.(2-4) Therefore, the manual continued to address both the physical and psychological dimensions of strategic bombardment. Under "Conventional Operations," AFM 1-1 discussed penetration and determined that "conventional operations require the use of aircraft of such a scale as to be impracticable without air superiority. "(3-2) Thus while asserting that the limited firepower and accuracy of conventional ordnance required air superiority to protect numerous aircraft on repeated missions, atomic operations obviated this need through the superior firepower of individual bombers. In conventional operations, airpower gained superiority with interceptors, escorts, and repeated attacks against airfields. In nuclear strikes, attrition would be high, but tolerable This new AFM 1-1 was closely followed by AFM 2-11, "Aerospace Operational Doctrine: Strategic Aerospace Operations," a descendant of the earlier AFM 1-8. Patterned after the earlier manual, AFM 2-11 reiterated that both war-making capability and the "psychosocial

fabric" of a nation were strategic targets. Corresponding to the countervailing strategy of the day, the manual articulated the need for different attack options across the spectrum of conflict, and the need for secure command and control links to orchestrate the bombing campaign.⁹⁰ Again the manual voiced the need for both conventional and nuclear capability, global reach, and ample intelligence support.⁹¹ Yet, strategic aviation remained postured solely for general war. Although conventional ordnance was mentioned, the discussion centered almost totally on nuclear war --as if the drafters could not foresee strategic bombing below the level of nuclear war. The Strategic Air Command seemed to equate "strategic" bombing to nuclear warfare.

During the 1960s and early 1970s, the United States found itself absorbed in the war in Vietnam. Airpower played a key role in our effort and the results questioned the viability of existing doctrine. While Vietnam raised many issues regarding strategic bombing, two were continuations of on-going doctrinal concerns -- penetrability and destructiveness.⁹² Air Force efforts through the late '50s and '60s centered on the penetrability of Soviet airspace. The lethality of Soviet-built defenses around Hanoi led to the enhancement of electronic countermeasures (ECM) or jamming (electronically blinding or confusing) of enemy detection and tracking systems. Similar efforts in WWII with chaff⁹³ had good, though temporary, results against German radar system.⁹⁴ Later, the Air Force developed aircraft and crews specifically designed and trained to attack enemy defense while other aircraft penetrated to the targets. The concept enjoyed such success that it has continued to date with the F-4G wild Weasel program. Experiments using speed and altitude as alternatives failed and the USAF abandoned the B-58 and XB-70 (bombers designed for supersonic, high-altitude attack). Defense suppression and low altitude seemed to be the answers to preventing the detection and targeting of penetrating aircraft.⁹⁵

The air battle over North Vietnam taught the Air Force that the ability of large aircraft with correspondingly large payloads to penetrate was increasingly limited. Therefore, the smaller aircraft designated to perform the strategic bombing mission had to maximize the effectiveness of their diminished bomb loads. Precision guided munitions (PGMs) were one solution. Such munitions used

various means to achieve unprecedented accuracies. With such accuracies, their small bombs could actually exceed the destructiveness of less precise larger bombs--given certain weather and operational constraints. Designers achieved the accuracies with either target designator equipment on the aircraft to guide the bombs to their targets, or with expensive navigational systems within the weapon itself. The war in Vietnam sped their incorporation into future campaign plans. Even though precision munitions increased the effectiveness of the bombers, attrition was still high. Therefore, penetrability still dominated the strategic bombing agenda. For without the ability of aircraft and/or missiles to penetrate, there could be no strategic bombardment. As defenses continued to advance, aircraft needed something besides jamming and low altitude to ensure their survival.

On 15 April 1975, a new draft of AFM 1-1 superseded the 1971 edition. The new doctrinal manual once again altered the basic "characteristics of aerospace forces" seeing them as flexibility, responsiveness, survivability, and surveillance. Survivability had replaced the penetration ability of the past, and was seen as a function of "defensive countermeasures, penetration aids, and redundancy of system components."⁹⁶ Survivability and mission success were also driven by familiar employment principles.

This latest version of AFM 1-1, like its predecessors, continued to advocate initiative and surprise in aerospace operations,⁹⁷ and addressed the current aerospace missions. Strategic attack was the first mission listed with a purpose little changed from the earliest days of aerial bombardment. The purpose of strategic attack remained to destroy the enemy's war-making capabilities or his will to fight. The manual identified the need for both conventional and nuclear strategic attack (and even expounded extensively on nuclear combat in an additional section on "Employment of Aerospace Power in Modern Conflict," (3-4)), (3-2) but it failed to articulate a viable employment concept for conventional strategic bombardment. Within strategic nuclear war or theater nuclear war, targets included enemy military capability and/or politico-economic centers. However, there was no mention, as in earlier manuals, of the expected attrition of penetrating bombers. The bombers would still get through, with survival a

function of ECM, penetration aids, and redundant components.

However, only four years later, strategic attack had fallen in the list of Air Force responsibilities behind the air superiority mission and the basic organizing, training, and equipping of forces.⁹⁸ The 1979 version of AFM 1-1 rejected the traditional regulation format, and instead adopted a more contemporary appearance. The well illustrated manual also spent far more time on the political-military interaction than any previous editions. In the brief discussion of strategic offensive operations, AFM 1-1 stressed that such operations could be conventional or nuclear, and that the penetrating aircraft would use "many types of penetration aids to assist in reaching their target. "(2-8) In its discussion of the air superiority mission, it quoted Alexander de Seversky in saying that "We cannot and must not dream of conquering the enemy without first capturing dominance in the air...", (2-15) but did not address command of the air regarding strategic operations.

Instead, it merely listed survivability again as a capability of airpower. Such survivability in hostile territory was the result of I'[s]elf protection features, such as defensive countermeasures and redundant subsystems... hardening, decoys, maneuver, and defensive measures. "(3-4) Initiative remained a high priority, (5- 1) as did surprise. Surprise was the result of timing, place of attack, manner of attack, tactics, deception, and security. (5-5 through 5-6) Targeting guidance was conspicuously absent, as was the lesson of the WWII escort debacle --whether the answer lay in escort fighters or simply an assertion that the benefits of the bombing campaign would offset the expected losses. Therefore, the regulation changed little by what it said, but left much of what was contained in former doctrinal manuals unstated.

The manual was not updated for five years. In 1984, the new AFM 1-1 identified the characteristics of airpower as those of speed, range, and flexibility; the capabilities to include survivability (without any indication as to the roots of this capability); and the proper employment centered on the offensive (initiative) and surprise.⁹⁹ It maintained that the enemy will and war-making

capability were the primary targets, while now arguing for simultaneous tactical and strategic operations. Strategic attacks would still target "vital elements of the enemy war sustaining capabilities and his will to wage war." (2-11) This latest version of AFM 1-1 seemed to free the constraints between tactical and strategic with the ability of aircraft to perform either mission, depending on the need of the day. Air superiority remained the primary mission, with now even strategic bombardment restrained by the enemy air threat. "[Strategic] attacks may be limited by ...the intensity of enemy defenses...." (2-12) The USAF had stated doctrinally that the bomber would not always get through the defenses. The air commander had to consider attrition before committing strategic forces without air superiority. Bombing was still an option, using "speed, maneuverability, tactics, deception, efforts to dissipate or defer enemy defenses, and weapons characteristics and employment" to overcome enemy air defenses. (2-12, 2-13) Surprise was a key to successful mission accomplishment, but surprise required good intelligence. (2-17, 2-18, 2-21) Proper control of strategic assets also required simple and secure communications. (2-21) The 1984 manual stood as the doctrinal guidance for eight years pending a major revision.

