STRATEGIC BOMBING: HOW PRECISION BOMBING DOCTRINE AFFECTS TRAINING

BY

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APPROVAL

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

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The conclusion 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.

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ABSTRACT

The purpose of this thesis is to explore the development of aircrew training through events in history that determined how the growth and evolution of training changed based on the theory, doctrine, organizational structure, operational focus, and technology of the period. It seeks to answer the main question, does the theory of strategic bombardment in air force doctrine still drive bomber aircrew training? In order to answer this question, bomber aircrew training leading up to the three case studies, the Combined Bomber Offensive, Linebacker II, and Desert Storm, will be evaluated across three relationships, air power theory against the aircrew's experience in combat, the amount of standardization versus the amount of improvisation present in training, and the balance between realism and safety in training. These relationships will aid answering the following questions. How the theory of employment affects bomber aircrew preparation in each case study? How technology changes training requirements for bomber aircrew? Finally, how well standardized training responds to a theater commander's requirements? By tracing the answers to these questions through the context of the three historical cases, this thesis seeks to determine common variables in aircrew training and their affect on the employment of bomber forces in each case study.

What these three cases show is similarities exist across the competing interests of theory and experience, standardization and improvisation, and realism and safety. The fundamental theory of offensive air power and strategic bombing still drives the doctrine for employment even if actual experiences vary across the three case studies. Technological capabilities exist today that make precision bombing possible from any platform and enhance the ability to provide realistic training but also create unique training requirements. Finally, a central effort of strategic bomber forces in Europe during World War II or the ability to mass forces in theater and execute mission rehearsal exercises prior to Desert Storm may not be possible in future conflicts. Therefore, prioritizing specific missions for bomber forces and maintaining theater specific reporting instructions will be crucial to defining training requirements for future conflicts.

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Chapter 1
Introduction

Purpose

The 2018 National Defense Strategy (NDS) refocuses Department of Defense resources toward an increasing strategic competition between inter-state rivals as the primary U.S. national security concern.[1] The NDS asserts strategic competitors have the potential to challenge the lethality of U.S. military forces because of rapid technological change and shifting global security environment conditions. The assumption that the United States and its coalition partners will continue to maintain air superiority and overwhelming firepower delivered via aircraft will be challenged in contested environments. Global Power, as one of the three fundamental capabilities outlined in Air Force doctrine, is not ordained by simply having the most technologically advanced air force or the most available resources in aircraft, weapons, and fuel.[2] The continued training of combat air forces to employ technologically advanced weapon systems, integrate with other platforms, and exploit the benefits of unified command structures and advanced intelligence gathering and analysis within these contested environments is critical to achieving national objectives.

The purpose of this thesis is to explore the development of aircrew training through events in history that determined how the growth and evolution of training changed based on the theory, doctrine, organizational structure, operational focus, and technology of the period. By examining trends through history, common elements have been traced by historians during the development of modern air power to determine the differences and similarities in aircrew training, what benefits and limitations existed, and the ultimate result on the execution of air power. Each conflict has specific variables unique to the employment of force within a theater, and the focus of this paper will remain on how training prepared aircrew for those variables. Specifically, it aims to

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[1] Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, D.C.: Department of Defense, 2018), 1.
[2] Curtis E. LeMay Center for Doctrine Development and Education, *Volume 1, Basic Doctrine*, 27 February 2015, 1.

answer the question: Does the theory of strategic bombardment in air force doctrine still drive bomber aircrew training?

By studying aircrew training during the development of the theory of strategic bombing, compared to the differences in training before the subsequent use of bomber forces during the Vietnam War and Desert Storm, the effect of early theory can be evaluated in the training process. The three specific historical examples are the preparation of aircrew for the Combined Bomber Offensive in WWII, the preparation of B-52 aircrews for participation in Linebacker II, and the use of B-52 aircrews during Operation Desert Storm.

Each scenario will be compared for commonalities existing in what theory or concept of winning was envisioned by theater commanders and the use of bomber aircraft to employ weapons against a combination of target sets deemed strategic and tactical. The definition of strategic versus tactical targets sets will be examined specifically as a portion of how Air Force doctrine and organizational structure changed training requirements to achieve employment against the two target types. For example, the development of air dropped nuclear weapons may or may not have significantly altered the definition of strategic and tactical targets, organization, and the availability of bomber aircraft for theater commanders in each period.

Changes in technology, types of aircraft, weapons, and the organization of forces have all occurred. The normalization of multi-role platforms and multiple mission set requirements in complex employment scenarios create advanced training requirements for all aircrew. However, the consistent focus on the maintenance of a strategic bomber force provides a common background to evaluate how well aircrew training requirements captured the changing environment of the bomber mission, or a failure by requiring training in too many missions without adequate resources, time, and integration.

These specific problems will be examined to provide relevancy for future aircrew training. Great power competition's return as a defense priority, the proposed modernization of the U.S. bomber fleet, and the continued reliance on bomber aircraft to provide effects in regional theater conflicts highlight the many reasons why defining if established doctrine forces the right aircrew training requirements.

Research Questions

A variety of factors affect aircrew training in the military. Early air power theorists such as Douhet, Trenchard, and Mitchell debated their peers on how air power's use could affect warfare, and they advocated for resources in the early twentieth century to realize their prophecies. The effectiveness of air power continues to be a topic of debate among military professionals because of the competition for resources and influence within the U.S. armed forces. However, the contributions of air power to past and current conflicts provide concrete examples of how air power has developed into a modern-day requirement for combatant commanders to execute a campaign.

How the U. S. Air Force has prepared to meet a combatant commander's requirements can be examined through a variety of variables. As the relative size of air forces grew, technology increased complexity and the sophistication of aircraft and weapons. Defense against aircraft also advanced, thereby forcing specialization in aircrew positions and integration of offensive aircraft with pursuit aircraft to defend attacking forces. In this paper, the case studies will be evaluated against four questions pertaining to these variables and how bomber forces trained to specialize in precision attack within the framework that the theory of strategic bombardment in air force doctrine still drives bomber aircrew training.

The first question pertains to the defined role of air power in each conflict and how the USAF perceived its role to determine if its organizational structure and training supported its mission. Specifically, does the existing air power theory of employment match the experience of combat for the USAF's bomber forces during each case study? The assumption that the evolution of USAF doctrine over time affects the development of training is a crucial variable because it shapes where resources are allocated, what technological innovations occur in aircraft, and how the USAF organizes its forces. This question highlights the initial emphasis on "strategic bombing" manifested in the Air Corps Tactical School's (ACTS) industrial fabric and key-node targeting theory. That theory formed the basis of the Air War Plans Division's (AWPD-1) plan to strike

Germany's industrial and economic centers with strategic bombers, as opposed to using those aircraft in the "tactical bombing" of military forces, supplies, and infrastructure.[3]

The use of strategic bombers in later conflicts, such as Vietnam and Desert Storm, for striking tactical targets is critiqued for blurring the roles of tactical fighter and strategic bomber aircraft.[4] However, the competition between traditional strategic bombing and tactical interdiction existed before the contemporary case studies. For example, J.C. Slessor, beginning with his Command and Staff College lectures in the 1930s, argues for the integration of air forces to assist the army's actions to defeat the enemy's army. The Air Land Battle concept developed prior to Desert Storm emphasizes the possible shifts in air power theory, which may influence doctrine and employment of bomber forces. Theory versus experience evaluates if training effectively prepared bomber forces for anticipated roles and missions.

The second question is how does technology change training requirements for bomber aircrew? Technology has affected air power doctrine through the development of nuclear weapons and the ability to create massive destructive force, as well as through the development of precision weapon capabilities. Technological advancement was seized by air power theorists for the promotion of Douhet's characterization of aircraft as an inherently offensive tool to hold vulnerable an enemy's land and sea territory.[5] Examples of the application of technology in World War II is the advent of the Norden bombsight for precision bombing. The advancement of sensors and weapons continues the pursuit of precise and effective bombing, but improvements also change training requirements, aircraft specialization, and combat experiences. With the proposition that doctrine drives training requirements, how training incorporates new technology in to tactics and training procedures may affect the results of strategic bomber employment in each case study. In turn, results of employment may or may not result in changes to air force doctrine by re-affirming ideologies or exposing deficiencies.

