THE INVINCIBLE BOMBER—IN SEARCH OF LOKI'S ARROW

BY

DAVID H. DONATELLI II, Major, USAF

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APPROVAL

The undersigned certify that this thesis meets master's-level standards of research, argumentation, and expression.

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Dr. James M. Tucci (Date)

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Dr. Richard R. Muller (Date)

DISCLAIMER

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

ABOUT THE AUTHOR

Major David H. Donatelli II is a United States Airman. He has served as a B-52H Electronic Warfare Officer, Weapons Officer, and on the Air Force Global Strike Command staff. He has been a nuclear certified aviator for over a decade and has fought in the skies over Afghanistan. Upon graduation from the School of Advanced Air and Space Studies, he will be the Director of Operations for the 340th Weapons Squadron at Barksdale Air Force Base, Louisiana.

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ABSTRACT

The advent of the aircraft inspired some to think of airpower as a means of ending war in a quicker and more cost effective manner. The bomber became the manifestation of this idea. Prior to becoming Prime Minister of Great Britain, Stanley Baldwin opined there was nothing more fearsome than the bomber as it could get through enemy defenses. The idea that the bomber will always get through has been a hallmark of United States Air Force (USAF) doctrine.

Belief in this dogma drove the early development of US airpower; however, combat operations for over a century challenged repeatedly the ideology's validity. Despite much contrary evidence, the thought still dominates in some corners of the Air Force. Perhaps the most troubling is its persistence in the area of nuclear bomber operations. Considering that a conflict requiring bombers loaded with nuclear munitions could be the man's last conflict, it would be a disappointing time to discover that the invincible bomber was indeed a myth.

The purpose of this paper is to explore, through three case studies, if the idea of the bomber always getting through is true. The three case studies are World War II, the Vietnam Conflict, and the Persian Gulf War. Each of the case studies examines how military organizational structure, technology, and thought affected how the USAF viewed the bomber. The USAF's view on the use of the bomber swings like a pendulum between the supplement and the complement. The bomber as a supplement represents the weapons systems as a stand-alone war-winning asset. Conversely, the bomber as a complement recognizes that it is just a part of the overall war effort.

In two of the case studies, World War II and Vietnam, the bomber is planned as a supplement until faced with the crucible of battle, and then it shifts to a complement. In the final case study, the Persian Gulf War, the bomber (or, more specifically, strategic effect) is considered a complement from the outset. The lesson garnered from the three case studies is the nation must have the political and financial will to sustain combat loses while the USAF experiments with the bomber's role as a supplement or complement. Finally, the nation cannot risk the concept of the bomber as a war-winning supplement in nuclear war as the Air Force will have neither the time nor resources to learn in such a short, terminal conflict.

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Chapter 1

Introduction

> *I think it is well also for the man in the street to realize that there is no power on earth that can protect him from being bombed, whatever people may tell him. The bomber will always get through, and it is very easy to understand that if you realize the area of space.*
>
> Stanley Baldwin

Former Prime Minister Stanley Baldwin's quote illustrates a foundational, if questionable, philosophy for air forces—that the bomber will always get through. The conviction of this dogma drove the early development of US airpower; but combat operations for over a century have repeatedly challenged the ideology's validity. Despite these questions, the thought still dominates in some corners of the Air Force. Perhaps the most troubling is its persistence in the area of nuclear bomber operations. Considering the level of conflict requiring bombers loaded with nuclear munitions could be the planet's last conflict, it would be a disappointing time to discover this truth is invalid.

The first manifestation of the invincible bomber dogma appeared prior to World War II. Interwar theorists focused on bomber speed, firepower, altitude, and armor to ensure penetration of enemy defenses. Despite heavy losses suffered by the bomber forces in World War II, the US Army Air Forces considered the strategic bombing campaign a success.[1] This perceived success, and the bright dawn of nuclear weapons, led the Air Force to continue the doctrine of high altitude bombing through the Korean War and into Vietnam. In the Vietnam conflict, the bomber was eventually successful because of high altitude employment, centrally planned formations, and overlapping electronic countermeasures. Before these operational changes, bomber formations

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[1] *The United States Strategic Bombing Survery, Summary Report (European War)*, (Maxwell AFB, AL: Air University Press, 1987), 37.

suffered heavy losses with little change in the doctrine or tactics. Even after the slow adaptation of these changes, bomber losses were significant and yet still considered *acceptable*.

Following the Vietnam conflict, air strategists failed to learn and clung to Strategic Air Command's doctrine. They considered both the Korean and Vietnam conflicts to be aberrations during which airpower was misused and convinced themselves future conflicts would once again feature engagements favorable to bomber operations.[2] Strategists did, however, acknowledge that air defenses would only improve after Vietnam. Therefore, bombers could no longer rely on speed or high altitude operations and needed other capabilities, such as stealth technology to insure successful penetration of air space.

The development of stealth is a result of the need to counter the radar guidance of surface-to-air missiles. Stealth became Loki's mistletoe arrow to defeat increasingly impenetrable enemy air defenses.[3] The success of stealth in Operation Desert Storm coupled with Effects Based Operations—enabled by precision bombing—shaped how strategists utilized airpower, and reinforced any faltering faith that the bomber would always get through.

Why, despite the weighty evidence of history, does the Air Force insist the bomber will always get through? Perhaps the question is more nuanced than that absolute suggests, and the real question is: Why do

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[2] Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (Lincoln, NE: University of Nebraska Press, 2006), 3; John Andreas Olsen, *John Warden and the Renaissance of American Air Power* (Washington, D.C: Potomac Books, 2007), 22.

[3] Baldr was the Norse god of purity and light and was invulnerable to most objects. Loki, the god of mischief, was jealous of everyone's love for Baldr and decided he must bring down Baldr. Through treachery, Loki discovered that Baldr did have one weakness, mistletoe. The gods passed the time by hurling various objects at Baldr delighting in his invulnerability. Loki took advantage of this pastime, created a mistletoe arrow, and gave it to Baldr's brother Hod to shoot at Baldr for fun. When Hod shot Baldr with the mistletoe arrow, the arrow instantly killed Baldr. Loki faded from sight, and the gods blamed Hod for Baldr's death. In essence, Loki's mistletoe arrow is another way of describing a silver bullet.

we insist on paying high costs in terms of airframes and lives in order to get *some* bombers through?

This research addresses the question and illustrates its relevance by applying it to a current context. The rationale behind an invincible bomber justifies key decisions made by airpower strategists today. If the very assumption is flawed, then there are significant implications regarding current strategies—to include nuclear operations. History repeatedly attempts to school deaf airpower zealots that there is no invincible bomber; there is, instead, a bomber that is successful and minimizes losses when integrated with other support assets, adapts technological advancements, and flexibly adapts changes in doctrine. The United States no longer has the force structure, nor perhaps, the political will to sustain significant losses to the bomber force for only a few to reach the target.

Intellectual Framework

The framework used for this paper is a combination of two ideas. The first is from Knox and Murray's *The Dynamics of Military Revolution, 1300-2050.* The authors postulate that "the conceptual approach to warfare or to a specialized sub-branch of warfare" depends upon the confluence of four factors: tactics, doctrine, organizational structure, and technology.[4] In the interwar period, the United States Army Air Corps was a branch of the US Army, and the four factors heavily influenced how airpower strategists innovatively developed combat airpower. That basis of airpower thought in the interwar years influences airpower theory today. There is one deviation from Knox's and Murray's idea used in this work. That deviation is that doctrine and tactics are combined into the category of *thought*.

[4] M.G. Knox and W. Murray, *The Dynamics of Military Revolution, 1300-2050* (Cambridge University Press, 2001), 12.

The interplay between tactics and doctrine is such that to separate one from the other is counterproductive. Doctrine and tactics in peacetime are "largely hypothesis," and only the test of combat can prove or disprove them.[5] In an effort to keep the interplay between tactics and doctrine whole, this work will combine the two into the concept of *military thought*. This allows for an analysis of each with regard to the other throughout the case studies. Thus, the three ideas explored in the case studies of World War II, the Vietnam War, and Desert Storm are military organizational structure, technology, and thought.

Critical to the three ideas is the dynamic interaction between them. Technology alone has rarely driven military change.[6] Technology, within the framework of military thought, has a greater chance to cause change. Additionally, one must remember that technology is often *evolutionary* rather than *revolutionary*.[7] It is the slow plodding of "problem solving directed at specific operational and tactical issues in a specific theater of war against a specific enemy" that yields change.[8] In effect, technological advancement becomes a punch and counterpunch as each side attempts to react to the other's advancement. In short, the "advantage may be fleeting if one's opponent is agile in responding with appropriate countermeasures."[9] The three facets of military change—organizational structure, technology, and thought—work in unison to define how the USAF views the idea of the bomber.

The second portion of this paper's framework investigates how the military incorporates change. Jonathan House, in his book *Combined Arms Warfare in the Twentieth Century,* explores the US Army's trials and

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[5] I. B. Holley, "Technology and Doctrine " in *Technology and the Air Force: A Retrospective Assessment* ed. Jacob Neufeld, George M. Watson Jr., and David Chenoweth, (Washington D.C.: Air Force History and Museums Program, 1997), 104.
[6] Knox and Murray, *The Dynamics of Military Revolution*, 192.
[7] M.R. Smith and L. Marx, *Does Technology Drive History?: The Dilemma of Technological Determinism* (MIT Press, 1994), 56.
[8] *The Dynamics of Military Revolution*, 192.
[9] Holley, "Technology and Doctrine " 106.

tribulations incorporating combined arms between the Army's different functional branches. House examines how a military views a single combat arm as a supplement or a complement to the total force. In short, is the combat arm considered a sliver bullet of victory, or is it integrated with other means of warfare? House argues that there is a pattern of behavior when a new combat arm is established. The first phase is the army cannot find a place to categorize the new combat arm either doctrinally or organizationally.[10] Consequently, strategists view the new technology as a specialized addition. An historic example is the use of aircraft early in World War I. The Army used aircraft as a reconnaissance asset attached to the Signal Corps. House notes that in the first phase, the new combat arm is a supplement to the established force.

The second phase features the advent of the zealots. A group of enthusiasts seeks to make the new weapons or technology an independent combat arm. In this process, these enthusiasts assert "exaggerated claims about its ability to achieve victory on its own."[11] A prime example is General Billy Mitchell in the interwar period as well as much of the Air Corps Tactical School cadre. Mitchell believed airpower would change warfare by holding at risk areas previously thought safe from attack, allowing airpower to attack the means of waging war.[12] The new weapon or technology in the second phase remains a supplement. Enthusiasts believe the new weapon can win a war on its own with minimal help from traditional forces.

In the third phase, the traditional forces integrate the new weapon and establish it as a complement. Combat often provides the experience necessary to fully develop a new weapon. Moreover, combat allows the

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[10] Jonathan M. House, *Combined Arms Warfare in the Twentieth Century*, Modern War Studies (Lawrence, KS: University Press of Kansas, 2001), 8.
[11] *Combined Arms*, 8.
[12] William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power--Economic and Military* (Tuscaloosa, AL: University of Alabama Press, 2009), 4-5.

enemy to develop countermeasures to the new technology. House states that once the countermeasures are put in place, "the new weapon can no longer achieve victory by itself but must become a full-fledged member of the combined arms team."[13] One could argue the development of the surface-to-air missile was the countermeasure to the perceived successes of the bomber force in World War II and the Korean War. The USAF now had to integrate the bomber force in Vietnam with air cover and assets designed to suppress enemy air defenses. It is in this third phase that the traditional force integrates the new weapon as a complementary asset for victory. In sum, the Air Force's view of the bomber swings like a pendulum between a supplement and a complement.

Methodology

This paper combines the two conceptual frameworks described above into one. In doing so, it seeks to view the three case studies through the lens of how organizational structure, technology, and thought developed in the USAF with regard to the bomber. It also attempts to ascertain whether the USAF considered the bomber a supplement or a complement to airpower or military force at large.

The layout of each case study follows the same chronological pattern. The paper analyzes each of the three factors of military organization, technology, and thought before, during, and after each conflict. In parallel with the chronological layout, this study examines how the service's view of the bomber is viewed—as either a supplement or complement—to the rest of the war effort by airpower theorists and outside observers. Each of the three case studies seeks to answer the same question: why did the USAF believe the bomber would get through?

In the following chapters, this work focuses on three case studies covering World War II, the Vietnam Conflict, and the Persian Gulf War. The second chapter covers World War II. The weight of effort revolves

[13] House, *Combined Arms*, 8.

around the years leading up to war as the peacetime innovations laid the foundations for the wartime efforts. The interwar years provide the foundations of Air Force thought. In these early years, airpower theorists had little practical experience in the use of airpower in war. While World War I informed the basics of what aircraft could do, its use was limited. The interwar airpower advocates used theory instead to inform decisions on force structure and tactics. This combination of a lack of practical experience and theory-heavy speculation influenced how the United States would conduct the war in the air. In short, bombers would fly high altitude daylight precision bombing missions against industrial targets to weaken the Axis powers. This chapter also seeks to illuminate any changes in structure, technology, or thought that caused a shift in interwar concepts due to combat experience. Finally, the chapter will suggest the lessons *learned* in conflict were really lessons *observed*.

The third chapter focuses on the factors that informed on the use of airpower in Vietnam. In addition to its employment, the chapter focuses also on the organizational structure of the air force. The byplay between technological advances in the offense and defense affected how strategists utilized airpower. This chapter also focuses on the Vietnam and preceding Korean conflicts as aberrations deemed unworthy of a full examination by the organization. Moreover, the weight of airpower history and its perceived successes led airpower advocates to believe that airpower, and more specifically the bomber force, was misused.

The final case study, the Persian Gulf War comprises chapter four. This chapter explores the effect that stealth had on the concept of the bomber always getting through. The chapter looks at how the air force revitalized the idea of strategic bombing and the role that bombers, or in this case fighter-bombers, took to advance the airpower narrative. Airpower strategists built upon the lessons learned in Vietnam by realizing integrated air defenses would become the norm and developed methods to counter an integrated air defense. This led to the

development of stealth technologies, which to some became a silver bullet or Loki's arrow with the ability to strike perfectly a vital, well-defended target.