In March 1992, Air Force Chief of Staff General Merrill A. McPeak promulgated the latest version of AFM 1-1. Aerospace control retained its position as the premier responsibility of air forces, with expansion to include defense suppression to protect striking aircraft.¹⁰⁰ Strategic nuclear and conventional attacks targeted enemy centers of gravity, including "command elements, war production, supporting infrastructure, ... and key military components. Strategic attack should be persistent and coordinated so as to affect the enemy's capability and possibly his will to wage war." (11) Yet the new manual recognized that the enemy's would be an "elusive objective." (12) AFM 1-1 also recognized other limits to strategic bombing. Finally incorporating the lessons of Korea and Vietnam, the text asserted that strategic attack, while still able to impact on war sustaining capabilities, was not as effective against agrarian nations. (12) Therefore, the manual also stepped back from the long-held assertion of the decisive nature of airpower with a caveat that strategic bombardment can be decisive "at times." (12) But while it looked backwards to incorporate the lessons of previous conflicts, it also looked

forward to the emerging technologies. The new manual integrated much of the evolving technology just as 1950s doctrine had incorporated nuclear weapons.

The 1992 AFM 1-1, in searching for the answer to the original bombing question of target destruction found a new answer. PGMs offered the opportunity to achieve the levels of destruction that had previously required much larger explosive devices. Finding PGMs weapons of "tremendous leverage," they offered the ability to reduce airpower expenditures and collateral damage. (12)

This manual, while it provides the latest doctrinal guidance for the Air Force, is yet the latest step in an on-going evolution. Taken alone, it provides a snapshot of official doctrine on strategic bombardment. Viewed as part of the continuing tapestry of doctrine, the threads yield an evolving set of doctrinal tenets concerning strategic bombardment.

While certain threads in the tapestry have remained relatively consistent, others are markedly different now than in the formative days of airpower doctrine. A summation of current tenets is shown below. These tenets reflect the evolution of the theory, history, and doctrine, to date, on strategic bombing in the United States Air Force. Though this list is not taken exclusively from AFM 1-1 (1992), given the doctrinal nature of the stipulations, the manual well supports the tenets therein. The tenets represent a synthesis of doctrine to date and a guide to current thinking in the USAF. The next chapter will address how well these tenets embrace the latest technical innovations and how firm a foundation they provide for future doctrinal evolution.

Current Tenets of Strategic Bombing Doctrine:

Airpower is inherently offensive. It is best exploited through initiative. Strategic bombardment is one of the independent missions of airpower and affords the ability for offensive action.

It can strike directly at the enemy without first defeating his forces in the field.

It can directly target the war-making ability of the enemy. It can also target the will of the enemy people

to fight, though the enemy will is an elusive target.

Surprise is a multiplier. Initiative has its rewards.

The bomber will get through. In nuclear war it will suffer higher attrition due to the lack of escort, but the destructive capability of the weapons will offset losses. Conventionally, air superiority is required. It is achieved through electronic and physical suppression. Conventional operations require mixed force packages to provide a synergistic effect on the mission accomplishment.

Accuracy is the principal problem of bombing. Less accuracy requires greater firepower, more sorties, and more resources. Lethality, as a measure of accuracy and firepower, is a goal requiring continuous R&D.

CHAPTER FIVE

STEALTH

"In the development of air power, one has to look ahead and not backward and figure out what is going to happen, not too much what has happened."

--General "Billy" Mitchell ¹⁰¹

Although the latest draft of the official Air Force doctrine stepped forward to embrace emerging weapons technologies, one key technical revolution it neglected was the emergence of stealth. Stealth seemed to be the next logical step along the continuum of ensuring bomber penetrability. Stealth, or "low observability technology," has been a developmental interest for years. In an effort to enhance survivability of aircraft in a threat environment, aircraft developers have searched for ways to reduce the ability of radar to detect and track the airframes within radar range. The answer seemed a combination of aircraft size, material, design (i.e., the absence of right-angles or boxes in the frame which provide the most radar reflection), and electronic deception (jamming or confusion). Though aircraft as early as the 1960s' vintage F-111 incorporated some stealth features, such as coating of critical areas with special materials to reduce radar returns, the first major investment into stealth came with the B-1B.

The B-1B was an attempt to ensure bomber penetrability through improved stealth features in an increasingly threatening environment. Compared to its predecessor, the B-52H, the B-1B was a marked improvement. Designers incorporated new, curved inlet ducts for the engines with stream wise radar-absorbent inlet baffles and inflatable wing seals (which are more absorbent than the original seals on the B-1A). The result of these design efforts, as well as others, was to reduce the radar cross-section (RCS) to one-tenth that of the B-52.¹⁰² Designers also planned to improve on the B-52 with more advanced electronic warfare (EW) equipment.

Stealth, through its ability to hide from enemy radar detection, has a synergistic impact on the EW assets of any airframe. Since the aircraft is less detectable, it is in a threat envelope for much less time. Given the same level of ECM protection, the enemy has much less time to overpower the jamming and target the attacker.¹⁰³ Planners intended to outfit the B-1B with state-of-the-art ECM, but their goal

has yet to be reached. Technical problems still prevent the fielding of an effective defensive avionics suite.¹⁰⁴ Yet the desire to improve penetrability with design and electronic stealth measures continued.

The F-117A was the first stealth airframe built from the ground up. The F-117A incorporated a "zig-zag" fuselage, typical of a radar absorbing design (RAD) to significantly reduce the RCS.¹⁰⁵ The aircraft was first operationally employed during the US invasion of Panama.¹⁰⁶ During "Operation Just Cause," two F-117As launched from their Nevada desert base to strike a field next to a major Panamanian military barracks. Their weapons exploded closely enough to the barracks to stun the occupants and allow American ground forces to assume control of the situation. The aircraft were not detected in flying to and from the target.

This mission illustrated the key issue of the new stealth technology--penetrability--an essential aspect of any strategic bombing campaign. Though the accuracy of the bombing was hotly debated following the mission, especially given the imprecise nature of the target (a vacant field close to the barracks), the mission did demonstrate the compatibility of precision munitions and the stealth concept. The combination of the penetrability and lethality demonstrated the qualities traditionally demanded by aerial bombardment advocates since the time of Douhet.

But how does stealth mesh with the tenets of strategic bombing? By taking each tenet and comparing the assets and liabilities of stealth, one can determine the compatibility of existing tenets, and perhaps suggest necessary revisions and/or additions.

Tenets of Strategic Bombing Doctrine:

1. Airpower is inherently offensive. It is best exploited through initiative.

As demonstrated in Panama, and again in the desert war in Iraq, stealth aircraft have the ability to conduct offensive operations in environments that hold considerable danger for more observable aircraft. By transitioning to stealthy airframes, the USAF has preserved its offensive ability and forestalled losses

given the current level of defenses.

Stealth similarly preserves the ability to control the initiative in an aerial campaign. Stealth permits air forces to carry out their own operational plans, despite the defenses arrayed against them. Without stealth, defenses could dictate the targets and timing of attacks, much as losses over Europe in WWII caused temporary stops in deep strikes against Germany. The ability of strikers to thwart defenses preserves the ability of airpower to preserve the initiative, or the ability to strike at a time and place suitable to creating the greatest advantage.