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[3] Tami Davis Biddle, *Rhetoric and Reality in Air Warfare* (Princeton, NJ: Princeton University Press, 2002), 141, 206.
[4] Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca, NY: Cornell University Press, 2000), 85-90
[5] Giulio Douhet, *The Command of the Air,* trans. Dino Ferrari (Washington D.C.: Office of Air Force History, 1983), 98.

The final question focuses on the inherent tension between standardization and improvisation: How well did the Air Force manage the initial need to standardize training for bomber aircrew across multiple aircraft types and training bases while allowing innovation to respond to theater commander requirements? The rapid development and integration of a strategic bomber force into the European and Pacific theaters forced Air Force leaders to standardize training across multiple types of aircraft, mission sets, and geographic training areas in the U.S. The challenge of providing flexibility and the freedom to develop new practices and incorporate new technology was a problem since the rapid rise of aircrew in the Air Corps prior to World War II. This has also manifested in how combat environments are simulated in training exercises.

Integrated training of strategic bombers, pursuit (fighter), fighter-bomber, electronic attack, command and control, and support aircraft was identified early on by some Air Force leaders as a necessary requirement. In 1932, (then Major), General Carl "Tooey" Spaatz highlighted the importance of integrated training between the 7th Bombardment Group and the 17th Pursuit Group at March Field in California.[6] These efforts would be reinforced in the post-Vietnam era with the increased focus on tactical aircraft and air-to-air training. Whether or not standardization limited bomber force integration training and the participation in integrated exercises is debatable and addressed in each case study.

Many of the variables emphasized by these questions overlap within the historical analysis of the training requirements in the three cases. Theory can be challenged by an aircrew's actual experiences in combat. How they are prepared for combat in training needs to incorporate whatever available technology is possible in the period and how it is going to be used. The application of technology in to training scenarios can also make training safer, more realistic, and may provide limited feedback that is usually the outcome of actual combat performance. How these elements affect whether the theory of strategic bombardment in air force doctrine still drive bomber aircrew training will be examined based on the defined assumptions.

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[6] Rebecca Hancock Cameron, *Training to Fly: Military Flight Training, 1907-1945* (Air Force History and Museums Program, 1999), 283 – in a letter to Gen Foulois on trying to unify his command in California.

Assumptions and Limitations

Aircrew training is affected by many independent variables within the distinct time periods of each case study. The number of aircrew requiring training since World War II has decreased, but the sophistication of the aircraft being flown have changed. Instead of building an air force from a small amount of cadre with a limited amount of experience trained specifically for a theater, aircrew train continuously to be ready for combat in multiple theaters. To focus on a specific component and to draw comparisons within a specific type of force, certain assumptions and limitations are placed on the study.

First, the analysis will be restricted to only the USAF multi-crew bomber force in each case study. Second, the analysis will focus on aircrew training after the initial qualification in the crew position for the Vietnam and Desert Storm case studies. During World War II, an aircrew's transition from initial qualification to combat training occurred in such a quick timeframe and within the same training courses that come overlap between initial qualification and combat training will occur. Aircrew composition has changed slightly over time (for instance gunners no longer exist on modern aircraft and bombardiers and navigators have altered in structure and training requirements), but aircrew training still comprises offensive capabilities, electronic defensive systems, navigation, and formation flying as major training items that compete for time during training sorties.

Third, the case studies will be evaluated within the context of the technological evolution of each period. Technological advances sought by air force leaders to improve precision and survivability created different training requirements to increase the effectiveness of that technology. For example, the advent of nuclear weapons led to specialized training for the 509th Bomb Group employing the weapon on Japan, but it is assumed the basic principles for bomber forces remained throughout, even as employment practices differed between European and Pacific theaters.

According to Joint Publication 1-02 (JP), doctrine is defined as the "fundamental principles by which the military forces or elements thereof guide their actions in support

of national objectives. It is authoritative but requires judgment in application."[7] As a portion of current doctrine, the Air Force develops and trains forces to execute three fundamental principles: Global Vigilance, Global Reach, and Global Power for the joint force. Global Power defined as "the ability to hold at risk or strike any target anywhere in the world, assert national sovereignty, safeguard joint freedom of action, and achieve swift, decisive, precise effects."[8] One of the functions of global power is strategic attack.

Strategic Attack includes offensive operations to "weaken the adversary's ability or will to engage in conflict," including the ability to achieve outright a strategic objective of the conflict with airpower alone.[9] As we investigate aircrew training in each case study, the principles of strategic attack will be applied differently, including the application of industrial web theory targeting in Germany, to nuclear strike, to center of gravity targeting.

Theorists may see the purpose of doctrine differently. As an example, Colin Gray describes doctrine in *The Strategy Bridge* as a method to provide a common basis of understanding for the best military practice, overall guidance, and to demonstrate internally to an organization and the outside world what it stands for and believes to be right.[10] Others, such as Harold Winton and Edward Dolman use doctrine to link theory and execution. Winton specifically describes doctrine as the "conceptual link between theory and practice."[11] While Dolman takes an even more direct approach by stating that doctrine creates the foundation for tactics.[12] In this paper, it is the assumption that bomber aircrew are trained according to the doctrine that defines strategic attack during each period.

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[7] Curtis E. LeMay Center for Doctrine Development and Education, *Volume 1, Basic Doctrine*, 27 February 2015.
[8] Curtis E. LeMay Center for Doctrine Development and Education, *Volume 1, Basic Doctrine*, 27 February 2015.
[9] Curtis E. LeMay Center for Doctrine Development and Education, *Annex 3-70, Strategic Attack*, 25 May 2017.
[10] Colin S. Gray, *The Strategy Bridge: Theory for Practice* (Oxford, UK: Oxford University Press, 2010): 77.
[11] Harold R. Winton, "An Imperfect Jewel: Military Theory and the Military Profession," *Journal of Strategic Studies*, 34, no. 6 (2011), 861.
[12] Everett Dolman, *Pure Strategy* (New York, NY: Routledge, 2011): 193.

Literature Review

Academic literature on air power discussed in this thesis tends to converge on operational employment, organizational limitations, leadership critiques, and air power's overall effect. Aircrew training receives scant attention. After World War II, that gap of knowledge grows between interpretations on how bomber aircrew balanced the demands of Strategic Air Command (SAC) against the application of air power to tactical theaters of war. Much more focus was placed by observers on how tactical air forces from Tactical Air Command (TAC) shaped aircrew training standards after the failures of air power in Vietnam. These observations focus on the conditions that are perceived to result in air power's achievements during Desert Storm.

The most comprehensive work reviewed during this research on aircrew training programs was Rebecca Hancock Cameron's work, *Training to Fly: Military Flight Training 1907-1945*. Cameron's volume is an extensively researched account of the developing institutions and practices required to train aircrew through 1945 and the end of World War II. She relied on the official documents, letters, and policies of the individuals responsible for building an air force from the U.S. Army's Signal Corps, Air Service, Air Corps, and eventually Army Air Force. Cameron shows the difficulties in developing training as aircraft advanced in complexity and noting that flight training evolved past an "individual's mastery of nature and machine" to how it affects combat.[13] Flight training was forced to change as air power theory evolved and armies began to use aircraft in more ways to actively attack an enemy's forces and sources of strength.

Cameron characterizes the service's role in flight training during the interwar years as a balance between competing demands of quantity versus quality, theory versus practical experience, realism versus safety, and standardization versus improvisation.[14] Rapid expansion of the air forces and the encroaching demands of World War II created the tension between these elements. As she summarizes, peacetime preparation advanced ahead of U.S. involvement in World War II. Air force leaders altered the organizational structure of flight training units to develop locations to train for specialized tasks of

[13] Cameron, *Training to Fly*, 3.
[14] Ibid., 381.

flying, navigation, gunnery, and bombing. Training in the specialized tasks lacked the experiences of combat however, resulting in a misperception of the readiness of combat aircrew.[15] This lack of readiness would become apparent in the initial bombing results in Europe.

The four dynamic relationships Cameron references are applicable to air power's development throughout the conflicts studied in this paper. Resource allocation continues to force quantity versus quality compromises. Doctrine continues to be challenged by the perceived effects achieved by air power, the experiences of aircrew, and how aircrew employ and prepare for employment. Realism of training is balanced against safety, and organizational structure and individual efforts within commands affect the standardization against individual improvisation in training. Cameron's characterization of the competition between the four relationships will continue to be referenced as a methodology to compare the conflicting priorities that occur in training.