The final chapter comprises the conclusion drawing together the analysis of the three case studies. This chapter will also make recommendations based on the research enclosed in this paper. In order to draw valid conclusions one must first start at the beginning of airpower.

Chapter 2

World War II

World War II provides the first case study examining why airpower theorists thought the bomber would always get through. This conflict encompassed the entire world requiring the mobilization of all of a state's resources to ensure victory—Ludendorff's conception of total wart. As a result, military theorists had access to enormous resources, which led to the rapid development of military technology and a corresponding change in organizational structures and thought.

The confluence of military organizational structure, technology, and military thought reinforced airpower theorists' belief that the bomber would reach its target. There was, however, some evolution of thought that arose during the war as a result of the dynamic interaction between these factors. One can see the evolution by considering the state of long-range airpower before World War II, during combat action, and after the conclusion of hostilities. The Schweinfurt–Regensburg mission provided one catalyst for a paradigm shift in both organization and in some aspects of airpower thought. Technology supported the paradigm shift as evidenced by the design of long-range fighters with the ability to escort bomber formations. This was an idea considered superfluous in the interwar years. The first step in the case study is to examine the organization of airpower.

Organizational Structure

Before

World War I witnessed the first use of powered aircraft in combat with aviation units created inside of their respective armies. This arrangement was the first template for air unit organization. The organizational scheme worked as the majority of the missions performed by aircraft during the war directly supported the ground scheme of

maneuver. Aircraft performed reconnaissance, artillery spotting, and limited strikes against the rear area of the enemy. The Army and the War Department as a whole saw no reason to remove the aircraft from the Army and place them in an independent service.

As a result, the United States Army Air Corps became the centralized location for the development of airpower thought in the interwar years. Airpower advocates during this time had to balance the ideas of airpower as an independent war winning force and as ground support to its parent organization, the Army.

The subservience of the Air Corps to the larger Army caused issues with the development of airpower technology discussed later in this section. More importantly, the uniqueness of airpower lent a sense of mysticism to its development. This allowed airpower practitioners the freedom of maneuver to develop thoughts and ideas about airpower in a proverbial vacuum.[1]

Moreover, organizational freedom motivated a need to centralize airpower. In an effort to gain a larger voice within the Army, General Headquarters (GHQ) Air Force was formed in March 1935 and was separate from, yet cooperative with, the Air Corps.[2] GHQ Air Force reported directly to the Army Chief of Staff. This construct, while positive in some aspects, created unity of effort challenges only partially solved with the formation of the United States Army Air Forces (USAAF) in June of 1941.[3] The USAAF incorporated the Air Corps, GHQ Air Force, and all of the installations held between the two previous organizations. The USAAF reported directly to the Army Chief of Staff and controlled all aspects of airpower, to included installations.

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[1] David E. Johnson, *Fast Tanks and Heavy Bombers: Innovation in the U.S. Army 1917-1945* (Ithaca, NY: Cornell University Press, 1998), 222.
[2] Richard G. Davis, *Bombing the European Axis Powers: A Historical Digest of the Combined Bomber Offensive, 1939-1945* (Maxwell AFB, AL: Air University Press 2006), 40.
[3] Robert Frank Futrell, *Ideas Concepts Doctrine: Basic Thinking in the United States Air Force 1907-1960*, vol. I (Maxwell AFB, AL: Air University Press, 1989), 104.

The creation of the USAAF still left unclear lines of command, and it would take an outside influence to force a change in the War Department. President Roosevelt issued an executive order in October 1941 granting autonomy to the USAAF from Army ground forces and establishing the Chief of the Army Air Forces, General Arnold, as the commanding general with equal standing with regard to advising the White House.[4] The organizational stage was set to test the USAAF organization in combat.

During

The organization at the beginning of the war reflected prewar theory and ideas. Each of the commands established reflected the mission type of the aircraft or geographical location of the unit's operations, yielding a functionally divided USAAF.[5]

The VIII Bomber Command illustrates this functional division. The command executed bombing missions against occupied France and later Germany. The issues occurred when bombers began to strike targets outside of Allied fighter coverage. As a result, bomber losses increased without the added protection of escort fighters; however, USAAF leadership was beholden to the idea of a war winning airpower effort and continued to pour in additional bombers and resources with unrelenting determination. The 8th Air Force had control of both fighters and bombers but the organization was unwilling to integrate at the operational level the two disparate assets, until heavy losses eventually discredited the theory of unescorted bombers. One impetus for change came in the form of two Schweinfurt raids.

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[4] Michael S Sherry, *The Rise of American Air Power: The Creation of Armageddon* (New Haven: Yale University Press, 1987), 97.
[5] David R. Mets and William P. Head, *Plotting a True Course: Relections on the Usaf Strategic Attack Theory and Doctrine: The Post World War II Experence* (Westport, CT: Praeger, 2003), 9.

The allies decided to strike Regensburg and Schweinfurt, Germany to halt the production of ball bearings, which were critical to the manufacture of many war machinery. Without extensive fighter escort coverage, the bombers met heavy resistance from German defenders. The allies lost 16 percent of the attacking bomber force in both raids.[6] In the October 1943 Schweinfurt attack, Axis defenders shot down or damaged 198 of the 291 bombers—an unsustainable 68 percent casualty rate.[7] Moreover, the losses incurred at Regensburg and Schweinfurt "threatened Eighth Bomber Command's operational coherency and forced the command to stand down temporarily."[8] In short, the Allied bomber offensive could not continue this level of attrition without a change in methodology.

Most military organizations are resistant to change for good reason. This resistance is an effort to reduce chance in war. Clausewitz opined that war is an extension of politics.[9] This idea illustrates how the state may use force to maneuver for advantage. If this is the case, then an established method of warfare is required. In short, the military requires procedures the state understands, which become manifest as military doctrine.

Military doctrine is nothing more than a set of institutionalized standard operating procedures. Standard operating procedures establish predictability, stability, and some degree of certainty in a rational, purposeful instrument like the military.[10] Doctrine institutes a starting

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[6] Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas About Strategic Bombing, 1914-1945* (Princeton, NJ: Princeton University Press, 2002), 224.
[7] *Rhetoric and Reality in Air Warfare*, 224.
[8] Daniel R. Mortensen, "Regensburg/Schweinfurt," *Air & Space Power Journal* 17, no. 2 (2003): 30.
[9] Carl von Clausewitz et al., *On War*, Oxford World's Classics (New York: Oxford University Press, 2006), 87.
[10] Barry Posen, *The Sources of Military Doctrine: France, Britain, and Germany between the World Wars* (Ithaca, NY: Cornell University Press, 1984), 46.

point to establish military organization. Without some form of stability or direction, the military would be in a constant state of flux.

Therefore, the military bureaucracy must resist change in order to be an effective instrument for the state. The military must maintain a balance between predictability, for training and organization, without becoming irrelevant due to technological change or combat experience. Combat experience derived from the Schweinfurt raids helped demonstrate an organizational change was required.

Combat experience provided the impetus for an organizational change. In effect, it was a Kuhnian paradigm shift; the opposition to an organizational or doctrinal change was being removed by higher headquarters or was dying off in the skies over Europe.[11] A strict functional command structure was no longer viable. The organizational paradigm shift was the formation of the United States Strategic Air Forces (USSTAF).

In early 1944, General Arnold reorganized the air forces in Europe to form the USSTAF. The USSTAF provided overall planning for the 8th Air Force in England and the 15th Air Force in Italy.[12] The most important portion of this combination was the integration it provided. The USSTAF coordinated the two numbered Air Forces efforts against Germany. Consequently, the USSTAF was able to orchestrate attacks against Germany from two different directions effectively splitting the German defenses. Moreover, the reorganization focused operational synchronization between the fighters and bombers, which were a part of the 8th Air Force since 1942.[13] Finally, the reorganization in combination with a change in leadership freed fighters from close bomber escort to more of an enemy fighter-hunting roll. The new organization, in

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[11] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, Fourth edition. ed. (Chicago, IL: The University of Chicago Press, 2012), 150.
[12] Alan J. Levine, *The Strategic Bombing of Germany, 1940-1945* (Westport, CT: Praeger, 1992), 117.
[13] Biddle, *Rhetoric and Reality in Air Warfare*, 210, 226.

conjunction with fighter technological advancement, provided the means to protect the bomber en route to the target.

After

The integrated organizational structure formed by the USSTAF would not last after World War II. In the years between the two case studies of World War II and Vietnam, the newly formed United States Air Force (USAF) would dismiss lessons learned in combat. The advent of the atomic bomb in combination with the perceived success of strategic bombing led the USAF to a functionally regimented command structure. Despite the efficacy of integrating both fighters and bombers within a single command, after World War II the USAF decided to divide its forces between its nuclear and conventional arm. Strategic Air Command would be responsible for the execution of US nuclear operations while Tactical Air Command would focus on the conventional mission. Both would develop unique cultures that were diametrically opposed to one another and this in turn would cause issues in Vietnam.

Technology

Before

During the period between the two world wars, aircraft technology was still immature. Technology advanced slowly during the interwar years, and it was not until the crucible of combat that rapid advancements occurred. The state of technology had a direct effect on military thought and on the use of airpower during this period. Aircraft technology advanced rapidly with a focus on flying higher and faster, which translated into larger airplanes. While technology advanced, there was not corresponding reduction in size and weight and designers were not able to improve the performance characteristics of smaller aircraft.[14]

[14] Johnson, *Fast Tanks and Heavy Bombers*, 154.

Thus, the Air Corps saw the large bomber as the superior technological progression. The paragon of this progression was the B-17.

Speed was the primary factor in the early development of aircraft. The B-17s boasted a speed of 250 miles per hour, which was faster than the standard pursuit aircraft, the P-26, which maxed out at 234 miles per hour.[15] The key to increasing speed was increasing engine performance while reducing drag. At the time, engine performance increased at a steady, but slow, rate. Therefore, in order to increase the speed and ceiling of an aircraft the logical extension was to make a multiengine aircraft. The increased speed and ceiling also enhanced the theoretical survivability of the bomber.

The technology of the day reinforced the notion that a properly configured bomber would survive an attack. It would be difficult for a pursuit aircraft with the same characteristics as a bomber to find, let alone engage bomber formations. The Air Corps Board concluded that a "pursuit plane with pursuit safety factors, with at least 25 percent greater speed than bombers, with at least the range of bombers, with a higher ceiling capability than bombers, and with an extremely high rate of climb would probably not be technologically possible."[16] This increase in performance by the bomber also led airpower theorists to dismiss the idea of antiaircraft guns, as the bomber was too fast for engagement by ground defenses.[17] Furthermore, with advances in technology it seemed only logical that the bomber speed would continue to increase, thus increasing the margin of combat safety.[18] Consequently, the bomber became a self-perpetuating talisman of airpower. Ultimately, the bomber was the doctrinally preferred aircraft. This preference, linked with the

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[15] *Fast Tanks and Heavy Bombers*, 164.
[16] Futrell, *Ideas Concepts Doctrine: Basic Thinking in the United States Air Force 1907-1960*, 80.
[17] Daniel L. Haulman, "Precision Aerial Bombardment of Strategic Targets: Its Rise, Fall, and Resurrection," *Air Power History* 55, no. 4 (2008): 27.
[18] Johnson, *Fast Tanks and Heavy Bombers*, 164.

improvements in bomber performance outstripping pursuit capabilities, resulted in the reinforced airpower theory of an invincible bomber. The civilian market place also reinforced the preference of the bomber.

Aircraft manufacturers tended toward larger aircraft as they saw a dual use for those technologies supporting bomber development in the fledgling air transport industry. The qualities found in a bomber, range, speed, and cargo capacity, directly translated into civilian passenger and cargo transport planes.[19] Conversely, the qualities required for a fighter demanded ultimate performance in speed, rate of climb and reduced turning radius. In 1930, this was considered "too risky for most aircraft builders, perpetually on the brink of bankruptcy, to consider."[20] The economic conditions of the Great Depression and resulting scarcity of resources within the War Department reinforced the development of the bomber.

The United States after World War I, the War to End All Wars, wanted to capitalize on the peace dividend. The War Department received a drastically reduced portion of the Federal Budget in the interwar years and attempted to divide resources evenly between the services. The Army Air Corps, as a subunit of the Army, had to survive with a portion of the Army's share. Airpower theorists with limited funds had to choose what type of airframe to develop. Airpower reliant on technology could not afford a procurement holiday if it were to remain a viable part of national defense.[21] The combination of commercial economic proclivities, airpower thought, and a reduced budget led airpower theorists to focus on the development of the bomber over other

[19] Phillip S. Meilinger, *Bomber: The Formation and Early Years of Strategic Air Command* (Maxwell AFB, AL: Air University Press, 2012), 16-17.
[20] Davis, *Bombing the European Axis Powers: A Historical Digest of the Combined Bomber Offensive, 1939-1945*, 16.
[21] Meilinger, *Bomber*, 13.

forms of aircraft. The focus on bomber aircraft at the cost of the fighter became an issue when the conflict began.

During

The host of technologies developed during World War II is the focus of this section. Two key technologies are the development of long-range fighters and radar. Both directly affected the prewar airpower thought on strategic bombing in combat. The first discussed is the long-range fighter.

Prewar airpower thought maintained that the bomber did not need to be escorted to the target. The speed, altitude, armor, and firepower of the bomber would be sufficient to protect it from harm. Combat, the ultimate arbiter of theory, would judge this belief wrong. The Schweinfurt raid illustrated with blood the need for bomber escort. Fortunately, fighter technology had advanced sufficiently so it was now possible to have a fighter with the range to escort bombers deep into Germany. The combination of improved engines in both the P-51 Mustang and the P-47 Thunderbolts with the mass production of effective drop tanks enabled sufficient range for the fighters to escort the bombers.[22] Fighter innovation was one improvement; the next was radar.

Both the Axis and Allies used radar offensively and defensively during the war. Interwar airpower theorists were unaware of the development of radar because of classification issues.[23] This led to the assumption that bombers would have the element of surprise, because the enemy would have to rely on visually spotting bomber formations. The Luftwaffe learned firsthand in the Battle of Britain how effective the

[22] Mark Clodfelter, *Beneficial Bombing: The Progressive Foundations of American Air Power, 1917-1945* (Lincoln, NE: University of Nebraska Press 2010), 158.
[23] Futrell, *Ideas Concepts Doctrine: Basic Thinking in the United States Air Force 1907-1960*, 100.

combination of ground based radars directing intercepting fighters could be. The game now became a race to counter ground-based radar.