2. Strategic bombardment is one of the independent missions of airpower and affords the ability for offensive action.

a. It can strike directly at the enemy without first defeating his forces in the field.

b. It can directly target the war-making ability of the enemy. It can also target the will of the enemy people to fight, though the enemy will is an elusive target.

Stealth is truly an advantage in strategic bombardment and strengthens this basic tenet. As mentioned above, stealth press increasingly lethal defenses. Therefore, stealth strengthens the ability of air forces to conduct independent operations. Augmented by aerial refueling, stealth provides the backbone for the "Global Reach--Global Power" concept for future USAF planning.¹⁰⁷ By exploiting the range, penetrability, and lethality of the stealth systems, the Air Force forecasts itself to be the best service to protect American interests in a timely and forceful manner, despite the opposition and despite the large-scale redeployment of ground and air forces back to American territory. All of this is possible without first confronting the enemy forces in the field --a long- standing tenet of airpower. Stealth likewise obviates the need to confront the enemy in the air as well. By avoiding radar detection and tracking, stealthy airframes may even avoid the airborne battles that have been an inevitable element of bombing campaigns in past wars.

Stealth also offers unique targeting abilities. Because it can penetrate defenses and, coupled with PGMs, accurately destroy virtually any target subject to aerial attack, it strengthens the ability to destroy the capacity of the enemy to make war. Like a juggernaut, stealth assets have the ability to penetrate and deliver various combinations of nuclear and/or conventional munitions with unparalleled accuracies. However, speculation Though history has told that the will of the enemy is an elusive target, Janis also demonstrated in his studies that military morale decreases under continued bombardment when there is no chance to retaliate.¹⁰⁸ Given the inability of current systems to detect and track stealthy airframes accurately, defenses are subject to attack but have little ability to respond. Therefore, stealth may be an asset to the commander who wishes to undermine the resolve of the enemy military force. However, Janis also pointed out that civilians generally suffer from reduced resolve and lower morale only in the wake of "near miss" experiences.¹⁰⁹ Stealth, with its accurate payloads and reduced collateral damage, has a reduced ability to impact on civilian morale, barring a change in American philosophy to one of direct attacks against the enemy population.¹¹⁰ Experience to date seems to indicate that hoping to defeat the will to resist by social disruption and deprivation can lead to lengthy and frustrating campaigns. Janis discovered that while social deprivation produced a drop in morale, deterioration in wartime morale occurred most markedly in communities which suffered massive and repeated bombing attacks.¹¹¹ These are exactly the type of attacks that stealth and PGM technologies are designed to avoid.

Therefore, stealth strengthens the ability of the Air Force to conduct independent operations against the enemy without first defeating his forces in the field, including those in the air. It similarly strengthens the ability of strategic bombardment to attack the war-making capacity of the enemy, despite its location or defenses. However, given American political constraints and the desire to reduce or eliminate civilian casualties, the technology moves our forces further away from effective attacks on the enemy population's will to fight. Given that efforts are on-going to further develop stealth and PGM technologies, and given that American values are likely to become more rather than less restrictive, attacks on civilian morale and will to resist appear to be doctrinally unsound.

3. Surprise is a multiplier. Initiative has its rewards.

Surprise will continue to be an advantage to air warfare, and stealth enhances the ability of air forces to achieve that surprise. Surprise can occur at any level --strategic, operational, or tactical. Stealth, as its name implies, allows surprise through evasion of detection and tracking. Combined with the global reach of aerial assets, low observable airframes have the potential to arrive over target unannounced. This ability can catch defenses unprepared, or in a less than optimal posture. Such unpreparedness not only contributes to the survival of the attackers, but also to the results of the attack. Janis determined that insecurity and anxiety were greatest when individuals had insufficient time to seek shelter in a surprise attack. These feelings were further increased when defenses were also surprised and unable to return fire on the attackers. Anger towards the defenders frequently followed such attacks¹¹²

4. The bomber will get through.

a. In nuclear war bombers will suffer higher attrition due to the lack of escort, but the destructive capability of the weapons will offset losses.

b. Conventionally, air superiority is required. It is achieved through electronic and physical suppression. Conventional operations require mixed force packages to provide a synergistic effect on the mission accomplishment.

c. Accuracy is the principal problem of bombing. Less accuracy requires greater firepower, more sorties, and more resources. Lethality, as a measure of accuracy and firepower, is a goal requiring continuous R&D.

Stealth, above all else, was an effort to ensure penetrability. Previously, attrition of penetrating bombers was offset by the destructive power of the survivors. Survivability was enhanced through the laydown of ICBMs and SLBMs, whereby missiles were launched so as to destroy crucial defenses and targets prior to the arrival of the bombers. Additionally, ECM, low-level tactics, and speed were

essential to reaching objectives in enemy territory. Stand-off munitions prevented the need to penetrate the most heavily defended areas. Stealth will not only have these advantages working in its favor, but will also have its ability to evade normal detection. Therefore, it can not only penetrate, but also roam at will, searching for mobile targets. The confusion and degraded defenses below will only further enhance stealth capabilities. The larger issues become ensuring survivable command and control procedures to feed accurate and timely instructions and intelligence to the aircraft. These command and control links also require stealth to prevent disclosing the location of the attacker.

Similarly, stealth offers advantages in the conventional arena. Given the ability of stealth assets to evade detection and tracking, by both ground-based and aerial platforms, the need for air superiority becomes a question. While there is no doubt that air superiority remains a requisite for ground and naval operations, as well as for on-going operations with non-stealthy airframes, the need for escorting fighters and mixed force packages no longer exists. If air defenders cannot find the bomber, there is no need for an escort. If SAMs cannot track the striker, there is no need for defense-suppressing Wild Weasels. If there is no need for escorts and Weasels, then the tanker requirements drop drastically. Therefore, not only has stealth reduced the size of the force required for strategic bombing missions and thereby reduced the number of airmen at risk, but it has also severely reduced the supporting infrastructure required.

Given the compatible PGM capability, the strikers also ensure that fewer bombers are needed to accomplish the same mission with less collateral damage. While research and development must continue to provide increasingly accurate and reliable weapons systems, the result will mean that rather than fewer and fewer resources will be required to accomplish a given level of destruction. While a B-52 can carry fifty-one SOD-pound bombs, the B-1B can deliver 84 more accurately. The B-2 Stealth Bomber can carry an even larger load, even farther, with PGM accuracy.¹¹³ Therefore, doctrinally, the Air Force must lean forward to develop a doctrine compatible with smaller strike packages and more accurate munitions. While mixed force packages of bombers and escorts will continue to be important

given the number of non- stealth assets in the inventory, doctrine requires adjustment to incorporate the single-ship and few-ship strike formations into hostile environments, never envisioned before. Though this requires evolution in tactics as well, doctrinally the Air Force should fully develop the concepts alluded to in "Global Reach-- Global Power." Small strike packages offer an ability to deploy faster and with greater impact than ever in the past. Smaller organizations will have greater firepower and import in world events.

Therefore, current doctrinal tenets, though providing a good foundation for stealth technology, do require revision. But in order to anticipate the changes in the character of war fully, additional tenets are necessary.

CHAPTER SIX

PROPOSED NEW TENETS

"A wise man learns from his experiences; a wiser man learns from the experiences of others."