As specialization became necessary, the basic foundations for the effective use of bombers developed. Areas of emphasis highlighted by Cameron include formation procedures for mutual protection and massing weapons effects, navigation over long distances and water, gunnery skills, and use of specialized equipment to bomb accurately. These trends continue through contemporary examples. Cameron argues that specialization, "whereby pilots specialized in one of several missions with the aircraft supposedly appropriate to it, became permanently embedded in the American training system."[16] Specialization, in theory, created specific capabilities for specific missions. Bombers emphasized high-altitude, daylight, precision bombing, thriving during World War II and the initial Cold War emphasis on platforms delivering nuclear weapons. The experience during these conflicts underline the need for pursuit and fighter aircraft and composite force training, but the emphasis on precision bombing overshadowed development of these capabilities until later time periods.

After World War II, development and training of a bomber air force cannot be separated from the development of Strategic Air Command (SAC). *Bomber, The*

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[15] Cameron, *Training to Fly*, 380.
[16] Ibid., 559.

Formation and Early Years of Strategic Air Command is Phillip Meilinger's history of the formation of SAC. Meilinger uses six themes--mission, message, education, technology, intelligence gathering and analysis, and leadership--to describe the development of SAC, and subsequently strategic bombing after World War II.[17] As a command rising from the advancement of air power, the apparent success of strategic bombing, and the nuclear weapon, Meilinger highlights the importance of new technology and Gen Curtis Lemay's leadership as the Commander in Chief, of SAC (CINCSAC).

Doctrine was built on the three pillars of history, theory, and technology, but air power doctrine was limited in history and theory due to its relative age as component of force. Meilinger argues that technology emerged as a primary factor in the development of air power because of the limitations within the three-pillar doctrinal model. Prior to World War II, ACTS's theory of precision bombing as an offensive weapon was untested. Therefore, early theorists relied on developing technology to provide the means to achieve strategic bombing.[18]

LeMay took over SAC in 1948 after the culmination of events that stressed the lack of proficiency in SAC aircrew and the Lindbergh report. LeMay re-energized the command, focusing on the primary mission – employment of atomic weapons and emphasizing aircrew readiness to fight at a moment's notice. LeMay pioneered operational readiness inspections and emphasized proficiency in flying, radar bombing, and the ratio of available aircraft capable of sustaining a maximum effort.[19]

As controversial as LeMay's efforts were to harbor resources and promote SAC, SAC's long-range bombers and nuclear weapons acted as an equalizer to the Soviet Union's conventional forces' numerical superiority. LeMay emphasized technological advancements to increase the capabilities of a global nuclear strike force including the development of jet-age bombers, such as the B-52, and refueling aircraft such as KC-135 tankers. Requirements for aircrew specialization, re-affirmed by the development of

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[17] Philip S. Meilinger, *Bomber: The Formation and Early Years of Strategic Air Command* (Maxwell AFB, AL: Air University Press, 2012), xvi.
[18] Meilinger, *Bomber: The Formation and Early Years of Strategic Air Command*, 22-23.
[19] Ibid., 138.

advanced technology continued, within bomber training. LeMay also built SAC on the foundation of a standardized and hierarchical force structure focused on executing strategic bombing against the Soviet Union at any moment. While LeMay's emphasis on preparation was apparent in SAC's ability to execute its primary mission, the command's inability to train for or adapt to conventional theater wars will be critiqued by future reviewers of Vietnam and Desert Storm.[20]

Analysis of conventional theater conflicts in Vietnam and Desert Storm produced a great deal of literature on how the USAF adapted from its failures and criticisms in Vietnam to its successes in Desert Storm. Most of the literature focuses on the re-investment in tactical fighter forces, air-to-air combat training, and the improvements to training through the expansion of the USAF Fighter Weapons School and dissimilar air combat training exercises such as Red Flag. Marshall L. Michel III, an F-4 pilot with combat experience in Vietnam, wrote two books characterizing the air war over Vietnam.

Michel's *Clashes* emphasizes the lack of preparation and emphasis on air-to-air combat training for the USAF's fighter aircraft.[21] Michel concludes that the Air Force placed too much emphasis on unproven technological advancements in radar-guided, air-to-air missile engagements and under developed fighter tactics. The assumption was that air-to-air missiles would work and take the place of fighter aircraft guns and cannons. This was combined with an emphasis in air-to-ground employment in training, dual-role fighter pilots received 100 air-to-ground attack missions compared to six air-to-air combat missions every six months. Instead of emphasizing tactical training, the Air Force put its faith in technological advancements to counter air-to-air threats and Soviet aircraft technology.[22] The same assumptions and reliance on technology occurred in countering Soviet developed surface-to-air threats, while improvements occurred in

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[20] The primary sources used to evaluate SAC's contribution to air power during the Vietnam War were Marshal Michel's *Clashes* and *The 11 Days of Christmas* on fighter tactics and Linebacker II operations, Benjamin Lambeth's *The Transformation of American Air Power*, Mark Clodfelter's *The Limits of Air Power*, Brian Laslie's *The Air Force Way of War*, Thomas Hone's "Strategic Bombardment Constrained: Korea and Vietnam" in *Strategic Bombardment*, and Brig Gen James McCarthy and Robert Rayfield's *B-52s Over Hanoi*, a history of the Linebacker operations from the 43rd Strategic Wing Commander at Andersen AFB, Guam in 1972.

[21] Marshall L. Michel, III, *Clashes* (Annapolis, MD: Naval Institute Press, 1997): 118.

[22] Michel, *Clashes*, 158, 160.

electronic countermeasures (ECM) and enemy identification, the lack of proficiency in tactics formed around the technological advances resulted in the inefficient use of air power and ultimately resulted in staggering aircraft losses.

In Michel's second book, *The 11 Days of Christmas,* he describes the experiences of B-52 aircrew in the Linebacker II operation during Christmas 1972.[23] The book focuses on some of the operational and planning failures committed by SAC that may have contributed to the loss of fifteen B-52s on missions over Hanoi during the eleven days of bombing. Michel again argues that the Air Force relied upon untested technical innovation over proven tactics. He concludes that analysis of SAC tactics during Linebacker II highlighted deficiencies in SAC's ability to develop tactics for penetrating a high-threat environment. This includes deficiencies in B-52 aircrew rotations between previous Arc Light deployments to Vietnam, nuclear alerts, and back to operations in Vietnam, to the lack of testing and effectiveness of the B-52's electronic warfare jammers on Vietnamese SA-2 surface to air missiles. The slow incorporation of lessons learned from previous attacks and integration between fighter support aircraft highlighted SAC's organizational deficiencies during Vietnam, but also shortcomings in training requirements for bomber aircrew against heavily defended targets.[24]

Brian Laslie's *The Air Force Way of War* examines the changes to USAF tactics and training that occurred after the lessons of the Vietnam War. Vietnam challenged the predominant conceptualization of air war from strategic attack to a more theater air war and the use of aircraft to support ground forces. This created a paradigm shift in Air Force doctrine that resulted in the rise of the tactically-minded "fighter general" generation. This generation accepted increased risk during demanding training against realistic threats. As Laslie asserts, "the single greatest problem faced by USAF pilots, both SAC and TAC, during the Vietnam War was poor combat training prior to employment," and the experienced aircrew of Vietnam focused on changing this reality.[25]

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[23] Marshall L. Michel III, *The 11 Days of Christmas* (San Francisco, CA: Encounter Books, 2002), viii.
[24] Michel, *The 11 Days of Christmas*, 33, 185.
[25] Brian D. Laslie, *The Air Force Way of War: U.S. Tactics and Training After Vietnam* (Lexington, KY: The University Press of Kentucky, 2015), 29.