World War II became the foundation for the development of electronic countermeasures (ECM). The Germans began to use radar against British bombers to guide their aircraft spotting lights, night fighters, and AAA. The Allies required a method to counter this threat in order to ensure a sufficient number of bombers reached their targets for predictable damage results. The Allies used a combination of technological improvements known as Window and Monica. Monica was one of the first radar warning receivers in an aircraft to detect threats.[24] This improvement would allow bomber formations to detect radar-equipped German fighters as well as ground-based radar.

Next, the Allies developed Window in an effort to blind ground based radar.[25] Window is the precursor to today's chaff. Bombers would release strips of aluminum prior to and throughout the bomb run in an effort to blind the German radar.[26] If the bombers maintained a tight coherent formation, the chaff cloud was sufficient to force the Germans to aim antiaircraft fire and direct intercepting fighters by visual means only. Radar and its countermeasures has remained a staple for the modern air force, so much so that billions of dollars would later be spent in an effort to become invisible to radar.

After

World War II unleashed the minds of men in a time of crisis, sowed the seeds of technological development, and affected the prosecution of war up until today. The invention of radar and its proliferation take center stage in the next case study when paired with a surface-to-air missile. Furthermore, the technology to remain radar-invisible, coupled

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[24] Randall T. Wakelam, *The Science of Bombing: Operational Research in Raf Bomber Command* (Toronto: University of Toronto Press, 2009), 111.
[25] *The Science of Bombing*, 98.
[26] *The Science of Bombing*, 248.

with the concept that the bomber will always get through, has affected airpower thought to the present.

The most important technological advancement in World War II was the advent of the atomic bomb. This single weapon type changed the shape of both statecraft and warfare. It is the combination of the bomber and the atomic bomb, which led to the perceived supremacy of airpower. Bombers were able to range into the heartlands of both Nazi Germany and Imperial Japan. Once mated with an atomic bomb, it seemed the ultimate realization of airpower theory.

Thought

Before

Airpower thought in the interwar years is the basis of most doctrine and tactics used by the USAF today. The Air Corps Tactical School (ACTS) provided the foundation for interwar airpower doctrine. Air Corps strategists' concept for long-range aviation ran counter to popular sentiment in the interwar years. The United States' isolationist preference following World War I and any concept of strategic bombing utilized in any manner other than coastal defense did not sit well.[27] However, the progress of civil aviation expansion brought North America closer to Europe and emphasized the Atlantic and Pacific Oceans were no longer protective barriers.[28] As a result, the ACTS cadre continued to develop the doctrine of strategic bombing.

The ACTS cadre developed strategic bombing doctrine during airpower's infancy. Phillip Meilinger posits that sound doctrine has three pillars: history, theory, and technology.[29] Another name for history is experience, specifically combat experience. Airmen in the interwar period had limited combat experience in strategic bombing from World

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[27] Williamson Murray and Allan R. Millett, *Military Innovation in the Interwar Period* (New York, NY: Cambridge University Press, 2008), 106.
[28] *Military Innovation in the Interwar Period* 107.
[29] Meilinger, *Bomber*, 22.

War I upon which to draw.[30] Consequently, airpower strategists had to rely on the remaining two pillars of theory and technology. The technology of the time, previously illuminated, gave credence to the superiority of the bomber and subsequently strategic bombing. ACTS became the center of thought in the interwar period, and its graduates would emerge as air force leaders in World War II.

Education has remained a staple in military affairs, the Army Air Corps sent its best and brightest to ACTS. The list of students who attended ACTS was a "veritable who's who of important airmen. All three World War II generals—Joe McNarney, George Kenney, and Carl Spaatz—had attended ACTS, and 11 of the 13 lieutenant generals during the war were ACTS graduates."[31] By sending the best through ACTS, the Air Corps inculcated strategic bombing theory in its leaders. By the start of World War II, bomber advocates gained control of the air arm and overwhelmed opposition to their ideas.[32] The view held by ACTS graduates was that airpower was a "decisive, independent force, they paid little attention to the support of ground forces. They feared that this role could restrict their hard-won autonomy...."[33] ACTS, however, did not write official doctrine for the Army, yet most Airmen accepted ACTS texts as authoritative.[34] The most well received idea was the Industrial Web theory.

The Industrial Web theory was a system-based approach to defeat an adversary. The ACTS cadre rejected the idea of indiscriminate bombing of cities and instead focused on a way to cripple an opponent's economic war machine. ACTS consulted with business executives in the United States to find critical nodes within the supply chain that, if disrupted, would halt production. In a prewar anecdote, they found that

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[30] *Bomber*, 22.
[31] *Bomber*, 8.
[32] Johnson, *Fast Tanks and Heavy Bombers*, 222.
[33] *Fast Tanks and Heavy Bombers*, 222.
[34] Meilinger, *Bomber*, 22.

a single factory in Pittsburgh was the only factory in the US that produced propeller pitch-control mechanisms, and, when it flooded, aircraft production came to a virtual halt.[35] If ACTS could find the critical node in an enemy's industrial web, like the factory in Pittsburgh, it would not be necessary to destroy aircraft in the air or on the ground.[36]

The ultimate manifestation of the Industrial Web theory was Air War Plans Division (AWPD)-1. AWPD-1, developed in nine days, focused on "electrical power, rail and canal transportation, petroleum production, and other industries formed the backbone" of the German economy.[37] AWPD-1 would become the basis for the strategic air war in Europe. ACTS revised AWDP-1 in 1942 due to the change in the strategic environment; however, the basic underpinning of the Industrial Web theory remained unchanged in AWPD-42.[38] With a war winning theory in place, ACTS then focused on how best to execute the plan.

A combination of factors led to ACTS adopting High-Altitude Precision Daylight Bombing (HAPDB) to execute the Industrial Web theory. The current technology showed that pursuit aircraft did not have the speed nor altitude capabilities to match the newest bombers.[39] As mentioned previously, both military and civilian aviation communities chose to advance the bomber over the fighter, thus reinforcing the capabilities gap between fighter and bomber. The bomber's ability to operate at higher altitude, away from both fighters and existing antiaircraft guns, explains the high-altitude aspect of HAPDB. The development of the Norden bombsight "created an efficient solution to

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[35] *Bomber*, 20.
[36] *Bomber*, 20.
[37] "Air War Plans Division I: The Air Plan That Defeated Hitler," *Air & Space Power Journal* 17, no. 1 (2003): 4.
[38] Futrell, *Ideas Concepts Doctrine: Basic Thinking in the United States Air Force 1907-1960*, 130.
[39] Meilinger, *Bomber*, 18.

high-altitude precision bombing."[40] A limitation of the bombsight was the fact that it was a visual instrument requiring sufficient light for the bombardier to aim. As a result, the bomber had a theoretically precise instrument for high altitude use that required daylight for accuracy and could keep the bomber outside of known threat envelopes.

Planners believed the bomber "relying on speed, massed formations, high altitude, defensive firepower and armor, and simultaneous penetrations at many places—could make deep penetrations of German defenses in daylight hours."[41] Unfortunately, the veil of secrecy hid the invention of radar so ACTS theorists postulated that aircraft formation could choose penetration routes at will, lending to tactical surprise.[42] Radar was but one chink in the armor of the HAPDB theory; obstacles to achieving precision in combat became the other.

During

Combat operations affected bomb precision more heavily than predicted during the interwar years. The Norden bombsight had to remain stable for up to eight minutes while the bombardier essentially controlled the aircraft in order to aim the bombs.[43] This became problematic when attempting to avoid oncoming fighters and antiaircraft fire. These manmade obstacles paled in comparison to the effect that weather had on bomb runs.

None of these factors dissuaded airpower leadership to change doctrine. Instead, they focused on technological elements to support their doctrine. One such innovation was the use of radar onboard pathfinder aircraft to aim through the weather.[44] Another innovation was the development of long-range fighters for escort. Each of these

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[40] Johnson, *Fast Tanks and Heavy Bombers*, 154.
[41] Futrell, *Ideas Concepts Doctrine: Basic Thinking in the United States Air Force 1907-1960*, 110.
[42] Meilinger, *Bomber*, 18.
[43] Clodfelter, *Beneficial Bombing*, 71.
[44] Wakelam, *The Science of Bombing*, 76.

efforts aided HAPDB doctrine in Europe. ACTS and its graduates held firm to the idea of defeating Germany through economic collapse.

The reorganization of the USAAF in Europe into the USSTAF did cause a change in tactics. The escorting fighters were no longer tied directly to the bomber formation. The new tactic was to keep one third of the fighter force within close proximity of the bomber formation while the rest broke off to pursue engaging enemy fighters.[45] This forced a change in the culture of the fighter force from escorts to hunters, allowing the Allied fighter force to engage the enemy farther away from the bomber force.

After

The idea of the efficacy of strategic bombing crystalized in the minds of airpower strategists after World War II. The use of heavy bombers to attack the industrial centers of an adversary seemed to have a decisive effect, in combination with the land invasion of the Allies into Europe and the Soviets pressing in from the east. Air planners assumed correctly that bombers could penetrate enemy defenses; however, the "edge of offense over the defense has been much narrower than anyone had believed."[46] The advent of the atomic bomb only reinforced the idea of the bomber's effectiveness when aimed at industrial targets, and now it required fewer bombers as the weapon was more destructive. The doctrine of strategic bombing continued throughout the Korean War and into the next case study of Vietnam.

Conclusions

Ultimately, the bomber did get through but at great cost. Despite murderous losses to the bomber crews, the majority of the bomber formations made it through to their targets. The precision with which

[45] Levine, *The Strategic Bombing of Germany, 1940-1945*, 118.
[46] Futrell, *Ideas Concepts Doctrine: Basic Thinking in the United States Air Force 1907-1960*, 100.

the bombers struck their targets was less than expected, yet it seemed to have some effect on the German economy.[47] The United States had both the financial and political resources to sustain losses to the bomber force in order to defeat the Axis powers. Interwar doctrine forged from the landscape of current technology reinforced the need for bombers that were faster, flew higher, and were more precise than anything Douhet every dreamed of. Even the crisis of the Schweinfurt missions only partially caused changes in organization.

The Schweinfurt mission was one crisis, which spawned the formation of USSTAF. The Schweinfurt–Regensburg mission unequivocally demonstrated that bomber formations could not defend themselves and threatened the invincible bomber dogma.[48] The blood of the striking bomber crews provided the ink in which the need for long-range fighter escort was written. Yet, the bomber community resisted change to its focused dogma.

One reason the bomber community did not change its tactics was that the technology was not available to develop and field a long-range fighter. The second, and more important reason, was that bomber leaders acted as one would expect of military organizations and resisted change to military thought until the invincible bomber theory was tested in combat.[49] Combat gave airpower theorists the experience required to reevaluate existing thought. In the end, however, airpower theorists only *observed* and did not *learn* the lessons of integration and adapting to the rapid change in technology, the Vietnam case study demonstrates this absence of true evolution.

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[47] J. Adam Tooze, *The Wages of Destruction: The Making and Breaking of the Nazi Economy* (New York: Penguin USA, 2008), 671.
[48] Haulman, "Precision Aerial Bombardment of Strategic Targets: Its Rise, Fall, and Resurrection," 28.
[49] Posen, *The Sources of Military Doctrine*, 55.

Chapter 3

The Vietnam Conflict

The Vietnam Conflict case study follows the same framework used in the previous chapter. This chapter does not include the Korean Conflict. However, this conflict did have some bearing on the Vietnam Conflict. The United States involvement in the Korean War was conventional in nature; it was not the nuclear exchange the newly minted USAF planned to execute on the plains of Eastern Europe. Without the appetite for a second total war, the US attempted to limit conflict in Korea with an eye towards keeping China from becoming overly involved. Consequently, the US fought the Korean War with "frustrating limitations," specifically with regard to airpower. The war was a "sideshow," distracting the United States from the "real" threat in Europe—the Soviets.[1] Political leadership limiting the use of airpower plays out again in this case study. Even then, Airmen of both Korea and later Vietnam seemed reluctant to acknowledge war was an extension of politics, and political leadership had the right to limit military efforts.[2] Thus, the constraints placed on airpower were immovable, and the USAF wasted valuable effort flailing against them.

Further, the conclusions gathered by Airmen on the efficacy of airpower set the stage for the Vietnam Conflict. Thus far in airpower history—World War II and Korea—bombing was perceived as an effective political tool.[3] The perception of an independent war-winning service drove USAF doctrine development in the years following World War II and up through the start of the Vietnam Conflict. The central institutional focus of the USAF revolved around the use of nuclear weapons.

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[1] Dennis M. Drew, "Air Theory, Air Force, and Low Intensity Conflict: A Short Journey to Confusion," in *The Paths of Heaven: The Evolution of Airpower Theory* ed. Phillip S. Meilinger, (Maxwell AFB, AL: Air University 1997), 327.
[2] Clausewitz et al., *On War*, 81,87.
[3] Clodfelter, *The Limits of Air Power*, 3.

The military thought, organizational structure, and technology of this case study focus on the USAF's attempts to shoehorn its focused institutional predilection for nuclear warfare into a conventional war in Vietnam. Also examined is the ebb and flow between offense and defense as the US and Soviet Union attempted to thwart one another's advantages. The US focused on penetrating ever-more sophisticated Soviet air defenses built around radar and surface-to-air missile systems (SAMS). The next case study explores the need to defeat SAMS, which become an overarching theme in the pursuit of the ever-penetrating bomber and manifested in the eventual development of stealth. The heavy losses of B-52s to the Soviet-sponsored Vietnamese air defenses provided the impetus for stealth.

The central theme in this chapter is that of a solidified military structure attempting to incorporate changes in technology and thought. The focus of each *during* section revolves around Linebacker II as that operation provided the genesis of the Vietnam-era airpower myth—especially the belief that if the USAF were un-handcuffed earlier, the US would have won the war much sooner.