--Confucius¹¹⁴

While existing doctrinal tenets do largely anticipate and incorporate stealth, the new technology suggest some additions as well. The ability to penetrate, combined with the lethality of PGMs, negates much of the past rationale for nuclear weapons. Doctrine, as a driver of not only employment, but also acquisition, must embrace this concept; Americans will hardly tolerate the excessive destruction and wide-spread collateral damage associated with nuclear arms if it is less than necessary.

1. Precision munitions grant the ability for the single bomber to achieve significant results with conventional munitions.

Stealth is a continuum, and is not absolute. It is mutually exploitable by the both the offense and defense. To place too great a reliance on a rapidly evolving technology base would be as foolhardy as Douhet when he rested on the basic technology of manned flight. Stealth did take an increasingly lethal environment for penetrating aircraft and make it tolerable again. In doing so, it has removed the concept of strategic bombing from the endangered species list, at least temporarily, despite the technical advances in defense systems. Yet stealth is not a long-term panacea to penetration. Technologies already exist that can detect and track stealth aircraft. Over-the-horizon (OTH) radars, such as existing Soviet early warning systems or the Australian Jindalee OTH system, have already demonstrated the ability to detect stealth aircraft at long range.¹¹⁵ The Defense Department does not deny this capability, but merely argues that long-range detection is no substitute for the tracking necessary to stop penetration.¹¹⁶ Other technologies such as extra-low-frequency radars, carrier-free radar, and bi-static radars can also provide detection, as well as the necessary tracking to direct airborne or ground intercepts on penetrators. However, these capabilities are still on the technological horizon.¹¹⁷ Therefore, although temporary perhaps, stealth represents a retreat to the heady days of Douhet, immediately following WWI, when

defensive fighters and anti- aircraft artillery were unable to concentrate on attackers because they had so little warning of attack. The necessity to defend the entire perimeter of a front led Douhet to denigrate the power of a defense at all. While stealth is an attempt to step backwards to the early imbalance of power between the offense and defense in the air, and capitalize on temporary offensive superiority, current leaders cannot afford the luxury of assuming the defense will not exploit opportunities to recover an advantage. As a continuum, stealth requires vigilance and advancement. Defensive countermeasures will increasingly demand a marriage of performance and improved stealth characteristics. For like the nuclear genie, stealth is out of the bottle to stay. For the time being, stealth has promise.

2. The offense/defense balance is dynamic.

History is replete with technological advancements giving temporary advantage to either the offense or defense. The aircraft initially flew above and around threats to directly attack its target. Despite the limitations of its ordnance, it gave a brief advantage to the offense against defenders unable to detect and target it. However, the defense found new strength in early radar technologies in WWII. The Battle of Britain quickly demonstrated that radar had re-established a new balance between the attacker and defender. The offense countered and enjoyed temporary success with chaff and ECM. The defense re-established their footing based on better radar and interceptor technologies, electronic counter- counter measures, and better tactics.

Stealth is much like the above offensive advantages. It is temporary at best. It is also very expensive. Therefore, recognizing that current and proposed stealth systems will eventually be vulnerable, planners must incorporate a technical and operational flexibility into aircraft. This flexibility will allow technical upgrades to stealth and ECM assets as necessary and afford flexibility in future employment tactics. Failure to do so would risk arriving at some point in the future at which the defense can effectively counter all penetrating aircraft. This conclusion comes with a warning against excessive dependence on existing stealth technologies.

The above tenet and discussion on the stealth continuum also lead to another important point. Temporary advantages are powerful while they last. Stealth currently grants a powerful advantage to the offense. It affords unique possibilities. For stealth affects not only the airframe, but also the weapons. SRAM II and the Advanced Air Launched Cruise Missile both had stealth built into their designs. Stealth is not only important for penetration, but as Tom Clancy illustrated in his novel Clear and Present Danger, stealthy weapons design combined with stealthy delivery systems can give the nation the ability to respond militarily to world threats while maintaining plausible deniability.¹¹⁸ Research in weapons technology must keep pace with stealthy airframes to capitalize on all opportunities.

Perhaps as a corollary of the existing tenets and the proposed additions, one could view stealth as merely another technical step in the evolution of the bomber. With each step in the offense came a defensive counter. The bomber could get through, if it had an advantage. That advantage might be an escort, ECM, or now stealth.

3. Bomber penetration is not assured. Defensive augmentation improves the ability to penetrate. Low observable technologies significantly increase the odds of successful penetration.

Given the promise of stealth, current strategic bombing doctrinal tenets can remain largely unchanged despite the defensive threat. For the existing doctrine does not constrict the employment of stealth in strategic bombardment, though certain doctrinal changes would further embrace the new technology. From the 1970s until the mid-1980s, numerous studies attempted to terminate manned bomber operations, arguing the lethality of the environment made their penetration militarily impossible and the resulting casualties would be politically intolerable. The Brookings Institution performed one such study in an attempt to push the Air Force away from the manned bomber toward stand-off cruise missile carriers --forsaking bomber development. They concluded that attrition rates for penetrators would be too high to warrant bombers, and, therefore, cruise missiles which could flood defenses were a more viable option.¹¹⁹ Instead of abandoning the concept of strategic bombing due to the inability to

penetrate without excessive loss in aircraft and crews, stealth allows air forces to continue to look to the penetrating bomber as a force to attack the capability, though not will, of the enemy nation to make war. Target selection will still be based on analyses of key sectors of the military, economic, and political sectors to achieve a synergistic effect with each mission.¹²⁰ Therefore, stealth does not alter the basic doctrinal tenets, but rather encourages further evolution of that doctrine and forestalls previous pressures for change --changes directed towards diminishing the role of the manned bomber in strategic bombardment.

CHAPTER SEVEN

CONCLUSION

"In essence, courage is the ability to react positively to the challenge of the unknown. The unknown is in the main synonymous with the future, whose events are anticipated only in the light of experience, the sole heritage of the past."

--J. M. Cameron¹²¹

New doctrine grows from the tenets of old doctrine, fertilized with theory and experience.

Strategic bombing doctrine initially represented such a novel idea in warfare that no doctrinal base existed. While aviators awaited the emergence of a theoretical base, they codified their early experience into the lessons they had learned. Their concepts advocated the use of aircraft as an independent force to attack behind enemy lines. Douhet, also an early aviator, was the first to draft a comprehensive theory of airpower. His work represented the foundation for building strategic bombing doctrine. Using the air to attack the moral and physical support structure of the enemy directly, he argued that command of the air was necessary and sufficient for victory. Though Brodie and others would find fault with some of Douhet's arguments, the basic tenets of strategic bombing remained wedded to direct strikes against the moral and physical support structure for the army in the field, rather than the army itself. Each technical advance, from early bombsights to more powerful aircraft to the atomic bomb, brought airpower closer to the Douhetian ideal. As long as the bomber got through, technology provided an ever increasing level of accuracy and lethality with which to strike the foe. Faith in the ability of the bomber to penetrate, coupled with increasingly accurate and destructive weapons, drove Post-World War II doctrine. That doctrine was codified in successive manuals, the most recent of which was promulgated in 1992. Each manual built heavily on previous editions, each of which had a firm foundation on Douhetian theory. But aerial defense in recent years threatened the ability of the bomber to penetrate to exploit his high-tech weapons.