Laslie focuses on some of the training emphases and products that were developed between Vietnam and Desert Storm. These include the creation of Designed Operational Capability (DOC) statements to assign specific missions and theaters to specific units, new approaches to training such as the "building-block approach," and exercises such as Red Flag.[26] These training initiations would filter through the Air Force and be incorporated by all units, including SAC's bomber force. Laslie critiques SAC's support in Desert Storm, however, stating it had "the wrong equipment, the wrong mentality, and the wrong grasp on the history of aerial warfare to adequately provide useful contributions to the war."[27] Parts of this criticism may be accurate, but SAC's bomber force was stuck between two competing doctrines, the preparation for nuclear strike as part of one section of the nation's nuclear triad and adapting to the increasing threats of conventional theater war. Ultimately, Laslie credits five factors for the superior readiness of the USAF during Desert Storm: the creation of DOC statements, the building-block approach, advanced tactics and training highlighted by the Fighter Weapons School, realistic live fly training, and exercises such as Red Flag.[28]

While Laslie analyzes the revolution in tactical training after Vietnam, Benjamin Lambeth's *The Transformation of American Air Power* proposes that technology has contributed to an improvement in the capability of achieving a theater's joint force objectives directly through the use of air power.[29] Technology merged the capabilities between what were traditionally separated as strategic and tactical forces, and renewed the debate between the role of an air force contributing to interdiction of military forces versus targeting for strategic effect. These developments have been characterized by what Lambeth calls the nonlinear growth in this capability due to low-observable stealth aircraft, accurate stand-off munitions, and increased battlespace awareness, communication, and control.[30] This growth in technology has overcome many of the

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[26] Laslie, *The Air Force Way of War: U.S. Tactics and Training After Vietnam*, 41.
[27] Ibid., 145.
[28] Ibid., 181.
[29] Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca, NY: Cornell University Press, 2000), 2.
[30] Lambeth, *The Transformation of American Air Power*, 6.

limitations of targeting in Vietnam that was limited in intelligence, surveillance, and reconnaissance (ISR) and weapon accuracy.[31] Lambeth describes the three areas of increased competency after Vietnam as increases in aircrew proficiency, equipment performance, and the concept of operations.[32] Examples of the shift in training documented by Laslie include the shift from tracking flying hours to tracking sorties and mission events as a measure of training proficiency. These training revisions led to the development of three levels of proficiency: basic proficiency, mission-capable proficiency, and mission-ready status for individual aircrew.[33]

Lambeth concludes by re-visiting modern conflicts such as Operation Desert Storm, Operation Deliberate Force, as well as the disputes within air power theory. After Desert Storm, the bomber force completed a transition that focused efforts from a nuclear deterrence mission to conventional employment, confirmed by the dissolution of SAC and assimilation of the bomber force into the newly created Air Combat Command. The assumption that "strategic" equaled "nuclear" was being challenged by operational planners and advancements in new weapons such as GPS aided munitions and stand-off cruise missiles could make air power's attributes of speed, flexibility, and range more lethal for conventional forces.

Doctrine and air power theory, reaffirmed by the experiences of bomber forces during World War II and the advent of nuclear weapons created a resource imbalance heavily favored toward developing bomber forces. Air Force policies in the late 1940s and 1950s placed a primacy on Lemay's SAC bomber force. Lemay brought standardization to the nuclear force and created a proficient nuclear operations force. The arguments offered by Lambeth's, Michel's, and Laslie's reviews state that preparation for conventional theater warfare suffered, and it took the outcomes of the Vietnam War and Desert Storm to incite innovations within the bomber force's conventional bombing capabilities. How bomber force training adapted to the changing nature of conventional force, the requirement to maintain nuclear readiness and conventional proficiency, and

[31] Lambeth, *The Transformation of American Air Power*, 34.
[32] Ibid., 56.
[33] Ibid., 65.

what attributes have carried over will be explored further in the case studies in chapter three.

Methodology

Training within each era will be evaluated through Cameron's comparisons across the three case studies to understand the transformation of bomber forces. Training requirements developed by the Air Force's early pioneers provided the ability to achieve precision strategic bombing and maximize the effects of bombing on specific targets against increasingly capable threats with the resources and technology of each period. A qualitative comparison analysis of the different variables will determine how those variables influenced training requirements that balanced the needs of precision strike and survivability.

As an example, the established theory prior to World War II valued precision, hence the operational and training focus on precision daylight bombing and the American role in the Combined Bomber Offensive. The need to quickly build up American air forces pit quantity versus quality during the initial surge of aircrew training pipelines. The amount of training and what areas to focus on were constantly evaluated against the experiences of the Army Air Forces in Europe. The roots of aircrew training established prior to and during World War II would affect the future levels of realism in training over ensuring safety and affect the balance for standardization against improvising new tactics with improved technology. The competencies developed as bomber training requirements, including navigation, instrument flying, formation flying, night operations, target identification and bombsight operation, radio and radar operation, and defensive tactics generated needs for new technologies. New technologies created increasing requirements for training on the proper use and integration of those new capabilities. Therefore, the aircrew training cycle both increased in complexity with new technology and aircraft capabilities while also becoming more realistic compared to combat conditions. How bomber aircrew trained for the strategic bombing mission, and how the theory of strategic bombing affected that training will be the focus of this thesis. The story begins in chapter two with the study of aircrew training during the development of the Army's air forces prior to World War II.

Chapter 2

Developing an Air Force

> *The bomber now stands forth as the supreme air arm of destruction, which vastly enhanced power. When nations of today look with apprehension on the air policy of a neighbor, it is the bomber they dread. It is this heavy artillery of the air, which drives home to combatants on the ground the importance of air power.*
>
> William C. Sherman, *Air Warfare, 1926*

Aircrew Training Prior to World War II

From aviation's infancy, aircraft were always envisioned as a military tool. In 1907, four years after their first flight, the Wright brothers attested to the Board of Ordnance and Fortifications that their aircraft had military utility in an attempt to receive purchases from the Aeronautical Division.[1] After successful air trials of one of their aircraft at Fort Myer, VA in June and July 1909, in which Orville Wright demonstrated a one hour and twelve minute flight and a speed test at forty-two miles per hour, the War Department finally acquired its first airplane and contracted the Wrights to train two officers.[2]

The history of flight training and development of the first aviation training courses, beginning with the Wright brothers teaching military officers how to fly, would heavily influence training courses and methods used in the future. Early air force pioneers such as Gen Henry "Hap" Arnold would learn to fly at Dayton's Wright Field under the Wrights' tutelage. Arnold began his flight training in 1911 in a program designed to sequentially move a student through aircraft systems familiarization, aeronautical ground training, and finally flight instruction. After receiving enough training to be proficient in basic skills, students completed the rest of their flights on their own to gain experience. Although the machines themselves in 1911 were less complicated, this sequential system is still the basic model employed today.[3]

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[1] Rebecca Hancock Cameron, *Training to Fly: Military Flight Training, 1907-1945* (Air Force History and Museums Program, 1999), 15.
[2] Cameron, *Training to Fly*, 20.
[3] Ibid., 31-32.

Training innovations that would be developed at both the Wright facilities and the Curtis facilities in San Diego, CA, included the use of basic aircraft simulators on the ground to teach familiarization with controls, dual seat training methods to allow a student to receive instruction on piloting in the air, and eventually standardized controls on aircraft.[4] Early aviation struggled with charting a formal, standardized course because of rivalries between aviators trained on the different aircraft of the day. Companies such as Wright, Curtiss, and eventually Martin built machines in different configurations and with different controls requiring specialized training for each model.

During World War I, rivalries between the French, British, and American methods of training resulted in differing methods to produce bombing, pursuit, and reconnaissance aircrew.[5] American methods of instruction settled on a progressive training system that included ground instruction, followed by primary flight training, and then advanced training focused on either bombing, pursuit, or observation aircraft and roles.[6]

In the United Kingdom, the theory of bombardment as a military tool developed quicker than in the U.S. Army's Aviation Section. Capable of flying for eight hours with an 1,800-pound bomb load, the Handley-Page heavy bomber was employed as a night, long-range bomber to strike targets in Germany. British bombardment training, especially night flying, developed at a quicker pace than their American counterparts because of the defined night bombing theory. As a result, American aircrew selected to fly the British Handley-Page heavy bomber received most of their training in strategic bombing in the British training programs.[7] The preferred employment at night presaged the British desire to bomb at night during the Combined Bomber Offensive in World War II to avoid the German Luftwaffe.

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[4] Cameron, *Training to Fly*, 31.
[5] Ibid., 127. The French Roleur system of aircraft training progressed students through a course where they first piloted aircraft that could not leave the ground, followed by increasingly more advanced aircraft and maneuvers, all executed in single-seat aircraft. The British Gosport system kept a trainee with a single instructor during the entire program. Because of the individual instruction, the student was exposed to advanced maneuvers from the very beginning of training. Finally, the American system utilized dual-seated aircraft for in-flight instruction throughout training.
[6] Ibid., 128-131.
[7] Ibid., 188.