The second theme is the development of new tactics and technology that were acceptable separately, yet were much more effective when combined. The organizational structure of the USAF highlights one of the main challenges faced by the USAF to the integration of combat power.

Organizational Structure

Before

Before the Vietnam conflict, the USAF consisted of 13 major commands. Two of the warfighting commands, Strategic Air Command (SAC) and Tactical Air Command (TAC), had disparate missions. TAC focused on conventional war with the fighter and fighter-bomber at

center stage. SAC's mission centered on nuclear warfare and subsumed the lion's share of both national attention and funding.

SAC was established on the 21st of March 1946 with the mission to "…conduct long range offensive operations in any part of the world…conduct maximum range reconnaissance over land or sea…provide combat units capable of intense and sustained combat operations employing the latest and most advanced weapons."[4] In short, SAC's mission was to conduct nuclear operations against the Soviet Union. SAC's second commander, General Curtis LeMay, whose name would forever be synonymous with the organization, had very specific ideas on mission execution.

General LeMay built a massive warfighting organization with the purpose of responding to Soviet aggression in a measured, predictable way. LeMay understood that SAC's *first* mission might in fact be the *last* mission it ever executed. There were no second chances available for the command if the Soviets attempted to destroy the US. With this frightening concept firmly in mind, LeMay instituted a state of readiness that "was necessary to capitalize on that first and only chance to strike, should it ever be needed."[5] He boiled down the concept of SAC as "we had to be ready to go to war not next week, not tomorrow, but this afternoon, today…We had to operate every day as if we were at war."[6] LeMay instilled into SAC units the notion that they had to be ready at a moment's notice to fight the most horrific fight at the drop of a hat. The idea was that the Soviets would add the capabilities of SAC into their decision calculus. This mindset instilled an ethos in SAC that was "…so

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[4] J.C. Hopkins and Sheldon A. Goldberg, *The Development of Strategic Air Command, 1946 -1986* (Offutt AFB, NE: Office of the Historian, Headquarters Strategic Air Command 1986), 2.
[5] Warren Kozak, *Lemay: The Life and Wars of General Curtis Lemay* (New York: Regenery, 2009), 288.
[6] R. Michael Warden, *Rise of the Fighter Generals: The Problem of Air Force Leadership, 1945-1982* (Maxwell AFB, AL: Air University Press 1998), 59.

professional, so strong, so powerful, that we would not have to fight."[7] These ideas led the organization to cherish the ideals proselytized by SAC as the only means for the defense of the Republic. This feeling was embraced throughout the USAF and to a great extent the US government.[8]

As General LeMay worked through the bureaucracy of the USAF, he continued to advance those that personified his concept of the USAF as a nuclear war winning service. LeMay began to replace various generals within the structure of the Air Force with protégées that agreed with his mindset of the supremacy of the bomber.[9] This move instituted an organizational distrust between SAC and TAC. The animosity between the two commands was enough for one USAF general to remark that "In the early sixties SAC and TAC were like two rattlesnakes. They would hardly talk to one another."[10] This distrust between the two commands will play out in later sections on technological and military thought development. In short, the right hand saw what the left hand was doing but dismissed it as but a passing fad. This institutional distrust played out in the greater context of the Cold War.

Critical to the Vietnam Conflict is the overarching byplay between the US and Soviet Union. The Soviets lacked the forward basing the US enjoyed and turned instead to long-range missiles.[11] The threat of Soviet intercontinental ballistic missiles (ICBMs) triggered multiple responses, one of which was strip alert for the bomber forces. In line with LeMay's concept of *fight today*, SAC developed a ground alert of its nuclear bombers "whereby it would maintain approximately one third of its aircraft on ground alert, with weapons loaded and crews standing by for

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[7] *Rise of the Fighter Generals*, 59.
[8] Earl H. Tilford, *Crosswinds: The Air Force's Setup in Vietnam* (College Station: Texas A&M University Press, 1993), 33.
[9] Warden, *Rise of the Fighter Generals*, 104.
[10] *Rise of the Fighter Generals*, 104.
[11] Neil Sheehan, *A Fiery Peace in a Cold War: Bernard Schriever and the Ultimate Weapon* (New York, NY: Vintage Books, 2010), 152.

immediate takeoff."[12] One byproduct engendered by ground alert was a rigid adherence to checklist discipline to execute the nuclear mission efficiently at a moment's notice. Ground alert crews also required previously developed air attack plans and trained meticulously in order to perform the nuclear mission. Thus, SAC indoctrinated bomber crews to accept mission profiles provided by SAC headquarters. Ground alert, checklist mentality, and the animosity between TAC and SAC led to issues with integrating bombers and fighters designated for SAM suppression. A later chapter highlights this cultural disconnect.

During

The distrust between TAC and SAC continued during the Vietnam Conflict. The most evident personification of distrust was the way the Air Force organized warfighting combat air forces. The 7th Air Force was charged with coordinating the air war in the Vietnam theater. This involved coordinating both Navy and Air Force assets. On the surface, having a single unit charged with the integration of disparate forces seemed like the most effective manner to execute an air war. The reality was that 7th Air Force had little to do with the SAC-assigned B-52s.[13] SAC retained the authority to plan the execution of its assets within the theater.[14] This led to a lag in the codification of lessons learned by both TAC and SAC units in theater. The *Thought* section later in this chapter elaborates on this lack of learning.

After

The conclusion of the Vietnam Conflict did little to change the organizational structure of the USAF. The USAF remained wedded to the functional division of nuclear and conventional commands. It would take a massive shift in the strategic environment, the fall of the Soviet

[12] Hopkins and Goldberg, *The Development of Strategic Air Command, 1946 -1986*, 65.
[13] Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984*, vol. II (Maxwell AFB, AL: Air University Press, 1989), 282.
[14] Tilford, *Crosswinds*, 201.

Union—to drive a change.[15] Until then both commands continued along each's respective path of perceived military victory.

Technology

Before

Aviation technology advanced in an evolutionary manner after World War II. The development of technology prior to Vietnam revolved around the interplay between the offense and defense. The bomber as the personification of the offense took center stage for additional development. Conversely, adversary nations worked on methods to counter the onslaught of American airpower by developing complex air defenses. The continuously evolving cat and mouse game of offense verse the defense is the focus of this section.

In both World War II and the Korean Conflict, the bomber showed its ability to concentrate firepower on the battlefield. With this concentration, in combination with the perceived decisiveness of airpower in war, the US developed bombers that flew higher, faster, and had additional carriage capacity. The primary method of attaining greater capabilities was the use of the jet engine.

A jet powered bomber fit within the vision of SAC. General LeMay's focus for the development of a jet bomber was to develop an aircraft whose primary mission was "to engage in long-range atomic warfare."[16] The idea was that a jet bomber would outpace both air and ground defenses of the Soviet Union. The first all jet-engine swept-wing bomber was the B-47 Stratojet. Concurrent with the B-47 the US began to develop a larger nuclear weapons stockpile. The combination of more atomic weapons to service the host of Soviet targets with a jet-powered

[15] In 1992 Air Combat Command was established subsuming portions of SAC and TAC combining fighters and bombers into one command, but this fact is beyond this case study and the next.

[16] Mark D. Mandeles, *The Development of the B-52 and Jet Propulsion: A Case Study in Organizational Innovation* (Maxwell AFB, AL: Air University Press 1998), 64.

bomber allowed SAC to reach the potential envisioned by LeMay.[17] The B-47 is germane to this case study as its development laid the foundations for a follow on bomber, the B-52—a primary actor in the skies over Vietnam.

The initial development concept for the B-52 illuminates the driving thought in the USAF at the time. The Air Force designed the B-52 to be the executor of the World War II concept of the Industrial Web Theory. An additional requirement of the B-52 was the ability to strike the Soviet Union from the United States. In sum, the B-52 was a platform to deliver atomic weapons "as soon as hostilities start" against Soviet economic and military targets from the US.[18] US technological development remained focused on the offense against the Soviet Union.

The defense made significant technological developments centered on radar and missiles. As alluded to earlier, the offense and defense were in a tit-for-tat race. As aircraft "speeds, ceilings, rates of climb, ranges, firepower, and sensor capabilities improved," so too did defensive measures.[19] The use of SAMS to defend vital areas proliferated from the Soviet Union—eventually to Vietnam. SAM development eventually caught up to aircraft performance, triggering changes in tactics. One change instituted in the 1960's was to fly bombing missions at low altitude, a potential blind spot for the SAMS.[20] Tactics, discussed later, were not the only method used to counter the SAM threat.

Two technological developments developed prior to the Vietnam Conflict to counter SAMS were electronic countermeasures (ECM) and standoff weapons. A full discussion on ECM and its effects on the air war in Vietnam is in the next section. Standoff weapons development

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[17] Kozak, *Lemay: The Life and Wars of General Curtis Lemay*, 303.
[18] Mandeles, *The Development of the B-52 and Jet Propulsion: A Case Study in Organizational Innovation* 62.
[19] Karl P. Mueller, "Strategic Airpower and Nuclear Strategy: New Theory for a Not-Quite-So-New-Apocalypse," in *The Paths of Heaven: The Evolution of Airpower Theory* ed. Phillip S. Meilinger, (Maxwell AFB, AL: Air University Press 1997), 288.
[20] "Strategic Airpower and Nuclear Strategy," 282-283.

elucidates how SAC proposed to blunt the Soviet air defenses. The concept was to arm bombers with nuclear-armed missiles allowing for sufficient standoff range, thereby reducing bomber vulnerability to SAMs. In addition, resident within these standoff weapons was the ability to use the nuclear weapons not only for the bomber's primary targets but also to use them against "early warning radars and SAM sites in order to suppress the enemy's defenses and make penetration easier."[21] In short, SAC's plan was to use nuclear weapons to punch through Soviet defenses in order to deliver an additional nuclear strike on the primary target.

During

Combat spurred US technological development in radar bombing and defensive measures. Bombing was problematic in the vast swaths of jungle that covered Vietnam. The USAF had difficulty finding sufficient targets that met with the preconceived notions of victory—namely industrial and military complexes within the Vietnamese agrarian society. Without natural or manmade objects for radar-energy to reflect off B-52s had difficulties pinpointing assigned targets.[22] The first method devised by the USAF to increase bombing accuracy in the jungle was to place radar beacons throughout key portions of Vietnam.[23] This provided known locations for B-52 radar navigators to triangulate the aircraft position in order to calculate a bombing radial. The second method to increase bombing accuracy evolved from World War II technological innovation. The USAF utilized pathfinders for both fighter and bombers (Pave Phantom and Pave Buff) as well as flareships to designate targets for formations.[24] The pathfinder initiative gave way to

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[21] "Strategic Airpower and Nuclear Strategy," 284.
[22] Earl H. Tilford, *Setup: What the Air Force Did in Vietnam and Why* (Maxwell AFB, AL: Air University Press 1991), 276.
[23] *Setup*, 276.
[24] *Setup*, 276.

an even more effective method of ground based navigation augmentation—COMBAT SKYSPOT. SKYSPOT illuminated a B-52 on a bomb run transmitting updates on altitude, speed, range and bearing to help the radar navigator solve the bombing problem with more accurate data. Using the SKYSPOT system, B-52's could release ordinance within 1000 yards of friendly troops, with additional testing this number would shrink significantly.[25] Pathfinders were no longer required with the use of SKYSPOT. Technology, through SKYSPOT, addressed accuracy issues, but that still left the problem of countering SAMS.

North Vietnamese air defenses, supplied by the Soviet Union, comprised a dense network of SAMS and antiaircraft artillery (AAA). SAMS covered the high altitude approach while AAA covered the low to medium altitude. The USAF used speed to counter the AAA threat, if the aircraft moved sufficiently fast, then the gunner could not track the aircraft effectively. Speed alone would not solve the SAMS threat, especially for the lumbering B-52s. Consequently, the Air Force set up a "SAM Task Force" lead by and comprised of service members from TAC to develop technical and tactical solutions to the SAM threat.[26] The SAM Task Force developed both active and passive measures to blunt the SAMS' effectiveness.

The radar-warning receiver was one passive method. The warning receiver would monitor for SAMS, one of which was the SA-2, and audibly warn the pilot through speakers in the helmet and strobes on a screen in the cockpit if a SAMS was tracking the aircraft or had fired a missile.[27] This allowed the pilot some modicum of warning to react to the threat. When the Air Force combined passive measures with active ones, the Wild Weasel was born.

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[25] Jacob Van Staaveren, *Gradual Failure: The Air War over North Vietnam, 1965-1966* (Washington DC: Air Force History and Museums Program, 2002), 267.
[26] Tilford, *Setup*, 124-125.
[27] *Setup*, 126.

The primary active measure for SAM suppression was the Shrike. In May of 1966, the USAF deployed the AGM-45 Shrike missile. The Shrike locked onto a SAM radar's emissions and followed it back to the radar destroying it.[28] The Wild Weasel was the name given to TAC-assigned aircraft designated to suppress SAMS. The Wild Weasels used the combination of a passive receiver to track SA-2s with the Shrike to destroy the radar, which steadily decreased the effectiveness of the SA-2s. The planning and use of Wild Weasel technology and tactics was passed from pilot to pilot; however, SAC crews had little experience with SA-2s, eventually leading to the first B-52 lost in November of 1972.[29] The lack of dialogue between SAC and TAC alluded to in the previous section was paid for in blood. Technology had advanced sufficiently enough for an uneasy parity between offense and defense, gains for either side would be dependent on developing new tactics.

After

The technological byplay between the offense and defense continued after Vietnam. The Air Force's fascination with technology in the 1950s and 1960s continued as it sought Loki's arrow to defeat the ever-increasing lethality of SAMS. The technological marvels of jet fighters and bombers were not the panacea Airmen thought; technology would not, in fact, "finish this thing quickly."[30] With the lessons of what an integrated air defense could mean to USAF strategic nuclear-delivery platforms, the Air Force sought to advance its offense. One method was to invest technological development in standoff weapons. This would allow the bomber to release weapons well outside enemy air defenses, risking the weapon and not the bomber and its crew. The next method was stealth. Stealth would allow the USAF "to penetrate enemy air

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[28] *Setup*, 126.
[29] Davis, *Bombing the European Axis Powers: A Historical Digest of the Combined Bomber Offensive, 1939-1945*, 165.
[30] Tilford, *Setup*, 285.

defenses in order to launch conventional bombing attacks, Northrop developed the B-2 "Spirit" stealth bomber as a penetrating nuclear bomber to attack targets."[31] Stealth would be the ultimate manifestation of "the bomber will always get through."