Stealth has emerged as the latest advancement in the see-saw advancement of offensive and defensive weaponry. With low observability technology comes the promise of a bomber that can continue to penetrate into the foreseeable future. Though stealth itself represents a major advancement in

aviation technology, it does not warrant a major revision in aerial doctrine. These aircraft can continue to attack the will and capacity of the enemy to wage war through direct attacks on vital targets. (Though stealth and precision munitions will further undermine the ability of American aviators to attack civilian will effectively, the military will is still a very accessible target.) Though the definition of "vital" may change in the future, as it has in the past, experience and doctrinal evolution would indicate that airpower advocates will continue to search for the key targets and orchestrate an air campaign with strong foundations in traditional strategic bombing doctrine.

While traditional tenets remain largely unchanged, some minor evolution will occur in doctrine. Stealth and precision munitions currently give the single bomber the power of a multi-ship strike force of the past. This power was aptly demonstrated by single F-117A aircraft attacking heavily defended targets during Operation Desert Storm, with lethal precision. Yet doctrine must also recognize that the offense/defense balance is dynamic. It must incorporate the importance of stealth to both the offense, while anticipating the defensive reactions. As the defense reacts, once again the bomber will be increasingly threatened. It will not always get through to the target, but will require increasingly sophisticated defensive augmentation. Stealth is but one aspect of a total package of self-protection measures. Combined with current ECM, it is enough for now. Yet, it will not be sufficient into the future.

Doctrine that stagnates becomes dogma. Howard warned of the dangers of dogma. He stated that no doctrine is ever totally correct at the beginning of a war. Instead, the ability of the force and its supporting doctrine to adapt rapidly to the demands of the environment will be the margin of victory. Dogma inhibits progress as it stifles the machinery of flexibility and change. Therefore, it is essential for the United States Air Force to examine existing doctrine critically in the light of new technical advancements, to incorporate the lessons of former conflicts, and to anticipate the needs of the future. To stop that analysis and adjustment at any point, intellectual or technical, is to take one step closer to dogma.

Stealth is but one more thread sewn into the tapestry designed by Douhet. It is driven by his design, but falls far short of completing the project. As a concept, it is combat proven in Panama and Iraq. Yet, it provides another fold to doctrine, not an absolute truth or perfect solution. Therefore, it is essential that doctrine look both backwards and forwards to incorporate this change in order that it remains the flexible and powerful tool that it is intended to be.

"Victory smiles on those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur."

--Air Marshal Giulio Douhet¹²²

NOTES

1. Quoted in Military Air Power: The CADRE Digest of Air Power Opinions and Thoughts, compiled by Lieutenant Colonel Charles M. Westenhoff, USAF (Maxwell AFB, Alabama: Air University Press, 1990), 89.
2. Robert Jackson, Airships: A Popular History of Dirigibles, Zeppelins, Blimps and Other Lighter-Than-Air Craft (Garden City, New York: Doubleday & Company, Inc., 1973): 33.
3. United States Department of State, Catalogue of Treaties: 1814-1918 (Washington, D.C.: U.S. Government Printing Office, 1919): 194. On 29 July 1899, The First Hague Convention prohibited the dropping of explosives from balloons. This Convention was not continued beyond the first review in 1904. By this time, progress in dirigible flight had overcome fears and demonstrated the military value of aerial bombardment.
4. Michael Howard, "Military Science in an Age of Peace," Journal of the Royal United Services Institute for Defense Services, Vol. 119, No.1, 1 March 1974: 3-11.
5. Cited in CADRE, 78.
6. Oxford American Dictionary, compiled by Eugene Ehrlich, Stuart B. Flexner, Gorton Carruth, and Joyce M. Hawkins (New York: Oxford University Press, 1980), 711.
7. Harold R. Winton, "A Black Hole in the wild Blue Yonder: The Need for a Comprehensive Theory of Air Power" (paper presented to the 58th Annual Meeting of the American Military Institute at Durham, N.C., March 22, 1991), 4-5.
8. Italian multi-engine aircraft, manufactured by Douhet's personal friend Giovanni Caproni before, during, and after WWI, favored the development of a strategic bombing theory.
9. Giulio Douhet, Command of the Air, trans. Dino Ferrari, eds. Richard H. Kahn and Joseph P. Harahan (Washington, D.C.: Office of Air Force History, 1983), 57. Douhet addresses the unique geography of Italy and the ability of airpower to defend the northern mountain passes and the water approaches. Ground power and naval forces do not provide the same measure of response and destructiveness. However, in his late work, "The War of 19__," Douhet applies his theory to a future Franco-German conflict.
10. Douhet, Command, 179.
11. Douhet, Command, 58.
12. Douhet, Command, 132.
13. Giulio Douhet, "Probable Aspects of the War of the Future," (a monograph published in April 1928) in Command of the Air, trans. Dino Ferrari, eds. Richard H. Kahn and Joseph P. Harahan, (Washington, D.C.: Office of Air Force History, 1983), 196.
14. Douhet, "Probable," 196.
15. Douhet, "Recapitulation," 281.
16. Douhet, Command, 59-60. Though Douhet wanted to target vital centers, he stated, "The choice of enemy targets... is the most delicate operation of aerial warfare. The truth of the matter is that no hard and fast rules can be laid down on this aspect of aerial warfare. It is impossible even to outline general standards, because the choice of enemy targets will depend upon a number of circumstances, material, moral, and psychological, the importance of which, though real, is not easily estimated."

17. Douhet advocated the use of high explosives to cause massive destruction, incendiary bombs to start fires in the wreckage, and chemicals to prevent disaster relief workers from performing their duties. In this way, airpower would drive populations away from cities and the centers of production. These thoughts are reflected not only in Command of the Air, but also in "Recapitulation" and "The War of 19_." These works postdate Command of the Air.
18. Giovanni Caproni File. Personal correspondence (with translations) between Giovanni Caproni and Giulio Douhet contained within the Caproni File at the United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 168.661-27. Letter cited dated March 13, 1918.
19. Douhet, Command, 128.
20. Douhet, Command, 65.
21. Bernard Brodie Strategy in the Missile Age (Princeton, New Jersey: Princeton University Press, 1971). Strategy in the Missile Age was first copyrighted in 1959, but was not published commercially until 1965.
22. Brodie, Strategy, 104.
23. Brodie, Strategy, 148-160.
24. For Douhet, this meant the enemy bomber force. For Brodie, the term was far more encompassing, including bombers and missiles.
25. Brodie, Strategy, 152-160.
26. Brodie, Strategy, 166.
27. Brodie, Strategy, 130-131.
28. Brodie, Strategy, 131.
29. Underlying this tenet is the concept that there will be many limited wars where airpower will not be decisive. There must be a credible limited war option. However, in Strategy (p. 144) Brodie does state, "No campaign on a comparable scale is likely ever again to be carried on between great belligerents with HE or other chemical bombs,...because technological developments have made long-range sorties with bombers or missiles far too costly to be acceptable as means of delivering bombs of such very limited capability." The accuracy of his prediction is questionable. Large scale bombing efforts in Korea and Vietnam did not involve nuclear weapons, though some military leaders did argue for their use. Likewise, those conflicts could easily fall within his definition of limited wars. The strategic bombardment campaign during Desert Storm likewise did not involve nuclear arms, but did involve stealth and precision guided munitions technologies. Numerous conflicts since the dawning of the nuclear age demonstrate that nations can prosecute large-scale bombing efforts without nuclear arms. The accuracy of Brodie's prediction therefore depends upon the reader's interpretation of Brodie's use of the term "limited war" and the reader's definition of the term "decisive."
30. Cited in CADRE, 172.
31. Dennis M. Drew and Donald M. Snow, Making Strategy: An Introduction to National Security Processes and Problems (Maxwell Air Force Base, Alabama: Air University Press, 1988), 163-164.
32. Modern Warfare & Society, Vol. I, ed. Lieutenant Colonel Robert C. Ehrhart, (United States Air Force Academy, Colorado: Department of History, 1982), v-vii.
33. Drew and Snow, Making, 164-166
34. Allan W. Howey, Military History and Doctrine, ACSC Vol. V, (Air Command and Staff College, Maxwell Air Force Base, Alabama: Air University Press, 1989), 13-15. Drew and Snow (Makino, pp. 164-165) also relate the importance of "extrapolations of experience" judged by "logic, intuition,

and 'gut feelings.'" However, they seemed to imply that such extrapolations are relevant only in the absence of an experience base upon which to rely.