Bombardment training was not formally organized in the U.S. until March 1918. The operational skills required in Europe were replicated in the U.S. Army's Aviation Section training schools by adopting many of the theater's training techniques. The Aviation Section emphasized classroom work in compass and map reading for navigation, weapon ballistics for bomb releases, aerial photography, and both day and night bombing with exploding and non-exploding bombs.[8] Fully trained crews from the United States, comprising a pilot and bombardier, were entering service in France by the summer of 1918.

During the interwar period, the structure of aircrew units and training shifted as funding and priorities altered through the service. Flight training divided into Primary and Advanced stage, and by 1923, primary flight training consolidated to a single location at Brooks Field near San Antonio, Texas because of reduced personnel and funding.[9] After completing Primary Flying School, students continued training at the Advanced Flying School located at Kelly Field near San Antonio prior to moving on to a specialty, either observation, pursuit, or bombardment. During this period, approximately 25 percent of Primary Flying School graduates advanced to the bombardment specialization. In the interwar period, bombardment training reinforced skillsets for bombardment's role as a subordinate force to land armies. Training concentrated on piloting, radio communication, signaling, photography, and gunnery. Because of the peacetime conditions, instructors and students dedicated more of the 260 hours of flying time to transition and solo flying. Approximately 30 hours were dedicated to bombing raids. One of the opportunities for bombing practice was conducted as a three-aircraft formation during cross-country compass navigation practice by simulating bombing raids on cities.[10]

In 1923, the entire continental bombardment force consisted of only one bombardment group flying de Havilland DH-4 and Martin MB-2 bomber aircraft. The group moved from Kelly to Langley Field in Virginia and conducted limited unit training because of a lack of resources and facilities. Shortages of resources and equipment were

[8] Cameron, *Training to Fly*, 142-143.
[9] Ibid., 225.
[10] Ibid., 235-236.

common during this period. Many units lacked gunnery ranges in close proximity to their airfields, lighting and equipment for night training, and bomb sight equipment for bombing training. Inspections of training units revealed these deficiencies, but the lack of an emphasis on flight training and its people limited any corrections despite the calls for more training.[11] In a 1920 letter to the General Staff, Chief of the Air Service Maj Gen Charles Menoher highlighted the fact that larger aircraft combat units and formations would require greater training including the ability "to learn eventually to operate with brigades and divisions."[12]

Eventually, technological advancements in aircraft and the need for more complex training and standardization across the service was recognized. Unit training would be organized into four phases: individual training for three months, aerial gunnery training and organization as a unit for the second four months, reserves forces training, and the last three months included combined maneuvers with other aviation units and field exercises with the Army.[13] But training continued to be limited by resources, manpower, and funding. The Air Corps developed units of measure equating the amount of flying hours to proficiency. In 1931, all pilots were urged to fly at least fifty hours per year, but flight hours did not equal proficiency in key aviation elements. A lack of instrument training, all-weather flying capability, and instruction during this period became apparent during the 1934 Air Mail disaster that resulted in ten fatal Air Corps accidents.

The 1934 Air Mail controversy stemmed from the decision of President Roosevelt to re-compete the federal contracts for air mail due to perceived corruption from the civilian air carriers. While the contracts were being competed, the Air Corps took over the air mail service. The experiment was a disaster, however, resulting in the convening of the Baker Committee, headed by former Secretary of War Newton Baker, to respond to the aircrew fatalities and incompetency of the Air Corps in the mission. Air Corps leaders largely pointed their blame on the lack of the Air Corps funding, modern aircraft, and standardized facilities.

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[11] Cameron, *Training to Fly*, 238.
[12] Ibid., 239.
[13] Ibid., 239.

The Baker Committee found that Air Corps aircraft were not as advanced as their civilian counterparts or suitable for night flying. As an example, the Curtis A-12 Shrike monoplane originally produced in 1933, lacked new equipment such as landing lights and aircrew oxygen systems required to fly at altitudes higher than 15,000 feet for long periods of time. Testimony revealed the Air Corps' aircraft limited performance capabilities compared to commercial aircraft and the differences in the experience level of military pilots and commercial. Commercial pilots typically flew 900 hours annually while military pilots received 200 hours annually and only 10 hours of flying in instrument conditions.[14] In addition, the Air Corps pilots were flying older aircraft with outdated instrumentation compared to brand new advanced commercially flown Douglas DC-1 aircraft.

The experience of the Air Mail failure and the Baker Committee would be one of the factors for increasing Air Corps appropriations from $30 million in 1935 to $83 million by 1939, and the Air Corps would be caught playing catch up through the start of World War II.[15] In his history of the Air Mail fiasco, Kenneth Werrell concludes that the Air Corps, due to its short-comings, would enter World War II as a "daylight, fair-weather air force, and emerge from that war only slightly better off."[16] How this affected doctrine and expectations for the Air Corps will be discussed in the case studies in chapter three.

As the service grew, organizational structure affected how aircraft and units specialized training. Changes in organization created a competition between formal training and unit training requirements. With the formation of the General Head Quarters (GHQ) Air Force, approved in May 1933 and made permanent in March 1935, the Air Corps proclaimed a wartime mission for combat air force units in the continental U.S.[17] However, the split service structure now separating the Air Corps and the GHQ Air Force

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[14] Kenneth Werrell,""Fiasco" Revisited: The Air Corps and the 1934 Air Mail Episode." *Air Power History*, 57, no 1. (Spring 2010), 23. The testimony on military and commercial training is referenced from the Baker Committee transcripts in Werrell's article.
[15] Tami Davis Biddle, *Rhetoric and Reality in Air Warfare* (Princeton, NJ: Princeton University Press, 2002), 145.
[16] Kenneth Werrell, ""Fiasco" Revisted: The Air Corps and the 1934 Air Mail Episode," 25.
[17] Biddle, *Rhetoric and Reality in Air Warfare*, 143-144.

staff resulted in the separation of authority in the Air Corps. The Office of the Chief of the Air Corps staff focused their efforts on increasing capability within the advanced training phase as the organization responsible for individual training, while the GHQ Air Force focused its efforts on unit training and prioritized tactical training with advanced pursuit, attack, and heavy bomber aircraft.[18]

The three GHQ Air Force wings provided the flexibility to develop training and employment doctrine within combined units of pursuit, bombardment, attack, and reconnaissance squadrons at one location.[19] During this time, March Field was a beacon of advancement in unit training because of the low population in the surrounding area and unique terrain in the western states. The wing at March Field also had the ability to practice bombing on the recently purchased Muroc Dry Lake, now Edwards Air Force Base, a rare capability so close to its homefield.[20]

In 1939, the Chief of the GHQ Air Force, Maj Gen Frank Andrews spoke about the necessary increases in capabilities required for aircrew training: "The combat crews to fully man each airplane must be trained and available, and they must have sufficient experience to prepare them thoroughly in their particular specialty…It is a rarely recognized fact that an airplane of a type in production can be built much faster than a crew can be trained to man and maintain it."[21] The realization that competently trained aircrew needed to practice their craft on suitable ranges and airspace was quickly being recognized. This recognition set off a blitz to acquire training fields, develop standardized methods, and provide more resources to equip the quickly forming Air Corps.

During the late 1930s, aircrew training formalization would later help accommodate the massive numbers of pilots, navigators, bombardiers, and gunners to go through training between 1939 and 1945. Approximately 193,440 individuals would graduate from Advanced training during that period, 90,533 of whom go on to fly multi-

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[18] Cameron, *Training to Fly*, 279.
[19] Ibid., 282.
[20] Ibid., 285.
[21] Ibid., 286. From an address to National Aeronautic Association, St. Louis, MO – Jan 16, 1939 – titled "Modern Air Power."

engine aircraft. Bombardier graduates equaled 28,361, navigator graduates equaled 56,119, and over 309,000 graduates of various gunnery schools also completed specialized training during that time.[22]

Before American aircrew flew combat missions in the European theater, the advanced team of the VIII Bomber Command (including Gen Ira Eaker) had to determine how best to establish combat units in the European Theater of Operations (ETO). Among other questions, they had to resolve how operations were going to be conducted and what follow on training would be required in Britain as aircrew arrived to the theater. The implementation of bomber operations in Europe provides the first intersection of air power theory against wartime experience to judge aircrew training, available technology, and the methods of standardization versus improvisation in tactics, techniques, and procedures.