Thought

Before

Airpower thought between the conclusion of World War II and the start of the air campaign in Vietnam remained closely tied to nuclear weapons. The newly established USAF jealously guarded the nuclear mission as it "best justified independence," and powerful atomic weapons became the culmination of strategic bombing.[32] SAC executed the nuclear mission; therefore, it received the bulk of the USAF budget and focus. The focus remained on strategic bombing and little else was considered doctrinally. The USAF saw little need to invest time and effort developing additional ideas on airpower, effectively abdicating this realm to civilians. Instead, SAC remained occupied with developing target lists for the Soviet Union and the "operational-level war plans and continued in general to approach strategic airpower much as their wartime predecessors had during the Combined Bomber Offensive."[33] The focus on strategic bombing thought manifested in leadership selection.

General LeMay eventually became Chief of Staff of the Air Force and selected leaders with a mindset similar to his own. Within three years of LeMay's becoming Chief of the USAF, he had ensured that "three-fourths of the highest-ranking Air Force officers in the Pentagon came directly from SAC," further raising the strategic bomber to an unassailable position.[34] The supremacy of strategic bombing doctrine translated into airpower doctrine.

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[31] Mueller, "Strategic Airpower and Nuclear Strategy," 285.
[32] Drew, "Air Theory, Air Force, and Low Intensity Conflict," 327.
[33] Mueller, "Strategic Airpower and Nuclear Strategy," 292.
[34] *The Limits of Air Power*, 29.

Air force doctrine focused solely on strategic bombing. The Air force first published doctrine in 1953 and it underwent three different changes in 1954, 1955, and 1959. Critical to each of these changes was that it seemed doctrinally the Korean War did not happen.[35] Manual 1-8 "Strategic Operations" became the modus operandi of the Air Force as the majority of the leadership believed strategic bombing was *the* Air Force mission, and Manual 1-8 provided the appropriate guidance to execute the mission.[36] In short, the USAF ignored limited war, like in Korea, and "preferred to think of it as little more than a small version of conventional war."[37] This would become problematic in the Vietnam Conflict. The underlying assumption, based on both World War II and Korea, was that the bomber would always get through, or a sufficient number would, to inflict ruinous destruction on the enemy.[38]

During

The Air Force, true to its doctrine, developed a plan to bring Vietnam to its knees through an aerial onslaught. The Air Force developed a standard strategic bombing campaign listing 94 targets designed to destroy "North Vietnam's capacity to continue as an industrially viable state."[39] The campaign manifested in Rolling Thunder, which lasted from early 1965 until late 1968. Controlled from the White House, Rolling Thunder attacked all 94 targets using mostly TAC assets; however, rather than destroying North Vietnam's industrial capacity, the campaign was conducted as a show of strength. Further, the political constraints imposed by the White House chafed Airmen as the bombing pauses allowed the North Vietnamese to reorganize and resupply—the campaign did not use airpower as Airmen believed it

[35] Drew, "Air Theory, Air Force, and Low Intensity Conflict," 331.
[36] Clodfelter, *The Limits of Air Power*, 27,29.
[37] Drew, "Air Theory, Air Force, and Low Intensity Conflict," 321.
[38] Mueller, "Strategic Airpower and Nuclear Strategy," 288.
[39] Drew, "Air Theory, Air Force, and Low Intensity Conflict," 334.

should.[40] A change in administration and growing public dissatisfaction with the war would give Airmen a chance to rectify the situation in Linebacker II.

President Nixon ordered Linebacker II, which would last from 18 to 29 December 1972 as a "maximum effort."[41] Linebacker II represented a mission the Air Force has planned for, using massive formations of B-52s attacking a major city and port to bring the North Vietnamese to their knees. The President removed Hanoi and Haiphong from the restricted target list, enabling bombers to strike vital SA-2 supply lines and the North Vietnamese command structure. The 11-day bombing campaign helped drive the North Vietnamese to the negotiating table and reaffirm Airmen's beliefs that, had they been turned loose earlier, the war would have been much shorter.[42] How Linebacker II was fought is more relevant to both this case study and the overall thesis.

Linebacker II resembled a World War II bombing campaign more so than previous endeavors. The first three nights of Linebacker II were reminiscent of B-29s streaming over targets, as the B-52s marched in a line over 70 miles long, bomber cell after cell.[43] As mentioned above, SAC headquarters planned the B-52 missions. Previous bombing campaigns like Arc Light involved targets lightly defended by the Vietnamese. Conversely, in Linebacker II SAC planners failed to modify tactics against an air defense intelligence organization ranked third best in the world after Israel and the Soviet Union.[44] SAC developed sophisticated methods for the suppression of air defense; however, these tactics were designed for a nuclear attack environment.

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[40] "Air Theory, Air Force, and Low Intensity Conflict," 334.
[41] Marshall L. Michel, *The Eleven Days of Christmas: America's Last Vietnam Battle*, 1st ed. (San Francisco, CA: Encounter Books, 2002), 86,213.
[42] Drew, "Air Theory, Air Force, and Low Intensity Conflict," 334-335.
[43] Tilford, *Setup*, 256.
[44] Davis, *Bombing the European Axis Powers: A Historical Digest of the Combined Bomber Offensive, 1939-1945*, 165.

SAC developed both technology and tactics to account for the advanced Soviet air defenses surrounding Moscow. The B-52 had onboard electronic warfare systems designed to jam Soviet air defense radars. In effect, successful jamming would blank the enemy's radar screens, making it difficult to track the incoming bombers. Furthermore, the B-52G aircraft were modified for the more advanced Soviet homeland defense and lacked both the power and specific systems to counter the SA-2.[45] The SA-2 was an older SAM system given to the Vietnamese when the Soviets upgraded the homeland air defense. Consequently, the more modern G models' electronic warfare systems were tailored to counter newer Soviet systems. The electronic warfare systems of the B-52Ds, older than the G models, were not upgraded yet and thus were customized to counter the SA-2. Moreover, SAC aircrew and planners intended to penetrate Soviet air defenses at low altitude, counting on previous nuclear strikes to have diminished some of the SAM systems.[46] Instead, Linebacker II missions flew at high altitude and well within the effectiveness radius of the SA-2.[47] SAC planners assumed the formations' overlapping ECM coverage would be sufficient to allow the bombers to get through.[48] The first two nights supported the idea, as there were only three aircraft lost out of 121, well below one percent.[49] Unfortunately, the B-52's luck did not hold out, as on the third night six aircraft were lost in less than nine hours. SAC planners need to change in order to conserve the precious nuclear capable B-52s from further losses.

SAC needed to adjust its tactics to stem B-52 losses, and they did so by integrating the B-52s with TAC. The previous three days the B-52

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[45] Michel, *The Eleven Days of Christmas*, 33.
[46] Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984*, 296.
[47] Tilford, *Crosswinds*, 166.
[48] Walter J. Boyne, *Beyond the Wild Blue: A History of the United States Air Force, 1947-1997* (New York, NY: St. Martin's Press, 1997), 174.
[49] Tilford, *Setup*, 255.

formations attacked on the same headings, altitudes, and airspeeds. Further, TAC aircraft deployed lines of chaff, used to confuse SA-2 radars, but instead highlighted the B-52s flightpath to the target for the SA-2s.[50] In short, the rigidity of SAC's planning did not take into account the experience gained in combat by TAC's aircrews. This would all change by the fourth night. SAC adjusted the flightpaths of B-52 formations to attack the targets from multiple azimuths and altitudes. Further, TAC Wild Weasels suppressed SA-2 sites along with additional jamming and chaff corridor aircraft. SAC also mandated that only B-52Ds would attack Hanoi as they had the onboard ECM suited to the SA-2.[51] The combination of a change in tactics plus the onboard B-52 ECM was sufficient to degrade Vietnamese air defenses.[52] Overall, during Linebacker II the USAF lost 15 B-52s out of 795 sorties, roughly 1.89 percent; of note all 15 losses were over Hanoi (372 sorties) at a loss rate of 4.3 percent.[53] Despite a lower loss rate overall, SAC still sought additional ways to counter the defense but with an eye on nuclear war vice limited war.

After

Airpower in Vietnam is another story of lessons observed rather than learned. The doctrine the USAF used in Vietnam declared that an agrarian preindustrial nation could be defeated in the same way as Nazi Germany and Imperial Japan were in World War II.[54] The Vietnam conflict did not fit within the prescribed doctrine of a nuclear focused air force. Instead, Vietnam was "something of a sideshow" that distracted from the real enemy.[55] Consequently, just as after the Korean Conflict,

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[50] Michel, *The Eleven Days of Christmas*, 92.
[51] Tilford, *Setup*, 257.
[52] Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984*, 297.
[53] Michel, *The Eleven Days of Christmas*, 239.
[54] Tilford, *Setup*, 285.
[55] Donald J. Mrozek, *Airpower and the Ground War in Vietnam.* (Maxwell AFB, AL: Air University Press, 1988), 18.

the post-Vietnam USAF turned its attention to the defense of Europe against the Soviet Union.[56] Both military and political leaders learned selective lessons from Vietnam, namely the effectiveness of Linebacker II and carried that lesson forward.[57]

Conclusion

Again, the bomber got through this time, and with reduced losses. Despite the losses, Airmen viewed the Vietnam air war through refractive lenses, seeing only the lessons that proved preconceived notions. One prevalent myth is that Linebacker II "won" the war.[58] In reality, the termination was due to the strategic environment changing sufficiently by the time Nixon took office. President Nixon and his Secretary of State, Henry Kissinger, sufficiently maneuvered the international milieu and removed the threat of direct Chinese or Soviet involvement in the conflict, which were primary concerns during Rolling Thunder.[59] Despite this, many general officers with Vietnam combat experience felt that Linebacker II was "the model of what the air campaign should have been-right from the start in 1965."[60] Linebacker II was an air campaign that Airmen trained for in the post-World War II years.

The Linebacker II concept of operations followed the doctrine of strategic attack. It was designed to attack the command structure of North Vietnam (Hanoi) and destroy vital supply nodes (Haiphong Harbor). It also seemed to Airmen that they were finally "turned loose" to attack what they saw as vital targets to bring the conflict to conclusion, certainly more so than bombing open swaths of jungle.[61] The myth of Linebacker II has some merit, as the USAF demonstrated what it was

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[56] Tilford, *Setup*, 283.
[57] Clodfelter, *The Limits of Air Power*, 201; Tilford, *Setup*, 284.
[58] Clodfelter, *The Limits of Air Power*, 4; Tilford, *Setup*, 289.
[59] Staaveren, *Gradual Failure: The Air War over North Vietnam, 1965-1966*, 309.
[60] Charles T. Kamps, "Operation Linebacker II," *Air & Space Power Journal* 17, no. 3 (2003): 72.
[61] Tilford, *Setup*, 278.

capable of when it integrated its forces, but the bomber was a complement, not the main force.

Linebacker II demonstrated what a well-integrated aerial attack package could accomplish. SAC planners were forced to learn from the combat experience of TAC's aircrews. Vietnam showed a deficit in airpower thinking with regard to limited war. SAC could not rely on the same tactics used to deliver nuclear weapons to penetrate an overlapping air defense. Instead, SAC and TAC combined forces to blunt the enemy's advantage. A combination of active and passive measures to suppress air defense, in combination with multiple attack azimuths and altitudes, allowed the bomber to succeed. These support packages looked very similar to what the USAF uses today and perhaps is a lesson learned rather than observed. Linebacker II was the air campaign the USAF wanted from the start. Later in life, when General LeMay was asked if the United States could have won Vietnam, his reply was, "In any two-week period you want to mention."[62] Linebacker II's force packaging successes were carried forward into the Persian Gulf War.

[62] Clodfelter, *The Limits of Air Power*, 206.

Chapter 4

The Persian Gulf War

The time between the last case study of the Vietnam Conflict and the case study of the Persian Gulf War covers a significant span of time. In this period the Cold War still raged on and it continued to drive developments in military organizational structure, technology, and thought. The Persian Gulf War case study continues with the framework described in chapter one. Before delving into the specifics of the case study, a few moments are required to describe context.

There were two operations between Vietnam and the start of the Persian Gulf War that set into motion changes that influenced the latter war's execution: Operations Urgent Fury and Just Cause. Operation Urgent Fury occurred in October of 1983 and was a US invasion of Grenada to rescue threatened US citizens. The extent of the operation is beyond this work; however, Urgent Fury demonstrated that the US military required a "wake-up call" with regard to joint training as well as command and control issues left unaddressed since Vietnam.[1] While Urgent Fury was a limited operation compared to the previous case studies, Operation Just Cause was much more substantial.

In fact, Just Cause was the largest US military operation conducted since the Vietnam Conflict. This campaign ousted Manuel Noriega, the Panamanian dictator.[2] Just Cause, besides spreading freedom, had a much more profound effect on the future of airpower with the introduction of stealth. The F-117A Nighthawk made its operational debut in Just Cause.[3] Critical to this vignette was how the Nighthawks began the mission from Nevada, flew to Panama, invisibly struck targets

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[1] William T. Y'Blood, "Peace Is Not Always Peaceful," in *Winged Shield, Winged Sword: A History of the United States* ed. Bernard C. Nalty, (Washington DC: Air Force History and Museums Program 1997), 417; Boyne, *Beyond the Wild Blue*, 285.
[2] Kamps, "Operation Linebacker II," 429.
[3] Y'Blood, "Peace Is Not Always Peaceful," 430.

to “stun, disorient, and confuse,” and then returned home.[4] This first use of stealth aircraft was successful and suggested the expense of the technology was justified. The lessons learned from these two operations were also combined with lessons gleaned from Vietnam.