35. Laurence S. Kuter, "Air Power --The American Concept," Unpublished speech from 1943 contained in the United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 167.6-50(NC).
36. Edgar S. Gorrell, "History of the Air Service, AEF," in ~ U.S. Air Service in World War I, Vol. II, ed. Maurer Maurer (The Office of Air Force History, Washington, D.C.: U.S. Government Printing Office, 1978), 143.
37. Gorrell, "History," 145-149.
38. William C. Sherman, "Tentative Manual for the Employment of Air Service," in The U.S. Air Service in World War I, Vol. II, ed. Maurer Maurer (Washington, D.C.: U.S. Government Printing Office, 1978), 313-408.
39. Sherman, "Manual," 314-318.
40. Thomas H. Greer, The Development of Air Doctrine in the Army Air Arm 1917-1941 (Office of Air Force History, Washington, D.C.: U.S. Government Printing Office, 1955), 16.
41. Greer, Development, 14-15.
42. Martha Byrd, Chennault: Giving Winos to the Tiger (Tuscaloosa: The University of Alabama Press, 1987), pp. 38-39, 48-49, 50-51, and 78-80. Chennault arrived at ACTS in August 1930. He agreed that air superiority was essential, but disagreed with strategic bombing advocates on the proper means to accomplish the mission. He argued for stronger pursuit aviation as opposed to a determined bomber offensive as the best means destroying enemy aviation. Opposing close support of bombers, he felt that fighters should be free to search out aerial battle. Later during his tenure in China, Chennault came to appreciate the power of bombardment gain command of the air. In May, 1943, Chennault drafted a campaign plan to render the Japanese Air Force "ineffective." In addition to fighter sweeps, he too depended on strategic bombardment to strike directly at Japan and at the vulnerable lines of communication in pursuit of these goals. For information on the air campaign see Claire Chennault, "A Plan for Operation of Air Force in China," Dated 13 May 1943; and CLC Papers; Plan of Operations in China, Dated 30 April 1943, United States Air Force Historical Research Agency, File number 862.317.
43. Greer, Development, 37-40.
44. Training Regulations were not approved at the higher levels of the War Department. As such, they did not represent official doctrine. Sanctioned doctrine was reflected in Field Manuals, approved by the War Department.
45. TR 440-15 "Fundamental Principles for the Employment of the Air Service," January 26, 1926. Department of War, Washington, D.C.
46. Air Service Tactical School, "Employment of Combined Air Force," Air Service, Department of War, April 6, 1926, 1-5.
47. Greer, Development, 40.
48. "Employment," 1.
49. "Employment," 3.
50. "Employment," 11-14.
51. Haywood S. Hansell, The Strategic Air War Against Germany and Japan, ed. Richard H. Kahn and

Joseph P. Harahan (Office of Air Force History, Washington, D.C.: U.S. Government Printing Office, 1986), 27.

52. Office of the Chief of the Army Air Force, "AWPD/1: Munitions Requirements of the Army Air Forces," War Department, Washington, D.C., August 12, 1941, United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 145.82-1 Part 2. Citation is from Tab 2b, pp. 4-6. Also see Haywood Hansell, The Air Plan that Defeated Hitler (Atlanta, Georgia: Higgins-McArthur/Longino & Porter, Inc., 1972), 40-51.
53. Hansell, *Strategic*, 41.
54. Hansell, *Air War*, pp. 56-59.
55. Combined Chiefs of Staff, Plan for Combined Bomber Offensive from the United Kingdom, 14 May 1943, United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 119.04-6, p. 1. The Combined Chiefs of Staff state that, "The mission of the U.S. and British bomber forces, as prescribed by the Combined Chiefs of Staff at CASABLANCA, is... to accomplish the progressive destruction and dislocation of the German Military, industrial, and economic system and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened." For further discussion, also see Hansell, *Air War*, 56-59.
56. "Outline Notes on the Strategic Bombardment Survey." Attachment to letter from the Strategic Bombing Survey office in London to Colonel R. D. Hughes, ODI, USSTAF, dated 9 August 1944. The attachment documents work to date on the survey, concentrating on basic aims, organizational considerations, and outstanding items. United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 519.55A.
57. The plans for the Strategic Bombing Survey were discussed by President Roosevelt and Marshal Stalin at the Yalta conference. The Americans departed thinking that there was unanimity of understanding as to both the general and specific plans to conduct operations in Soviet occupied territory. However, the survey team repeatedly complained to General Marshall about the Soviet General Staff delaying and canceling inspection tours. The team eventually deduced that inspection requests would be only selectively approved based on Soviet assessments of necessity. They further relayed that it was increasingly obvious that the Soviets "did not want us to know the reactions of the [occupied territory's] population to Russian Control." Letters from the Strategic Bombing Survey Team to General Marshall and Headquarters USSTAF from 16 March 1945 to 20 April 1945. Citation is from 19 March. United States Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 519.55A: 1944-1945 and 519.55A-1: 1945.
58. The United States Strategic Bombing Survey: Summary Report (European War) (Maxwell Air Force Base, Alabama: Air university Press, 1987), 6-9.
59. Strategic (European), 39.
60. Strategic (European), 39-40.
61. For a full discussion on the decision to attack the transportation network, see: W. W. Rostow, Pre-Invasion Bombing Strategy: General Eisenhower's Decision of March 25 1944 (Austin: University of Texas Press, 1981). For a comprehensive discussion of the impact of the attacks on the transportation network, see: Alfred C. Mierzejewski, The Collapse of the German War Economy, 1944-1945: Allied Air Power and the German National Railway (Chapel Hill: The University of North Carolina Press, 1988).
62. Orvil A. Anderson, letter to the Secretary of War, through the Commanding General of the Army Air Forces, concerning the Final Summary Report of the Strategic Bombing Survey, covering the war

against Japan, dated 11 July 1946. The letter summarizes the findings of the study. United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 137.701-1A: 1946.