"Strategic versus Tactical" – Theory and its Effect on Aircrew Training Guidance:

As the aviation force was developing, the offensive theory of air power that would dominate the Army Air Forces World War II strategy was evolving at the Air Corps Tactical School. The Industrial Web Theory that would later develop into AWPD-1 and high-altitude daylight precision bombing produced training and technical requirements to successfully execute that theory. The pursuit of precision bombing for strategic effects would continue well after World War II. During the Cold War, the preeminent theory of strategic bombing revolved around the Strategic Air Command nuclear bomber force and the Single Integrated Operational Plan (SIOP) nuclear deterrence plan. The downfall of the Soviet Union and rise of limited theater conflicts reasserted the requirement for a conventional strategic bomber force.

During the interwar period between World War I and World War II, the development of strategic bombardment was limited by the Army's official doctrine and training requirements. Army Training Regulation 440-15, "Fundamental Principles of Employment of the Air Service dated 26 January 1926, assigned a supporting role in the

[22] Cameron, *Training to Fly*, 567. The Flying Training Graduates numbers are sourced from the Army Air Forces Statistical Digest: World War II, table 47 and referenced in the appendix of *Training to Fly*.

future "to aid the ground forces to gain decisive success."[23] In contrast to the delegation of air power in support of the army, Major William Sherman, after completing the Air Service Tactical School, instructed at the Army's Command and Staff College and challenged the subordinate role in his work titled *Air Warfare*.[24]

Air Warfare, published in 1926, confronted the idea of relegating air power to the support of land forces by defining the multiple missions of observation, pursuit, attack, and bombardment aviation. Sherman states that the "bomber now stands forth as the supreme air arm of destruction, with vastly increased fire," due to its increased accuracy with a bomb sight, specialized munitions, and ability to "approach from any direction … change speed … (and) alter his course in either a horizontal or a vertical plane, in order to avoid antiaircraft fire."[25] Sherman highlighted four categories of bombardment-attack objectives including bombing large population centers, the enemy's supply system, land battlefield fortifications, and destroying sea craft for coastal defense.[26]

Sherman was beginning to tie air bombardment to the strategic purposes of attacking an enemy's supply systems and industrial centers instead of an enemy's armed forces. Examples from World War I of bombing supply systems included the German attack on the British ammunition dump at Audruicq, France, but the application of strategic bombardment would not be realized by air forces until greater advancements in technology and training existed. In 1931, crews testing the Sperry L-1 and Norden Mark XI bombsights still determined "inferior accuracy" and complicated pilot directing systems.[27] Advancements in bomb sights such as the Norden Mark XV with its stabilized bombing approach equipment and automatic flight controls would be required to achieve accuracy at the higher altitudes and the greater airspeeds of the B-18, B-17, and B-24s.

Sherman's theory focused on bombing supply lines, fortifications, and sea crafts because he believed that international law and the fear of reprisal from victimized

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[23] Biddle, *Rhetoric and Reality in Air Warfare*, 138.
[24] Ibid., 140.
[25] William C. Sherman, *Air Warfare*, (1926, repr., Maxwell Air Force Base, AL: Air University Press, April 2002), 179, 187.
[26] Sherman, *Air Warfare*, 190.
[27] Stephen L. McFarland, *America's Pursuit of Precision Bombing, 1910-1945* (Washington D.C.: Smithsonian Institution Press, 1995), 33.

countries would limit the bombing of population centers. In the late 1920s and early 1930s, American strategic bombardment theory already opposed attacking civilian and non-military targets. Because of the secrecy surrounding the Norden bombsights, ACTS instructors were not aware of the improving technology. As McFarland states, the doctrine developed without the appropriate technology to execute precise attacks from higher altitudes on lines of communication and supply systems, instead assuming that American capabilities would produce the necessary tools to execute precision bombing.[28]

Early theorists had not completely focused on unsupported bomber operations as the ultimate expression of air power. Sherman's *Air Warfare* stated the necessary requirements for attack and pursuit aviation, announcing that single bombers were helpless against a flight of pursuit aircraft and that unsupported bombers, even with the ability to defend themselves, would eventually be defeated by defenses.[29] Kenneth Walker's 1931 ACTS pamphlet on "Bombardment Aviation" concluded that bombers would be forced to fly at higher altitudes in order to avoid enemy pursuit aircraft and anti-aircraft fire. Contemporary exercises highlighted the difficulty in acquiring and pursuing bomber aircraft at higher altitudes, giving support to the idea of an unstoppable force, but the higher altitudes diminished bombing accuracy. The problem of accuracy needed to be solved.[30]

Eventually, ACTS instructors divided targets into two classifications in the 1932 Field Manual 1-10, *Tactics and Techniques for Air Attack*. Targets were classified as either precision targets or area targets. Precision targets were defined as those that "require either a direct hit by a bomb of the proper size or a hit within a limited distance therefrom," and area targets were defined as those that "require a distribution of bombs of the proper size throughout the area in which the definite targets lie."[31] The manual and ACTS definition of precision versus area targets, however, did not delineate the difference between strategic and tactical. The 1934-35 "Air Force Objectives" section of

[28] McFarland, *America's Pursuit of Precision Bombing, 1910-1945*, 90.
[29] Sherman, *Air Warfare*, 188.
[30] Biddle, *Rhetoric and Reality in Air Warfare*, 142.
[31] McFarland, *America's Pursuit of Precision Bombing, 1910-1945*, 94.

the "Air Force" document raised the assertion that Germany was defeated in WWI due to the "moral collapse of her civilian population."[32] Instructors such as Maj Harold George articulated the moral collapse of Germany in lectures and argued that air power could force an enemy's loss of the will to resist.[33]

Despite George's lecture regarding loss of enemy will, the theory of economic collapse would win out in American interpretation of strategic bombing. U.S. industrial infrastructure was used to identify targets in specific industries crucial for a country's economic well-being such as petroleum, coal, electric power, and transportation. It was assumed by air force leaders and target designators that foreign industry mirrored U.S. industry and would affect production and the population in the same ways.

The application of attacking a civilian population's morale through the economic base provided the basis for strategic attack and industrial node theory of WWII. Richard Overy describes the shift from tactical support of the army to the strategic use of air power by describing the belief that air power can achieve its own objectives by "directly attacking the enemy's will to resist, bypassing the surface campaign and independent of its immediate objectives."[34] ACTS formulated strategic bombardment to strike targets that affected an enemy state's willingness and capability to conduct war. This differed from supporting ground movements and operations through tactical bombardment, no matter the relationship to the front. Therefore, as WWII approached, Army Air Corps priorities focused on the development of equipment and training to achieve strategic bombardment.

After WWII, the results of the U.S. Strategic Bombing Surveys and the devastation created by fire bombing and atomic weapons overshadowed the realities of the strategic bombing campaigns in Europe and the Pacific. As Biddle notes, air forces moved away from precision bombing to more indiscriminate forms of bombing in order

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[32] Biddle, *Rhetoric and Reality in Air Warfare*, 157.
[33] Ibid., 157.
[34] Richard J. Overy, "Strategic Bombardment before 1939 Doctrine, Planning, and Operations," in *Strategic Bombardment*, ed. R. Cargill Hill (Air Force History and Museums Program, 1998), 11.

to achieve effects because of the effectiveness of enemy defenses and the infant stages of precision bombing technology.[35]

During the Cold War, air force doctrine continued the sentiment that strategic bombing of an enemy's industrial complex could result in the capitulation of an enemy. U.S. Air Forces Manual 1-8, *Strategic Air Operations*, May 1954, states "the fabric of modern nations is such a complete interweaving of major single elements that the elimination of one element can create widespread influence on the whole."[36] Atomic weapons, however, would soon overshadow any counter to the psychological effect that strategic bombing achieved. As conventional forces drew down, strategic air forces as a part of Strategic Air Command grew into the Single Integrated Operational Plan (SIOP).