Vietnam demonstrated to the Air Force the need to operate in a high-threat environment. In the interwar years, they developed three methods to attempt to increase the lethality of the Air Force. The first was realistic training that came in the form of Red Flag. Red Flag simulated the first ten combat missions, thereby allowing aviators to develop skills in a highly contested environment under as realistic scenarios as possible.[5] The second was the development and sustainment of electronic attack. The Air Force continued to modernize jamming platforms and self-protection jammers for individual aircraft. Finally, the Air Force invested heavily in radar-avoiding stealth technology.

The Air Force tested these lessons learned in combat operations in the deserts of the Middle East. In the dawn’s early light of 2 August 1990, Iraq invaded the neighboring nation of Kuwait in an effort to recoup lost resources from years of war with its arch-nemesis Iran.[6] The United States led a United Nations-authorized coalition of nations in opposition to Saddam Hussein’s invasion. Both military and political leadership were determined to ensure that this conflict would not follow in the footsteps of Vietnam. With impressive restraint, President Bush allowed military planners to develop a war plan to eject Saddam’s forces from Kuwait. Unlike the Johnson Administration’s execution of Vietnam, there would be no “Tuesday luncheon meetings” to decide targets.[7]

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[4] Boyne, *Beyond the Wild Blue*, 288.
[5] *Beyond the Wild Blue*, 217.
[6] Thomas A. Keaney and Eliot A. Cohen, "Gulf War Air Power Survey Summary Report ", ed. Department of the Air Force(Washington DC: U.S. Government Printing Office 1993), 1.
[7] Boyne, *Beyond the Wild Blue*, 297.

Fortunately, the USAF had built a successful organizational structure to defeat Saddam.

Organizational Structure

Before

The structure of the Air Force as a whole remained largely unchanged from the Vietnam Conflict. There were, however, two notable trends in the years preceding the Persian Gulf War. The first was the shift in leadership at the highest levels of the Air Force. The shift, which began at the conclusion of the Vietnam Conflict, is referred to as "the rise of the fighter generals." In 1975, the proportion of generals with bomber or fighter pedigrees was relatively equal; however, by 1990, the numbers shifted almost two to one in favor of fighter pilots.[8] There were more combat fighter command positions than bomber positions in Vietnam. It became a simple numbers game as fighter pilots garnered combat achievements, which appeared more appealing to promotion boards than the service of aviators sitting on nuclear alert. The shift between the disparate communities also had ramifications for the tenor of the Air Force. SAC believed in centralized and authoritarian procedures. Conversely, TAC celebrated a decentralized and collaborative perspective. In turn, TAC produced an increasing number of fighter generals who, with increasing influence, drove a philosophical shift towards a centralized control and decentralized execution mode of operation.[9] Fighter generals, because of deep personal relationships with their Army counterparts forged in the crucible of combat in Vietnam, were also more likely to lean toward supporting the Army scheme of maneuver.[10] The

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[8] Harold R. Winton, "An Ambivalent Partnership: U.S. Army and Air Force Perspectives on Air-Ground Operations, 1973-90," in *The Paths of Heaven: The Evolution of Airpower Theory*, ed. Phillip S. Meilinger, (Maxwell AFB, AL: Air University Press, 1997), 430.
[9] Boyne, *Beyond the Wild Blue*, 283; Winton, "An Ambivalent Partnership: U.S. Army and Air Force Perspectives on Air-Ground Operations, 1973-90," 421.
[10] "An Ambivalent Partnership: U.S. Army and Air Force Perspectives on Air-Ground Operations, 1973-90," 419.

Thought section explores this further. The Air Force and the Army codified this cooperation in the second trend.

The Department of Defense Reorganization Act of 1986 changed how the Department would conduct war. The reorganization act, commonly referred to as the Goldwater-Nichols Act, enacted sweeping changes to the hierarchy of the Department.[11] The act placed the Chairman of the Joint Chiefs of Staff into the chain of command that previously flowed from the President to the Secretary of Defense to the specified and unified commanders.[12] More importantly, the Act sought to create multiple theaters of operations in which the respective theater commander had total authority to conduct military operations.[13] This became important in the Persian Gulf War as it allowed the theater commander to designate a single airpower commander with control of all assets. This was in contrast to the convoluted organizational structure of the Vietnam Conflict. The single airpower commander was designated as the Joint Force Air Component Commander (JFACC).

During

During the Gulf War there was not as great a need for change in the organization of the Air Force as there was in WWII. As mentioned, the Air Force embraced the organizational concept of the JFACC as a single air commander. This was in response to the Air Force's suffering seven years of fragmented airpower command in Vietnam. Consequently, a visceral lesson from the conflict was the creation of a single airpower commander who worked directly for the theater commander.[14] General Schwarzkopf, the theater commander, assigned

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[11] William T. Y'Blood, "Metamorphosis: The Air Force Approaches the Next Century " in *Winged Shield, Winged Sword: A History of the United States*, ed. Bernard C. Nalty, (Washington DC: Air Force History and Museums Program, 1997), 536.
[12] "Metamorphosis: The Air Force Approaches the Next Century " 537.
[13] Edward C. Mann, *Thunder and Lightning: Desert Storm and the Airpower Debates* (Maxwell AFB, AL: Air University Press 1995), 30.
[14] Winton, "An Ambivalent Partnership: U.S. Army and Air Force Perspectives on Air-Ground Operations, 1973-90," 403.

Lieutenant General Horner as his JFACC; this was the first formal use of the JFACC.[15] Critical to the position of JFACC is control of all of the air assets in theater. This allowed Horner to control a crowded air space, thereby allowing "a degree of coherence in the conduct of air operations that would not have occurred had most air forces been assigned separate operating areas ('route packages') as in Vietnam."[16] In effect, Horner had the ability to apportion other services air assets to targets that affected the overall air strategy.[17] This allowed for the effective and efficient use of all air assets in theater. The success of the air campaign in the Gulf War rereinforced the Air Force's predilection for centralized control and decentralized execution.

After

The organizational structure of the Air Force after the Persian Gulf War underwent a tectonic shift. The strategic environment changed with the fall of the Soviet Union, calling into question the usefulness of the nuclear monolith of SAC. On 1 June 1992, the Air Force dissolved two warfighting commands, SAC and TAC, and formed Air Combat Command (ACC) with assets from each.[18] This impact of that decision still reverberates in the Air Force today. The result of combining SAC's strategic bomber force with TAC's fighters was, in effect, forcing cats and dogs to live together.[19] The forced merging of two different cultures: one focused on centralized control with the other celebrating freewheeling planning.[20] The Chief of Staff General McPeak was sensitive to the deep heritages of both former commands and ensured the "most famous units

[15] Y'Blood, "From the Deserts to the Mountains " 456.
[16] Keaney and Cohen, "Gulf War Air Power Survey Summary Report " 159.
[17] Boyne, *Beyond the Wild Blue*, 298.
[18] Steven L. Rearden, "U.S. Strategic Bombardment Doctrine since 1945," in *Case Studies in Strategic Bombardment* ed. R. Cargill Hall, (Washington DC: Air Force History and Museums Program 1998), 453; Boyne, *Beyond the Wild Blue*, 319.
[19] *Beyond the Wild Blue*, 315-316.
[20] *Beyond the Wild Blue*, 318.

were preserved, along with their heraldry."[21] A note of foreshadowing was present with the selection of ACC's patch. General McPeak rejected suggestions reminiscent of SAC and instead used the TAC patch wholesale. The only difference was in the text at the bottom that changed "Tactical Air Command" to "Air Combat Command."[22] The future of the Air Force continues to revolve around the attempted melding of the two cultures of nuclear and conventional operation.

Moreover, the bomber force would have two masters in this new construct. ACC was responsible for the bombers' conventional mission. Conversely, the newly established US Strategic Command was responsible for the bombers' nuclear mission. The merging of TAC and SAC assets, on the surface, seemed to solidify the concept of integration. In reality, the nuclear mission of the bomber force remained apart from the rest of the Air Force, just as it did under SAC.

Technology

Before

There are two technological developments resulting from combat in Vietnam: stealth and precision weapons. Each of these two technologies had far-reaching ramifications in the conduct of the Persian Gulf War. The first is stealth, alluded to earlier, and the development of the F-117.

The Air Force emerged from Vietnam with a laundry list of improvements required to operate in a contested environment. The air defenses of Vietnam illustrated that the Air Force needed a technology that could penetrate Soviet air defenses and precisely strike targets.[23] Further, the Air Force observed the mayhem Soviet-built air defenses caused the Israelis in 1973. The answer, it seemed, was "an air vehicle designed to present little or no radar cross section (RCS) from any angle,

[21] *Beyond the Wild Blue*, 317.
[22] *Beyond the Wild Blue*, 319.
[23] *Beyond the Wild Blue*, 256, 259.

and one that minimized its heat signature to foil infrared detection."[24] In 1978, the Air Force, in combination with Lockheed Aircraft Corporation, began to develop the first aircraft centered not on performance characteristics but on RCS. The aircraft, codenamed Have Blue, would later become the F-117A Nighthawk.[25] The cost of any new technology is expensive, thus budget constraints played a part in the Nighthawks development.

In the years prior to the Reagan military buildup, budget limitations affected the development of new technologies. The original Air Force plan was to buy 100 aircraft; however, due to budget constraints the Air Force only bought 59.[26] The aircraft itself was relatively inexpensive. In 1991 dollars, the flyaway cost for the F-117 was $52.5 million, while a comparable strike aircraft, the F-111F, was $45 million.[27] The real cost saving, according to the Air Force, came from supporting assets. The F-117 would only need air refueling while the F-111 would need a complete combat escort package (with the associated fuel, weapons, refueling, maintenance, and possible risk of lives).[28] While technically true, this is where the myth of stealth technology had its beginnings.

The F-117 became, as described in the framework section of chapter one, a supplement to other forms of aircraft. Stealth would allow the F-117 to strike targets deep within enemy territory without risking additional lives, reminiscent of the notion of airpower during the interwar years and ACTS. Stealth does not, nor was it intended to, make an aircraft invisible; rather, it makes it more difficult to track and therefore

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[24] Richard G. Davis, "Strategic Bombardment in the Gulf War," in *Case Studies in Strategic Bombardment* ed. R. Cargill Hall, (Washington DC: Air Force History and Museums Program 1998), 532.
[25] Boyne, *Beyond the Wild Blue*, 247; Davis, "Strategic Bombardment in the Gulf War," 532.
[26] Boyne, *Beyond the Wild Blue*, 260.
[27] Davis, "Strategic Bombardment in the Gulf War," 532.
[28] "Strategic Bombardment in the Gulf War," 532.

engage the aircraft.[29] Stealth is a mathematical extension of visual camouflage used as far back as World War II. Stealth technology merely enabled an aircraft to be less observable to radar emissions. The combination of a reduced radar signature with flying at night makes a stealth aircraft more difficult to engage.

The notion of radar invisibility is a myth. Yet, the invisibility myth permeated the ranks of the Air Force. Some Air Force leaders and planners "thought this platform was invincible, that it was totally invisible to all defenses, and we could simply go barreling our way through anything that we wanted to do."[30] The idea of stealth became Loki's arrow with the ability to operate "in sort of an assassin's role: the ability to go deep, surgically remove a particular target, and not be seen or heard of in any other way."[31]

There were some in the Air Force that saw stealth as a complement to other forces, but they were not the most prevalent voice. Regardless of the classification of the system, in the early days, it caused issues with the integration of the F-117 into current war plans.[32] The shape and materials used to build the aircraft gave the Nighthawk its low observable nature while other technological improvements were developed.

The second major technological innovation pursued prior to the Persian Gulf War designed to fulfill airpower theorists' dreams was precision weaponry. The most notable development in precision weapons during this period revolved around the Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) pod. The LANTIRN pod allowed high accuracy weapons release at low level, both at night and during the

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[29] "Strategic Bombardment in the Gulf War," 533.
[30] Paul G. Kaminski, "Low Observables: The Air Foce and Stealth," in *Technology and the Air Force: A Retrospective Assessment* ed. Jacob Neufeld, George M. Watson Jr., and David Chenoweth, (Washington DC: Air Force History and Museums Program, 1997), 306.
[31] "Low Observables: The Air Foce and Stealth," 306.
[32] "Low Observables: The Air Foce and Stealth," 308.

day. It did not give the Air Force an all-weather capability it enjoys today but instead gave the Air Force a very good under-the-weather capability.[33] The LANTIRN pod was ultimately paired with improved guided weapons.

The Air Force first used laser-guided weapons in Vietnam to great effect and continued their development following the conflict. Throughout the years between Vietnam and the Persian Gulf War, the Air Force made steady improvements to the weapons. The evolution of the PAVEWAY weapons series eventually lead to the third version in the mid-1980s that enhanced structural integrity, improved guidance, and added folding wings so aircraft could carry additional weapons.[34] The combination of new laser-guided weapons and the LANTIRN pod were a combination that seemed to support the ideas of ACTS in the interwar period.

The technological improvements to precision weapons concentrated airpower's effectiveness into a single aircraft. Precision guided weapons multiplied the effectiveness of a single aircraft's bomb load. Now a single aircraft could precisely strike multiple targets on a single pass that previously would have taken multiple passes by a large strike force.[35] In short, technological improvements allowed the Air Force to think in number of targets per sortie rather than sorties per target.[36] By the start of the Persian Gulf War, precision weapons' improvements had not reached the majority of the aircraft in the Air Force, only about 125-135 fighter-bombers were modified.[37] These few aircraft, however, were used extensively in combat.

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[33] Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984*, 562.
[34] Davis, "Strategic Bombardment in the Gulf War," 529.
[35] Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984*, 562; Davis, "Strategic Bombardment in the Gulf War," 575.
[36] Keith L. Shimko, *The Iraq Wars and America's Military Revolution* (New York, NY: Cambridge University Press, 2010), 81.
[37] Davis, "Strategic Bombardment in the Gulf War," 529-530.

During

The USAF, in collaboration with coalition air forces, used a combination of stealth, precision and electronic warfare to overwhelm a well-integrated Iraqi air defense. Prior to the commencement of combat operations, the US stationed roughly 90 percent of the service's precision weapons aircraft, including the F-117 in theater.[38] Stealth aircraft attacked heavily defended key leadership and communications nodes at the onset of the war to blind the air defense. This enabled follow on strikes with conventional aircraft almost impossible to track and engage.[39] The use of the LANTIRN pod allowed USAF aircraft to become "corsairs of the night" striking multiple targets per sortie.[40] Even bridges, historically difficult to destroy, were no match for new technology with seven to ten bridges destroyed weekly.[41] In order to facilitate this symphony of destruction, the Air Force had to protect the strike force.