63. The United States Strategic Bombing Surveys: The Japanese wartime Standard of Living and utilization of Manpower. Manpower, Food and Civilian Supplies Division, United States Strategic Bombing Survey (January 1947), 46-47 and 99-101.
64. United States Strategic Bombing Survey: The Effects of Strategic Bombing on Japanese Morale. Morale Division, United States Strategic Bombing Survey (June 1947), 64-71.
65. Morale, 4.
66. Wartime Standard, 99-112; and Morale, 1-6.
67. Robert F. Futrell, The United States Air Force in Korea:- 1950-1953, Revised edition, Office of Air Force History (Washington, DC: U.S. Government Printing Office, 1983), 334.
68. Departments of the Army, the Navy, and the Air Force. FM 110-5/JAAF/AFM 1-1, "Joint Action Armed Forces," 19 September 1951, Washington, D.C.: U.S. Government Printing Office, 1951, ii.
69. FM 110-5/JAAF/AFM 1-1, iii. Subsequent citations from this publication are parenthetically annotated within the text.
70. Clodfelter, Mark. "Precursors to the Storm: An Overview of American Air Campaign Planning, 1917-1964." School of Advanced Airpower Studies. Unpublished paper. p. 26.
71. USAF Historical Study No. 127: "The United States Air Force Operations in the Korean Conflict, 1 July 1952-27 July 1953," 1 July 1956, p. 5, Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 101-127.
72. Study No. 127, 25.
73. Study No. 127, 26.
74. For a full discussion of the targeting of the hydroelectric resources see USAF Historical Study No. 127: United States Air Force Operations in the Korean Conflict, 1 July 1952-27 July 1953 (1 July 1956); and "The Attack on Electric Power in North Korea," Air University Quarterly Review, Vol. VI, No.2 (Summer 1953), 13- 30.
75. "Reservoirs and Irrigation Complexes: Hwanghae and South Pyongan Provinces." Inclosure No.3, in "Minutes of FEAF Formal Target Committee Meeting, 24 March 1953," in "FEAF Formal Target Committee Minutes, 30 December 1952-24 March 1953, United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama HRA K720.151A. Also see, "The Attack on the Irrigation Dams in North Korea: A Quarterly Review Staff Study," Air University Quarterly Review, Vol. VI, No.4 (Winter 1953-54), 40- 61. In addition to the damage predicted based on the "vital relationship of the irrigation darn system to the whole national economy...", (43) aviators also justified the attacks based on the flood damage to North Korean lines of communication.
76. Clodfelter, p. 32.
77. Department of the Air Force. AFM 1-2, "United States Air Force Basic Doctrine" March 1953, United States Air Force, Washington, D.C.: U.S. Government Printing Office, .1953. p. i. Subsequent citations from this manual are annotated in the text.
78. AFM 1-2 (1953), 11. AFM 1-2 discussed the goal of aerial operations, including comparisons to land and naval forces. While surface forces "were occupied with the destruction of like forces..." air forces "made it no longer necessary to defeat opposing armed forces as a prerequisite to destroying the sustaining elements of a nation's strength. Therefore, the conventional buildup phase subsequent to the initiation of hostilities and preparatory to taking the offensive may no longer be necessary,

and in any event, can no longer be assured. "Like Douhet, Vandenberg predicted the decisiveness of airpower through the sheer level of destruction and social disruption. Like Brodie, he felt that airpower would be decisive before armies could mobilize and navies deploy.

79. "The Power to Penetrate," *Air University Quarterly Review*, Vol. VI, No.4 (Winter 1953-54), 29.
80. Marcelle S. Knaack, Encyclopedia of U.S. Air Force Aircraft and Missiles, Volume I, Post-World War II Bombers 1945-1973. Office of Air Force History (Washington, DC: U.S. Government Printing Office, 1988), 6. Carswell AFB, Texas received the B-36 bomber in November of 1948. On December 7-8, 1948, Carswell flew the new bomber on a 35.5-hour, 10,000-mile sortie to demonstrate its capabilities. No fighter of the period was capable of such endurance or range.
81. Knaack, 39. The Air Force briefly experimented with parasite fighters. Under this scheme, the fighters and bomber would launch separately and then rendezvous in flight. The fighter would then attach itself to the bomber until needed for escort. The bomber had to be capable of launching, recovering, and servicing the fighter in flight. The Air Force used B-36Ds and F-84Fs in the tests before canceling the project.
82. Department of the Air Force. AFM 1-3, "Air Doctrine: Theater Air Operations," 1 April 1954, United States Air Force (Washington, DC: U.S. Government Printing Office, 1954), 1. Subsequent citations are embedded in the text. AFM 1-3 did differentiate between theater and strategic forces. "Theater forces are designed primarily to accomplish the mission .of a theater of operations, while strategic air forces are designed primarily to wage a sustained air war against the heartland of an enemy nation. While these mission normally have different specific objectives, each force has the capability of supporting the other to produce interrelative effects." (7) Thus the manual recognized the overlap of mission areas and capability.
83. The 1 April 1954 edition of "United States Air Force Basic Doctrine" was a word-for-word copy of the 1953 manual.
84. Department of the Air Force. AFM 1-8, "Air Doctrine: Strategic Air Operations," 1 May 1953, United States Air Force (Washington, DC: U.S. Government Printing Office, 1953), 1. Subsequent citations from this manual are annotated in the text.
85. AFM 1-8 (1954), 1, 3, and 11. "While control of the air remains essential to the late exploitation phases of operations and to the defense of land and sea areas, the motives and capabilities of the initial offensive render the conduct of that offensive possible without first defeating the enemy air force."(1) The manual went on to state that diversion and escort were important, and that theater and naval air forces "contribute greatly to the strategic air operation by performing these functions. "(11) Such forces could not only provide escort, but were also capable of joining the strategic effort with improvement in range capability. (3) In this regard, air leaders seemed to incorporate some of the lessons of Korea, when air-to-air losses of bombers in the Yalu Valley temporarily forced the Air Force to suspend bombing in the area. For further discussion of the stand down, see Thomas G. Mashos, 1stLt., "History of the 91st Strategic Reconnaissance Squadron, Medium, Photo: 1 June 1951-30 June 1951." 91st Strategic Reconnaissance Squadron, Yokota Air Force Base, Japan, 1951. United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA K-SQ-RCN-91-HI (June 1951).
86. Department of the Air Force. AFM 1-2, "Air Doctrine: United States Air Force Basic Doctrine," 1 April 1955. United States Air Force (Washington, DC: U.S. Government Printing Office, 1955),4.
87. Department of the Air Force. AFM 1-2, "Aerospace Doctrine: United States Air Force Basic Doctrine," 1 December 1959. United States Air Force (Washington, DC: U.S. Government Printing Office, 1959), 6.
88. Department of the Air Force. AFM 1-1, "Aerospace Doctrine: United States Air Force Basic Doctrine," 14 August 1964. United States Air Force (Washington, DC: U.S. Government Printing

Office, 1964), p. 1-2.