SIOP-62 represented the first operational plan for nuclear retaliation against the Soviet Union in the case of nuclear war. Integrating U.S. nuclear bombers, Polaris missiles, and ICBMs into a coordinated massive retaliatory response or preemptive attack centrally controlled by Strategic Air Command (SAC). Eventually, the influence of SIOP shifted as Presidential administrations changed in the 1960s. As Kaplan describes in *To Kill All Nations*, SAC went from the predominant recipient of the military budget to a lesser status after the Vietnam War.[37] SAC's force structure and training emphasis on nuclear deterrence, however, would have implications for future combat. The need to get bombers anywhere in the world for nuclear retaliation led to the perfection of global strike and airborne refueling.

The nuclear age and the Cold War did attach an alternative connotation to the concept of "strategic" bombardment. During the Cold War, "strategic" air power came to be synonymous with "nuclear" weapons and long-range bombers. As Lambeth describes in *The Transformation of American Air Power*, everything short of nuclear, strategic air power was referred to as tactical support of land forces or "theater" air power.[38] Air power during the Vietnam War would carry this connotation because of the

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[35] Biddle, *Rhetoric and Reality in Air Warfare*, 288.
[36] Mark Clodfelter, *The Limits of Air Power*. (1989; new imprint, Lincoln, NE: University of Nebraska Press, 2006), 28.
[37] Edward Kaplan, *To Kill All Nations* (Ithaca, NY: Cornell University Press, 2015), 217.
[38] Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca, NY: Cornell University Press, 2000), 1.

preponderance of air support to ground forces and the limited approved targets sets in Vietnam.

Air Land Battle doctrine developed during the 1980s and codified in the Army's Field Manual 100-5 focused on targeting second echelon forces and the counteroffensive necessary to attrite the Soviet Union's massive conventional force capability. With Air Land Battle doctrine, the existing assumption that the success of land forces depended on the air interdiction of enemy land forces and close air support included using B-52s as a conventional interdiction asset in theater.[39]

[39] Lambeth, *The Transformation of American Air Power*, 86.

Chapter 3
Case Studies

Chapter two described the development of the air forces prior to World War II and how that development period separated strategic bombing against the tactical use of air forces. ACTS also definitively defined a difference between precision targets and area targets with the intention of developing a bomber force capable of using precision attack against targets in Germany. Starting with World War II and the Combined Bomber Offensive, the effect of strategic bombardment theory on the ability to prepare bomber aircrew to employ precision bombing and remain survivable will be judged in this thesis against the experiences of aircrew. The standardization of training and the ability to create realistic training environments under the influence of technological innovation in bombing aircraft and defensive forces will affect the preparation of bomber aircrew for each case study.

The Combined Bomber Offensive

The first case study covers the period of build-up of bomber aircraft and aircrew from the end of 1941 until April 1944 when preparations for the invasion of France and Operation Overlord took precedence. While the Combined Bomber Offensive (CBO) did not officially begin until June 1943, strategic bombing theory's emphasis on daylight precision bombing significantly shaped the training for the build-up of U.S. air forces in England. By December 1943, Eighth Air Force included 218,000 men, 1,603 heavy bombers, and 1,705 fighters. Available aircrew to fly surpassed the number of operational bombers in England and the Eighth Air Force was able to launch as many aircraft and release more tons of bombs than the British Royal Air Force. The increased numbers of airman and aircraft enabled the true effect of the CBO to be felt by Germany. In December 1942, only 353 bombers and 381 tons of bombs were launched compared to 5,000 bombers and 10,000 tons of bombs in December 1943. Instead of formations of fifty or fewer aircraft, simultaneous operations of two or more 100-bomber formations and 160-bomber single formations were able to be generated for missions. These formations increased the amount of tonnage of bombs dropped on targets and increased

survivability of the formations against German defenses. By spring 1943, the amount of aircrew and aircraft reached the numbers anticipated to mount a bomber offensive.[1]

Theory vs. Experience:

The development of the Air War Plans Division's Plan-1 (AWPD-1) in August 1941 at ACTS solidified into doctrine the Air Corps' theory that bomber aircraft relying on speed and high-altitude formations with overwhelming defensive firepower could fly unrestricted to targets. The Air Annex portion of the "Rainbow 5" plan selected 154 targets consisting of German electric power production, transportation staging areas, petroleum generation and storage, air bases and aircraft production, and industries such as aluminum and magnesium important to war production.[2] In addition to reducing Germany's war effort, the plan initially expected to undermine German morale by also attacking civilian population centers. Selective targeting became the desired plan, however, which forced the requirement for a method to precisely delivery bombs on to specific targets. The updated plan, AWPD-42, was produced in September 1942 and further focused bombing efforts on aircraft production and repair, railroad marshalling yards, and submarine locations on the coast.[3] The report estimated 13,038 bombers – 3,995 B-17s, 3,740 B-24s, 2,040 B-29s, and 1,062 B-26s-medium bombers – would need to be produced before 1944. Air Force leaders specifically noted the assumption that if industry could produce the aircraft, the aircrews could be properly trained to man the bombers in time.[4]

At the Casablanca Conference in January 1943, Gen Ira Eaker, as the Eighth Air Force Commander, convinced the participants of the conference of the capabilities of precision daylight bombing. There, the Combined Bomber Offensive would be laid out as four, three-month phases starting in April 1943 and lasting until March 1944. The

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[1] Eighth Air Force, Growth, Development, and Operations, December 1, 1942 - December 3, 1943, P. 4, 9, Call # 520.01, IRIS # 00219007, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[2] History, History of the Eighth Air Force, January 28, 1942-August 17, 1942, P. 7. Call # 520.01, IRIS # 00219007 USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.
[3] Tami Davis Biddle, *Rhetoric and Reality in Air Warfare* (Princeton, NJ: Princeton University Press, 2002): 210.
[4] History, History of the Eighth Air Force, January 28, 1942-August 17, 1942, P. 7, Call # 520.01, IRIS # 00219007, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.

CBO would focus on 92 targets among six specific systems including Germany's aircraft industry and the Luftwaffe's fighter strength, submarine bases, oil, ball bearings, synthetic rubber production, and military vehicles.[5] Eaker was a proponent of continuous bombing of the German war effort while the build up of ground forces continued. The Americans would provide continuous bombing in Western Europe during the day, while the British Bomber Command would continue striking at night.
Others, such as Gen Carl "Tooey" Spaatz, who would later command Eighth Air Force, insisted on gaining air superiority by targeting the Luftwaffe before an invasion of Western Europe occurred.[6]

The reality of the start of bomber operations in Europe was modest. The first heavy bomber raid occurred on August 17, 1942 and consisted of only twelve B-17s from the Eighth's 97th Bombardment Group attacking a marshalling yard in Rouen, France.[7] The build up of strategic bomber forces was taking longer than expected. Eaker expected to have thirty bombardment and pursuit groups in Europe by October 1942 to execute the bomber offensive.[8] From the fall of 1942 until the spring of 1943, however, only six heavy bomb groups were in Eighth Air Force.[9] Training pipelines were producing fewer than expected aircrew and assets were continually siphoned off for the North Africa campaign. Bombs delivered from strategic air forces would not continuously fall on Germany until 1944.

In addition to the problems in training and supply pipelines, the daylight precision bombing experiment was less effective than expected. As cloud cover in the target area increased, circular error probability accuracy doubled from approximately 1,000 feet of

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[5] History, Eighth Air Force Growth, Development and Operations, December 1, 1942 – December 31, 1943, Call # 520.01, IRIS # 00219007, USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.
[6] Message, Eaker to Spaatz, 8th AF, April 26, 1942, Call # 520.01, IRIS #00219007, USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.
[7] *The United States Strategic Bombing Surveys* (September 30, 1945, repr. Maxwell AFB, AL: Air University Press, October 1987), 14.
[8] Message, Eaker to H.A. Craig, Assistant Chief of Air Staff and Plans, Washington, D.C., May 9, 1942, Call # 520.01, IRIS # #00219007, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[9] Stephen L. McFarland, *America's Pursuit of Precision Bombing, 1910*-1945 (Washington, D.C.: Smithsonian Institution Press, 1995): 188.

miss distance to almost 2,000 feet of miss distance.[10] Accuracy was also affected by aircrew misidentifying targets, improperly calibrating Norden bombsights, and incorrectly inputting atmospheric conditions such as wind speed.[11] The U.S. Strategic Bomb Survey (USSBS) states bomb accuracy was estimated at only 20 percent of bombs falling within the defined 1,000-foot target radius for the European theater and 31 percent for Eighth Air Force.[12] These problems would lead to improvisations in formation procedures and the use of radio waves for synchronized bombing later in the war. By 1945, 41 percent of bombing was executed visually and 33 percent completed with the H2X radar receivers.[13]