Active and passive electronic warfare aircraft disorientated Iraq's air defense. The Air Force learned from Linebacker II about the requirements for an integrated escort for striking aircraft. In fact, if electronic warfare aircraft were unavailable to escort the strike package, then planners canceled the mission.[42] Coalition aircraft used a combination of onboard jamming equipment (either internal to the aircraft or via a pod) or escort jammers to blind Iraqi air defense radars. Additionally, the Air Force used the new AGM-88 high-speed anti-radiation missile extensively throughout the campaign to destroy various radars.[43] The air defense surrounding Baghdad was extensive. Missions into this high threat zone required the combination of all available

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[38] "Strategic Bombardment in the Gulf War," 557.
[39] Keaney and Cohen, "Gulf War Air Power Survey Summary Report " 224.
[40] Boyne, *Beyond the Wild Blue*, 299.
[41] Y'Blood, "From the Deserts to the Mountains " 475.
[42] Keaney and Cohen, "Gulf War Air Power Survey Summary Report " 195.
[43] "Gulf War Air Power Survey Summary Report " 196.

electronic warfare assets for mission success. Even the mythological F-117 requested direct electronic warfare support for strike into Bagdad; it was the only time the F-117 unit requested any additional assistance.[44] For the first time, high above the conflict, the Air Force used space assets to facilitate the deluge of airpower.

Some consider the Persian Gulf War as the debut of space assets. The Persian Gulf War used both the Global Positioning System (GPS) and satellite communications throughout the conflict. Aircraft used GPS-enabled precision navigation extensively; even the venerable B-52 utilized GPS when executing the then longest combat mission in history.[45] Moreover, satellite communications allowed for an unprecedented command and control. GPS and satellite communications "cloaked the battlefield with an enveloping power that transcended Iraqi understanding."[46] The combination of stealth, precision engagement, and space are legacies the Air Force nurtures to this day.

After

Investment in technology paid off in the Persian Gulf War generating even more interest in new developments. The radical design of the F-117 proved itself in combat, removing any doubts remaining from Operation Just Cause on its battlefield effectiveness. [47] Moreover, the F-117's success highlighted that "high-technology systems with precision munitions in sufficient numbers can offset more numerous, less sophisticated ones."[48] The combination of stealth and precision enabled the Air Force to forgo rolling back enemy air defenses and strike directly at critical targets. Consequently, the USAF sought even more sophisticated stealth aircraft. This aircraft, the B-2A Spirit, started in

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[44] Y'Blood, "From the Deserts to the Mountains " 458-459.
[45] Davis, "Strategic Bombardment in the Gulf War," 528; Boyne, *Beyond the Wild Blue*, 275.
[46] *Beyond the Wild Blue*, 294.
[47] Keaney and Cohen, "Gulf War Air Power Survey Summary Report " 226.
[48] Davis, "Strategic Bombardment in the Gulf War," 612.

the Carter administration, would be a radical departure from the F-117 technology, fusing composite materials and a smooth blended wing approach.[49] The development of the B-2 revolved around the requirements of greater range and a greater precision weapons payload. Its development was reminiscent of the pre-WW II quest for increased bomber range, speed, and payload. The Gulf War spawned new technology and the requirement for improved precision weapons.

The popular recollection of the air campaign in the Gulf War is of weapons striking specific windows in specific buildings. In fact, the US military used roughly 9,000 laser-guided weapons, compared with over 200,000 unguided "dumb bombs."[50] Unfortunately, weather caused targeting issues. Consequently, the Air Force developed all-weather weapons harnessing the GPS constellation. This was in an effort to extend the legacy of the Gulf War with regard to the minimization of civilian casualties regardless of weather conditions.[51] The legacy of precision haunts the Air Force today. Precise in World War II might be a square block, while in Vietnam a specific bridge, and in the Gulf War, a specific window.[52] Anything less than perfect strike with today's expectations of collateral damage can have strategic implications.

Thought

Before

The tension between nuclear operations and supporting the ground scheme of maneuver characterizes airpower thought prior to the Persian Gulf War. The Air Force had few doctrinal changes after Vietnam.[53] In essence, the United States as a whole settled into a defensive mindset. Very little effort was put into developing theater war

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[49] Boyne, *Beyond the Wild Blue*, 250, 260.
[50] Keaney and Cohen, "Gulf War Air Power Survey Summary Report " 226.
[51] Davis, "Strategic Bombardment in the Gulf War," 611.
[52] Boyne, *Beyond the Wild Blue*, 300.
[53] *Beyond the Wild Blue*, 255.

plans “to take the offensive and carry the fight to the enemy's homeland.”[54] The prominent exception to this malaise was Air Force strategic planners developing the nuclear single-integrated-operational-plan (SIOP).[55] SAC planners continued to develop war plans that saw the Air Force through nuclear operations as a war-winning course of action. The shift in Air Force leadership from bomber to fighter generals changed this mindset.

Fighter generals sought to continue the relationship forged in the crucible of combat with the Army. TAC’s corresponding obsession to SAC’s SIOP was AirLand Battle.[56] The pendulum of airpower thought swung from nuclear operations to supporting the ground commander. Some in the Air Force saw this as a departure from the tenets of an independent air force, tying airpower too closely to the ground.[57] The ascendant TAC generals focused instead on the problem at hand, the defense of Europe from the hordes of Soviet conventional forces.[58] The Army shared the same viewpoint and developed AirLand Battle.

AirLand Battle was Army doctrine, but it was not Air Force doctrine. The Army, viewing the strategic landscape of Europe and drawing lessons from previous conflicts, realized it could not hope to win against the Soviets on the plains of Europe without airpower.[59] The idea that AirLand battle was Air Force doctrine centered on a memorandum of understanding between the Army and Tactical Air Command to train together in order to improve the effectiveness of joint operations.[60] In effect, AirLand Battle codified partnerships formed in the late 1970’s

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[54] Mann, *Thunder and Lightning: Desert Storm and the Airpower Debates* 27.
[55] *Thunder and Lightning: Desert Storm and the Airpower Debates* 30, 27.
[56] Warden, *Rise of the Fighter Generals*, 283.
[57] Davis, "Strategic Bombardment in the Gulf War," 534.
[58] Warden, *Rise of the Fighter Generals*, 228.
[59] Winton, "An Ambivalent Partnership: U.S. Army and Air Force Perspectives on Air-Ground Operations, 1973-90," 424-425.
[60] Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984*, 551,554; Winton, "An Ambivalent Partnership: U.S. Army and Air Force Perspectives on Air-Ground Operations, 1973-90," 433.

between the Army and Air Force as a method to train and develop force structures in mutual support of one another. During the same period as AirLand Battle development, another idea of airpower was circulated.

The Global Reach–Global Power concept became the clarion call for strategic airpower. Global Reach—Global Power was the idea that US airpower could reach anywhere in the world in mere hours.[61] It harnessed the concepts of nuclear operations, which the Air Force had adhered to for decades, and translated the offensive mindset to the conventional realm. In short, the technological edge the USAF possessed would allow it to project decisive combat power across the global in an emergency giving political leadership additional strategic options besides nuclear weapons.[62] The debate remains how much AirLand Battle or Global Reach—Global Power affected the thought process of the Air Force with regard to airpower's role in warfare—independent strategic air campaign or support for the ground force.[63] The argument was not a novel concept, as it remains a fundamental dichotomy in the Air Force today. The next section explains how the Air Force resolved the dichotomy of airpower in the Gulf War.

During

The tension between Global Reach—Global Power and AirLand Battle played out in the air campaign for the Gulf War. The Iraqi invasion of Kuwait spawned a coalition response. Airpower was first on the scene when the USAF deployed air superiority aircraft to help defend Saudi Arabia.[64] From the outset, General Schwarzkopf requested an air campaign to help drive Iraqi forces out of Kuwait. It just so happened

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[61] Boyne, *Beyond the Wild Blue*, 284.
[62] *Beyond the Wild Blue*, 290.
[63] Mann, *Thunder and Lightning: Desert Storm and the Airpower Debates* 29.
[64] Boyne, *Beyond the Wild Blue*, 293; Y'Blood, "From the Deserts to the Mountains " 448.

that his request went to the Air Staff where the task was given to Colonel John Warden and his staff at Checkmate.

Warden developed an air campaign reminiscent of ACTS and the industrial web. Warden developed an analytical model of an adversary using five concentric circles with the inner most as political leadership and the outermost ring, and least important, fielded forces.[65] With this model in mind, Warden's team developed an air campaign titled INSTANT THUNDER. The name suggested a direct refutation of the gradual nature of the Vietnam Conflict's Rolling Thunder. Warden's suggested campaign targeted Iraqi command and control to cause strategic paralyses throughout the enemy system.[66] INSTANT THUNDER was a stand-alone war-winning strategy designed to strike Iraqi centers of gravity by destroying 80 targets within a week.[67] While Schwarzkopf approved of the overarching idea, he and other airpower leadership did not see airpower as *the* war winning approach.

Warden's initial plan focused on Iraqi leadership and ignored the ground forces occupying Kuwait; this was something AirLand Battle enthusiasts found abhorrent. General Horner, the JFACC, rejected the stand-alone nature of INSTANT THUNDER. Horner felt the plan lacked sufficient detail to execute, although he did recognize the feasibility of the overarching idea of the campaign.[68] Consequently, he combined the ideas of INSTANT THUNDER and added concepts from AirLand Battle into a plan that culminated airpower thought prior to the Gulf War.[69] With the basic concepts of INSTANT THUNDER retained, the air campaign became the first of four phases the United States used to defeat Saddam.

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[65] Olsen, *John Warden and the Renaissance of American Air Power*, 109.
[66] Mann, *Thunder and Lightning: Desert Storm and the Airpower Debates* 35; Boyne, *Beyond the Wild Blue*, 293; Y'Blood, "From the Deserts to the Mountains " 456.
[67] "From the Deserts to the Mountains " 456.
[68] Boyne, *Beyond the Wild Blue*, 294.
[69] Davis, "Strategic Bombardment in the Gulf War," 545; Boyne, *Beyond the Wild Blue*, 294; Y'Blood, "From the Deserts to the Mountains " 456.

In those four phases, airpower was critical in enabling overall campaign success. Schwarzkopf envisioned those phases as:

Phase I: "Strategic Air Campaign" against Iraq

Phase II: "Kuwait Air Campaign" against Iraqi air forces in Kuwait

Phase III: "Ground Combat Power Attrition" (air attacks) to neutralize the Republican Guard and isolate the Kuwait battlefield

Phase IV: "Ground Attack" to eject Iraqi forces from Kuwait.[70]

Airpower alone would accomplish the first three phases and would execute the fourth in combinations with ground forces.[71] In sum, Air Force leaders combined the concepts of Global Reach—Global Power and AirLand Battle to the advantage of the coalition. One by-product of the air campaign in the Persian Gulf War was the blurring of lines between strategic and tactical assets.

In the preceding years of airpower history, planners tied specific aerial platforms to specific mission sets. A prime example is how the bomber was associated with strategic targets.[72] The Gulf War changed this mindset. Instead, the best-suited platform struck targets for the desired effect. Some of the first strategic strikes carried out in Phase I were by the F-117s in combination with helicopters to blind the Iraqi air defenses.[73] Follow on fighter-bombers bombed “strategic targets” to widen the gap in Iraqi air defenses. Conversely, B-52s, once considered the epitome of a strategic asset, focused on bombing Iraqi fielded forces and supply lines. These strikes followed B-52 launched cruise missile strikes completed in the opening hours of the air campaign.[74] The Persian Gulf War allowed the Air Force to explore and hone the inherent

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[70] Boyne, *Beyond the Wild Blue*, 298-299; Davis, "Strategic Bombardment in the Gulf War," 546-547, 568-569.
[71] "Strategic Bombardment in the Gulf War," 546-547.
[72] "Strategic Bombardment in the Gulf War," 574.
[73] "Strategic Bombardment in the Gulf War," 561.
[74] Boyne, *Beyond the Wild Blue*, 301; Y'Blood, "From the Deserts to the Mountains " 460-461.

flexibility of its aircraft and investigate the use of dichotomous military thought in a complementary manner.

After

The Gulf War became the blueprint for the future USAF. The strategic use of airpower demonstrated in the Gulf War became official doctrine taught in the Air Force.[75] The Gulf War demonstrated the speed, flexibility, and precision a modern technologically advanced Air Force can accomplish for the state.[76] The Gulf War seemed to have proven early theorists' concepts of airpower. Airpower, when planned by Airmen and used doctrinally, can reduce the duration of conflict. The Gulf War reinforced the narrative of airpower as a war-winning strategy.

Conclusion

The bomber, or more specifically the aerial asset, got through. The confluence of military technology and thought, specially the use and development of precision and stealth, demonstrated what early airpower advocates theorized over half a century earlier.[77] Pearl Harbor pales in comparison to the aerial onslaught carried out by coalition aircraft against Iraq.[78] The devastation wrought by modern airpower came at a much-reduced cost when compared to earlier conflicts. Not one bomber was lost in combat, compared to the fifteen B-52s lost in the eleven days of Linebacker II.[79] The overwhelming success of Gulf War airpower launched a new mythology.

Airpower strategists were determined to learn lessons from Vietnam. The drive to survive complex air defenses fostered the development of stealth. The Gulf War spawned the myth of stealth

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[75] Dag Henriksen, *Nato's Gamble: Combining Diplomacy and Airpower in the Kosovo Crisis, 1998-1999* (Annapolis, MD: Naval Institute Press, 2007), 54.
[76] Y'Blood, "From the Deserts to the Mountains " 486.
[77] Shimko, *The Iraq Wars and America's Military Revolution*, 82-83.
[78] Boyne, *Beyond the Wild Blue*, 302.
[79] Y'Blood, "From the Deserts to the Mountains " 462.

technology. The F-117s "were never touched by bullet or SAM, and as far as can be determined, were never even tracked by Iraqi radar."[80] This lent an air of invincibility to the stealth aircraft. The F-117 could strike critical nodes, thereby momentarily blinding enemy air defenses and allowing follow-on strikes. A conventional strike package then followed the stealth aircraft. These follow-on strike packages were much smaller than the Vietnam-era versions. Precision weapons allowed a single aircraft to strike multiple targets thereby requiring fewer aircraft, which required fewer escorts.[81] Technology also shifted airpower thought.