89. Department of the Air Force. AFM 1-1, "Aerospace Doctrine: United States Air Force Basic Doctrine," 28 September 1971. Department of the Air Force (Washington, DC: U.S. Government Printing Office, 1971), p. 1-2. The manual referred these questions to the 2- and 3- series publications--publications that were never written in many cases.
90. Department of the Air Force. AFM 2-11, "Aerospace Operational Doctrine: Strategic Aerospace Operations," 5 July 1972. United States Air Force (Washington, DC: U.S. Government Printing Office, 1972), 1.
91. AFM 2-11 (1972), pp. 2-3. "A high order of Intelligence data on the entire spectrum of the enemy war-making structure is fundamental to the selection of targets."
92. Airpower also raised the question of compatibility with political objectives. Daniel J. Hughes, in a summary of Barry P. Posen's The Sources of Military Doctrine, identified a central problem for military organizations which was apparent in Vietnam. "[B]ecause military organizations seek autonomy, their offensive doctrines are usually poorly integrated with the political aspects of grand strategy." (Quoted in CADRE, 114-115) For a further discussion on the political-military context of airpower in Vietnam, see Clodfelter, The Limits of Air Power: The American Bombing of North Vietnam, 1989.
93. Chaff is small strips of metal, or metal wire, released into the air to confuse radar. The metal strips reflect the radar waves and draw attention away from the object distributing the chaff.
94. Martin Middlebrook and Chris Everitt, The Bomber Command War Diaries: An Operational Reference Book: 1939-1945 (London: Penguin Books, 1990), pp., 410-412 and 447-449. Further documentation of "window" and ECM effectiveness can be found in operational test and evaluation reports from Eighth Air Force bombing missions over Germany in WWII. See Operational Analysis Section, Eighth Air Force, Analysis of Window and Carpet Protection for the Month of October, Report number OAD-70, dated 30 November 1944 United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 520.310; and Eugene Fubini, Gregg Stephenson, and David Park, A Manual of Electronic RCM, Operational Analysis Section, Eighth Air Force, dated 18 October 1944., United States Air Force Historical Research Agency, Maxwell Air Force Base, Alabama, HRA 510.310.
95. Bill Sweetman, "The Survivable Bomber," International Defense Review Vol. 20, no. 8 (August 1987, 1013-1015).
96. Department of the Air Force. AFM 1-1, "Aerospace Doctrine: United States Air Force Basic Doctrine," 28 September 1971. United States Air Force (Washington, DC: U.S. Government Printing Office, 1971), p. 2-1.
97. AFM 1-1 (1975), p. 2-2. Initiative allowed aerial forces, as in the past, to gain quick control over the air battle and have early decisive results. Surprise, through the use of "speed, maneuverability, deception, and innovative tactics,... can achieve concentration of fire power at times and places unexpected by the enemy. The advantages gained by surprise may far exceed the advantages of numerically superior enemy forces and positions.
98. Department of the Air Force. AFM 1-1, "Functions and Basic Doctrine of the United States Air Force," 14 February 1979, U.S. Government Printing Office: Washington, D.C. Subsequent citations are included in the text.
99. Department of the Air Force. AFM 1-1, "Basic Aerospace Doctrine of the United States Air Force," 16 March 1984. United States Air Force (Washington, DC: U.S. Government Printing Office, 1984), pp. 2-1 through 2-10).
100. Department of the Air Force. AFM I-I, Volumes I and II, "Basic Aerospace Doctrine of the united

States Air Force," March 1992. United States Air Force (Washington, DC: U.S. Government Printing Office, 1992), 11.

101. Cited in CADRE, 86.
102. Sweetmen, "Survivable," 1013-1014.
103. Sweetman, "Survivable," 1016.
104. Lieutenant Colonel Barry Chisholm of the Air Command and Staff College, interview by the author, 29 October 1991, Air Command and Staff College, Maxwell Air Force Base, Alabama. Lt Col Chisholm formerly worked in the Electronic Warfare Analysis Division of the Headquarters Air Force at the Pentagon and was charged with monitoring the B-1B ECM development problems from 1987-1989.
105. Doug Richardson, "Is Stealth Misleading?", Interavia Aerospace Review (October 1989), 968-969.
106. Broadens Daytime Operations," Aviation Week & Space Technology, Vol. 132 (5 March 1990), 30.
107. Donald M. Rice, The Air Force and U.S. National Security: ability to target enemy will.
108. Irving L. Janis, Air War and Emotional Stress: Psychological Studies of Bombing and Civilian Defense, The RAND Corporation (Westport, Connecticut: Greenwood Press Publishers, 1951), 150-152.
109. Janis, 144-145. "Near misses" are defined as close personal involvement associated with the effects of an attack. Examples include personal injury, loss of a family member, loss of personal property, loss of sleep, and/or impaired health. Near misses are more of a factor in area bombing than in selective precision strikes against purely military targets.
110. For a comprehensive discussion on the impact of morality on strategic bombing doctrine, see Edward C. Holland, Lieutenant Colonel, USAF, "Fighting with a Conscience: The Effect of an American Morality on the Evolution of Strategic Bombing Campaigns" (unpublished thesis, School of Advanced Airpower Studies, Air University, 1992). This morality in targeting is also closely associated with the political dimension of strategic bombing discussed in Clodfelter's The Limits of Airpower: The American Bombing of North Vietnam.
111. Janis, 151-152. Janis did determine that continued bombing did heighten intragroup aggression. This aggression frequently found vent against home authorities as well as the enemy. Hostility was most often directed against the home country when there were perceptions that defensive preparation was lacking, there were regular and predictable raids, and there was a failure to retaliate. While stealth does afford the advantage of denigrating defensive preparations and denying the immediate retaliation against attackers, predictability would deny the advantage stealth has in maintaining initiative in time and place. To sacrifice such initiative in order to inflame civilian hostilities would represent a misallocation of resources, given the inability to accurately predict or control the emotions engendered. Likewise, stealth denies the opportunity to retaliate against the attackers, if they cannot be detected and tracked, yet it does not prevent retaliatory strike via other means, including the rapidly proliferating intermediate range ballistic missiles. Unanswered social calls to retaliate tend to divert anger away from the enemy and onto the home government.
112. Janis, 119.
113. Major Michael Skinner of the Headquarter Air Force Chief of Staffs Operations Group, interview by the author, 25 February 1992, Pentagon, Washington, DC.
114. Quoted in Military Air Power: The CADRE Digest of Air Power Opinions and Thoughts, compiled by Lieutenant Colonel Charles M. Westenhoff, USAF (Maxwell AFB, Alabama: Air University Press, 1990), 11.

115. Bill Sweetman, "And Now, the Stealth-Defeating Radar!" Interavia Aerospace Review (April 1987), 331-332.
116. Bill Sweetman, "Stealth Technology Put to the Test," Interavia Aerospace Review (August 1990), 648.
117. Sweetman, "Stealth-Defeating," 332-333.
118. Tom Clancy, Clear and Present Danger (New York: G. P. Putnam's Sons, 1989), 426.
119. Alton H. Quanbeck and Archie L. Wood, Modernizing the Strategic Bomber Force: Why and How (Washington, D.C.: The Brookings Institution, 1976), 93-98.
120. Martin van Creveld, Technology and War: From 2000 B.B. to the Present (New York: The Free Press, A Division of MacMillan, Inc., 1989); and I. B. Holley, Jr., Ideas and Weapons (Office of Air Force History, Washington, D.C.: U.S. Government Printing Office, 1953). Both van Creveld and Holley articulate the necessity for equipment and doctrine to conform to each other. A mismatch can produce disastrous results. There must be a parallel evolution between the two. Examples of poor matches would be using an air force designed for close air support in a strategic bombing role, as in the German Stuka in the Battle of Britain. An example where efforts to mate tactical doctrine to equipment forced a cancellation of a planned acquisition would be the XB-70. The high altitude supersonic bomber was unable to conform to the change to low-level penetration tactics.
121. Quoted in Military Air Power: The CADRE Digest of Air Power Opinions and Thoughts, compiled by Lieutenant Colonel Charles M. Westenhoff, USAF, (Maxwell AFB, Alabama: Air University Press, 1990), 147.
122. CADRE, 85

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