Technological development shifted traditional concepts of what was a *strategic* or *tactical* asset. "Strategic" bombers attacked fielded forces, while "tactical" fighters attacked strategic targets.[82] The pendulum of airpower swung again--this time from mass destruction to pinpoint destruction of critical nodes, all in an effort to reduce the cost of war.[83]

The reduction of collateral damage is another legacy from the Gulf War. The Gulf War created a new standard of victory; the United States must win "quickly, decisively, with overwhelming advantage and few casualties. It must, in short, prevail by 99 to 1, not 55 to 54 in double overtime."[84] In essence airpower, embodied by stealth aircraft, represented the second phase in House's three phase hierarchy explained in chapter one. The second phase is where zealots profess a new technology's ability to win the war single handedly—a supplement to other methods of war. The question remains if stealth technology will ever obtain the complement level in the eyes of political and military leadership.

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[80] Boyne, *Beyond the Wild Blue*, 301.
[81] *Beyond the Wild Blue*, 309; Davis, "Strategic Bombardment in the Gulf War," 531.
[82] Y'Blood, "From the Deserts to the Mountains " 462; "Metamorphosis: The Air Force Approaches the Next Century " 565.
[83] Boyne, *Beyond the Wild Blue*, 301.
[84] *Beyond the Wild Blue*, 313.

Chapter 5

Conclusion

History never repeats itself, but the kaleidoscopic combinations of the pictured present often seem to be constructed out of the broken fragments of antique legends.

Mark Twain

The overarching question this thesis sought to answer is: will the bomber always get through? The suggested answer to this question is "Yes" according to the three case studies presented. The real issue swirls around how this affects the Air Force of today. In World War II, the United States was involved in an all-out effort to defeat the Axis powers. Consequently, the nation had both the political and financial will to absorb almost catastrophic losses to the bomber force. In some cases, bomber missions lost upwards of sixty percent of the attack force. Even in the divisive Vietnam Conflict, the nation absorbed significant, though markedly reduced, losses in the air. In the eleven days of Linebacker II, the United States was willing to lose fifteen B-52s, the symbol of US nuclear power, to advance national objectives. The Persian Gulf War set the bar even higher with regard to what was sufficient to meet national objectives. In the Gulf War, airpower suffered minimal losses, losing zero bombers in combat, and yet devastated one of the world's largest armed forces. The Gulf War set the precedent of almost zero loss of airpower to obtain national objectives. If minimal loss is the only viable option for limited war, what does the legacy of "the bomber will always get through" suggest to the USAF?

The quote at the start of the section from the great American bard lends focus to this concluding chapter. The past may not repeat itself, yet the present is constructed of consciously selected portions of the past. Moreover, the USAF specifically selected portions of its brief history to carry forward, namely the efficacy of the bomber. In broad strokes, this idea is correct. The bomber *did* get through in all three of

the case studies presented. However, the *cost* of getting a portion of the bomber force through is lost in the overall discussion. The real issue revolves around the second and third phases of House's argument presented in chapter one.

The pendulum swinging between two phases is the cause for concern. In House's phase two, zealots embrace a new weapon or technology as a war-winning tool. In this case, the bomber represents the tool in question. In phase two, the new weapon or technology is considered a silver bullet or Loki's arrow. In the third phase, the adversary introduces a counter to the tool, thereby partially negating the new weapon or technology. The integrated air defense armed with surface to air missiles countered the high-flying strategic bomber. Therefore, the "new' weapon is no longer thought of as a war winning innovation, and it is folded into the group and becomes part of the greater team.[1] One key factor for change between phase two and three is the crucible of combat. More specifically, combat provides stark lessons on the implications of technology, sometimes forcing a phase change.[2] In general, the bomber is a supplement before the start of hostilities and shifts to a complement during conflict. A brief excursion from the case studies illustrates this point, but first a short review of the factors affecting the shift between supplement and complement.

Chapter one highlighted the framework used throughout each of the three case studies. Knox and Murray's *Dynamics of Military Revolution* provided the first portion of the framework. The authors postulated that organizational structure, technology, doctrine, and tactics shape how the military operates. This work combined doctrine and tactics into military thought as each are so closely related. In sum, each of the three case studies sought to highlight how each of the three

[1] *Combined Arms*, 8.
[2] Posen, *The Sources of Military Doctrine*, 56.

factors influenced how the Air Force considered the bomber as a supplement or a complement. The confluence of the three factors drove the Air Force to view the bomber as a supplement in the first two case studies and as a complement in the last.

The genesis of airpower in warfare began in the years between World War I and World War II. During this period, airpower thought in some instances exceeded what the current technology could produce. In an effort to avoid the horrors of trench warfare from World War I, Airmen sought a supplemental method to win the nation's wars. The basic concept was to sidestep fielded forces and attack an adversary's industrial war making capabilities, thereby forcing capitulation. The instrument of this idea became the bomber.

The bomber fit the narrative Airmen sought to advance. The bomber could be a war winning tool—a replacement for traditional methods of warfare. This was only possible because of technological improvements in aviation. The steady increase in aircraft performance only solidified the bomber's supremacy. In order to fly higher and faster, the technology of the day drove larger aircraft to house additional fuel and engines to accomplish these requirements. Simultaneously, aircraft manufactures considered the development of pursuit aircraft too risky, as the advances required to improve the range and speed of these types of aircraft seemed beyond reach. Thus, the bomber's performance continued to improve, while pursuit technology languished. Combat provided the impetus of change.

Combat operations against Nazi Germany demonstrated to airpower advocates weaknesses in their theories. The first was that the bomber could not get through in sufficient numbers without proper escort. Combat often provides a jump-start to technological development. Germany developed much more advanced fighters than US planners anticipated in the interwar years. Consequently, a determined German fighter force savaged bomber formations.

The Schweinfurt raids' bomber losses served as a catalyst for change. The bomber forces sustained a 60 percent overall loss rate. Even in a total war, the United States could not sustain these murderous losses. The tides had changed, and the bomber could not accomplish the mission alone. Thankfully, pursuit technology had advanced sufficiently to allow a long-range fighter to escort bomber formations. Additionally, the allies executed an organizational change by nesting both fighters and bombers under commands responsible for different geographical areas in Europe. The stage was set for the bomber to become integrated into the overall air campaign. In sum, the bomber was the star of the stage, but it was no longer a one-act show; instead, air combat became instead a well-orchestrated drama with supporting actors.

Airmen entered World War II with the idea that the most efficient way to claim victory was to destroy the industrial makeup of a country through the use of bombers. Combat did not change this idea wholesale, but instead modified it. Airpower theorists learned that the bomber could not obtain unescorted victory due to advances in the defense. The bomber became a complement both to the notions of airpower and to the overall war effort of the state. Unfortunately, the pendulum swung back to *supplement* at the conclusion of World War II and the establishment of the USAF.

The bomber gained significant stature with the establishment of the USAF post-World War II. The invention and use of the first atomic weapons also added to the supremacy of the bomber. The combination of the two technologies drove airpower thought through many of the years in between World War II and Vietnam. The destructive power of atomic weapons gave the bomber the ability to hit multiple targets at once. It also allowed a few sorties to affect the enemy. Additionally, the formation of SAC along with its influence set the path for the USAF.

SAC's mission became the USAF's focus. Almost all-technological development at the time focused on making the bomber fly higher, faster,

and with greater range. Even TAC began to mirror SAC's focus on nuclear weapons in an effort to obtain as much of the budget as possible. The use of nuclear weapons inundated all levels of the USAF. The most notable was in the by play between the offense and defense.

The use of airpower against the Axis powers showed nations of the world the need for an air defense. Thus, technological development of SAMS and their integration within an air defense became a method to defeat the offensive power of a nuclear laden bomber. The answer, according to SAC planners, was to use nuclear weapons to help break Soviet air defenses. The USAF spent little effort either in developing conventional methods of SAM suppression or in the integration between SAC and TAC. Yet again, it would take combat and associated losses to drive the need for change.

Vietnam demonstrated the advances made in the defense. TAC learned the lessons faster than SAC, mostly because TAC engaged earlier in the conflict and over more heavily defended targets. In contrast, SAC added assets incrementally to the conflict in an effort to signal the increasing resolve by the United States. The losses in the first three days of Linebacker II created a moment of lucidity in the USAF. The early days illuminated the overreliance of SAC on nuclear weapons in the suppression of air defenses. It also showed that bomber formations could not use World War II tactics—a stream of bombers sequentially bombing a target at the same altitude, airspeed, and heading. Much like during World War II, combat forced the integration of TAC's smaller fighters and SAC bomber assets. SAC planners acknowledged the need for additional escorts into the heavily defended targets of Hanoi and Haiphong. A sufficient number of bombers would get through only if properly escorted. Again, this lesson reinforced that the bomber was but a complement to the air effort, and it carried through post-Vietnam.

The USAF sought to incorporate the lessons learned in the crucible of battle. The first was the need to suppress enemy air defenses with

something other than nuclear weapons—especially in a limited war. The USAF invested heavily in technological means to blunt air defenses through anti-radiation missiles and on- and off-board electronic countermeasures. The second lesson was the need for advanced training. Consequently, the USAF established RED FLAG as an exercise meant to simulate realistically an aviator's first ten combat missions. The concept was to have valuable lessons learned without the risk of combat losses. Another lesson learned that has had continued ramifications even in the current USAF was the need for precision weapons.

Precision weapons changed the methodology of airpower. Airpower strategists could now consider multiple targets per individual aircraft vice multiple aircraft per target. Technology forced a shift in airpower thought. Precision weapons were but a small part of the Persian Gulf War ordnance used, but they left a lasting impression on both the public and on political leadership. Airpower could strike anywhere with scalpel-like precision, alleviating collateral damage concerns. Precision weapons also blurred the distinction between the "strategic" and "tactical" asset. In the Gulf War, fighter-bombers struck the majority of the critical targets in Iraq while bombers attacked fielded forces. One main cause for this shift was that precision weapons were only developed for fighters, leaving technological developments to the bomber in the nuclear realm.

The Gulf War also demonstrated a change in airpower from the previous two case studies. The USAF entered the Gulf War focusing airpower thought, organizational structure, and technological development in a complementary manner. Airmen learned well the stark lessons of Vietnam: strike formations must be escorted. It seemed that the USAF had finally swung the pendulum to the complement—with one notable exception.

The development of stealth technology reinforced the idea that airpower was a supplement. The initial development of stealth was an

effort to blunt the defense. Stealth was low observable to radar, thus making it harder to track and engage. In the Gulf War, stealth F-117s operated without escort. The combination of stealth and precision weapons seemed to demonstrate what early airpower theorists predicted—airpower could skip fielded forces and strike vital targets forcing capitulation. The success of the F-117 and the perceived cost savings (stealth aircraft could attack alone without the need for expensive escort aircraft) solidified the follow-on B-2's place in the pantheon of war winning supplements.

The B-2 combines both precision and stealth in the ultimate talisman of the invincible bomber. The confluence of airpower organizational structure, technology, and thought seems to join into making the B-2 Loki's arrow. This could, however, prove to be unfortunate if the USAF does not heed the lessons of the past. The interplay between the offense and defense suggests that as one side gains an advantage in the offense, the defense will develop a counter. Just as House opined the defense will blunt the advantages of the offense thereby forcing the offense to reconsider the advantages of a new technology.

The B-2 is not an invisible aircraft, as some believe. Moreover, the B-2 fleet is limited, thus the United States does not have the luxury of losing a multitude of aircraft before realizing in combat that an enemy's defense has improved. Further, with the minimal losses from the Persian Gulf still fresh in its collective mind, the nation may not have the political will nor the financial resources for the USAF to consider the B-2 Loki's arrow. The sooner the B-2 is considered a complement, the more effective airpower will be.

There are two recommendations for additional research the author uncovered while composing this work. The first is a study on how House's supplement and complement interplay affects the planning of nuclear operations across the spectrum. The original intent of this work

was to delve into this interplay; however, classification issues arose that precluded investigating nuclear operations. Specifically, military planners should question the notion that bomber nuclear combat operations are standalone war winners. The concern is that nuclear bombers and their associated payloads have been associated with Loki's arrow—a mythical way to defeat an adversary. There appears to be a loss of collective corporate memory leading to planners to suggest that alone and unafraid bombers can deliver their nuclear payloads without molestation from a defender. It is as if there is a belief that once a payload is a nuclear weapon then a bomber does not require an escort.

This leads one to ask: Is there an organization actively integrating all available assets in a codified manner for nuclear operations? This is an important question to answer. If bomber nuclear operations spurn the concept of complement, then the loss ratio demonstrated in the first two case studies may be more than the nation is willing to accept.

The second focus of additional research should explore the effects of norms, conventions, and culture on the use of the bomber in both nuclear and conventional operations. The constant interplay between the different factions within the Air Force with their associated theories of victory would be an interesting research subject. Moreover, the idea of how these disparate cultures affected how the Air Force conducted operations throughout its history could illuminate possible cognitive dissonance within the service. It would be debilitating should the service, because of success, bet on a single weapons system much as the French did the Maginot Line.

In the end the advantage that Loki' arrow conveys, due to technological advancement, is fleeting. Warfare will always revolve around chaos and chance. Moreover, the interplay between the offense and defense will still be characterized by a punch and counterpunch mentality. The effort should focus on the advantage that the confluence of military organizational structure, technology, and thought brings to

military service but in a complementary manner. The nation and the military should remain leery lest it become "mired in the ways of the past, overcome by inertia, overconfident in the weapons they have grown to love and consider supreme."[3] The trick remains avoiding the declaration of specific weapon or new technology as independently war winning *before* the reality of combat makes the nation pay in blood.

[3] Richard A. Clarke, *Cyber War: The Next Threat to National Security and What to Do About It*, 1st ed ed. (New York, NY: Ecco, 2012), XI.

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