To adjust to the reduced accuracy of bombardment, the type of targets and methods were gradually changed by air force leaders. In November 1943, permission was granted by General Arnold for aircrew to drop bombs through overcast layers and attack "area targets."[14] Relaxed rules of engagement also preceded changes in targets in preparation of Operation Overlord. In the spring of 1944, strategic bombing of industrial targets like Schweinfurt transitioned towards railways, marshalling yards, and ammunition dumps to prepare for the Allied invasion. Gen Spaatz was able to continue to bomb oil refineries to pressure the Luftwaffe.[15] By 1945, Berlin, Leipzig, and Dresden also became priority targets. Marshaling yards within the cities were the official targeted areas, but the inaccuracies of daylight bombing produced significant damage to the town's themselves because of the employment of highly explosive and incendiary bombs in the campaign.[16]

Losses in the Eighth Air Force's bomber formations averaged almost 4 percent during 1943, but specific missions such as the second raid on Schweinfurt resulted in a 19

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[10] McFarland, *America's Pursuit of Precision Bombing 1910-1945*, 179.
[11] Ibid., *185.*
[12] *The United States Strategic Bombing Surveys,* 13. Stephen L. McFarland, *America's Pursuit of Precision Bombing, 1910-1945,* 186.
[13] McFarland, *America's Pursuit of Precision Bombing, 1910-1945*, 183. Table 10.2 Eighth Air Force Bomb-aiming Techniques provides percentages of visual, radar, and beacon bombing per year.
[14] Biddle, *Rhetoric and Reality in Air Warfare*, 228.
[15] Ibid., 232-234.
[16] Ibid., 254.

percent attrition rate – the loss of 60 bombers.[17] As the number of bombers grew in the Eighth Air Force, bomber formations increased in size to mass firepower and increase protection. By 1943, the use of two or more 100-aircraft formations, dropping on a lead bombardier's release, offered the optimal combination of firepower and protection that would continue throughout the European theater war.

Standardization vs. Improvisation:

One of the difficulties in studying a standardized form of training prior to World War II is that formal training requirements were being developed as the air forces grew. Initial estimates expected a requirement for 195,679 Officers and over 1.9 million enlisted personnel for the air forces by 1944.[18] Starting in May 1942, Eighth Air Force expected 50 new heavy bombardment aircrews, approximately 400 people, every month to build up the required heavy bombardment groups. It also expected a casualty rate for each heavy group to be approximately twenty aircrew killed operationally, three wounded, and six injuries from non-battle related injuries every 100 missions per month.[19] Producing these numbers of aircrew to feed to Europe was the goal of the U.S. based Second Air Force.

Prior to World War II, formal aircrew training was undergoing expansion as organizational structure and procedures multiplied to handle the increase in funding and demand for aircrew. Under the initial division between General Headquarters Air Force and the Air Corps Service, Second Air Force took up the requirements for Heavy Bombardment training. Pilots, bombardiers, navigators, and gunners all needed to move through formal training processes before conducting operational training as combined aircrew. As an example, pilots moved through a standard process consisting of first Basic flight training on single-engine BT-13 aircraft to learn instrument and formation

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[17] History, Eighth Air Force Growth, Development and Operations, December 1, 1942 – December 31, 1943, Call # 520.01, IRIS # 00219007, USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.

[18] History, History of the Eighth Air Force, January 28, 1942-August 17, 1942, P. 7, Call #520.01, IRIS # 00219007, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.

[19] Brig Gen Ira Eaker, Commander VIII Bomber Command, Plan for Initiation of U.S. Army Air Force Bombardment School Operations in the British Isles, 20 March 1942. Call # 520.168-1v.1, USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.

flying. Advanced flight training followed where students split between single and multi-engine aircraft, with most bomber pilots executing the training program in multi-engine aircraft. By 1942, students in the multi-engine advanced stage were becoming familiar with crew concepts and practicing take-offs and landings, three aircraft formations, navigation, and instrument flying.[20]

After advanced training, aircrew transitioned to combat aircraft and into operational training units (OTUs). Difficulties existed in providing theater specific training, however, in the advanced phases and OTUs. A lack of combat experienced instructors were available at the training units and there were difficulties in providing realistic bombardier and gunnery training because of the lack of range access and combat scenarios.

Eighth Air Force reported the arrival of aircrew with inadequate training in the U.S. after the 97th Bombardment Group's deployment to Europe. The weakest spot highlighted by the report was air gunnery training, but other deficiencies existed. The deficiencies reported in the heavy bombardment groups and replacement combat crews included high-altitude, group, and formation flying; defensive gunnery; high-altitude unit bombing; communications; navigation; airdrome discipline; and environmental and navigational considerations unique to Europe because of the weather.[21] Units were arriving to Europe with less than 50 percent of their authorized equipment, without required unit training complete, and without any experience flying in group formations at high altitude. These deficiencies degraded bombing accuracy and gunnery.

Training deficiencies also existed in practiced precision bombing techniques. Shortages in Norden and Sperry bombsights limited training opportunities. Training requirements in 1942 were 3,453 bombsights, but only 1953 Norden and 917 Sperry sights were available.[22] Shortages of fuel also reduced the number of missions and the training profiles available to fly. In order to decrease the amount of time and fuel spend

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[20] Cameron, *Training to Fly*, 405.
[21] Charles Overacker and Frank Robinson, Recommendations for Training and Initiation into Combat of the Heavy Bombardment Group in the U.K., February 15, 1943, P. 28, Call # 520.04-5, IRIS # 00219182, USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.
[22] McFarland, *America's Pursuit of Precision Bombing 1910-1945*, 158.

climbing to altitude during a mission, the majority of the training sorties were conducted at low altitude, below 10,000 feet. This limited the ability to practice precision bombing from altitudes above 20,000 feet, where combat drops occurred. Out of 678,190 practice bombs dropped through 1940, more than half of the releases were below 10,000 feet and only 2 percent were released above 20,000 feet.[23] Training was supplemented with A-2 trainer stands consisting of steered, three wheel, ten foot high platforms that could simulate drift and airspeeds up to 284 miles per hour. Proficiency standards in Training Manual 1-250 required bombardier students to drop 188 bombs within 230 feet circular error probability of the target within a twelve-week training that included eight weeks of flying training and thirty-four missions. By February 1942, to keep up with the war demand for producing bombardiers, training programs were reduced to nine weeks until 1943 when the programs were re-established at twelve weeks. Eventually, training caught up to demand by January 1944.[24] By then, some strain on training pipelines was also released because Eighth Air Force had changed tactics from each aircraft's bombardier acquiring the target to salvo-bombing triggered by an experienced bombardier. This reduced the impact of less qualified bombardiers in a bombing formation.

Salvo bombing was the brainchild of Gen Curtis LeMay, who by July 1943, was the Commander of the 305th Bombardment Group. LeMay chose to position his bombers into fixed box formations with experienced crews and the best bombardiers in the lead. Formations of bombers would then drop on the lead bomber's direction as opposed to individually aiming at the target. Drop-on-leader formations achieved a 24 percent bomb hit rate within 1,000 feet of the aim point as opposed to an 8 percent hit rate for individual targeting. Drop-on-lead formations also reduced the requirement for fully trained bombardiers and Norden bombsights in Europe, thereby alleviating some of the training stress.[25]

Eighth Air Force expected training requirements in theater and sought to develop transitional training units in the United Kingdom prior to operations in combat. Eaker

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[23] McFarland, *America's Pursuit of Precision Bombing 1910-1945*, 159.
[24] Ibid., 153-154.
[25] Ibid., 171-172.

expected OTUs to exist in the U.S. followed by reception in the U.K. at a transition OTU for four to six weeks of training focused on familiarization with the theater, landing approaches in weather, navigation, and evasive action at night. Aircrew Replacement Training starting in April 1942 would be four weeks: 116 hours of ground training and 50 hours of flying preparation followed by 50 hours of flying training. Sorties would be broken up into familiarization and cross-country flights, bombing, gunnery, and landing.[26]

Eighth Air Force was able to gain access to initial Bomber Command Replacement crew sites in Northern Ireland at Bovingdon and a Fighter Replacement center at Cheddington. Initially seven replacement centers were proposed to handle the incoming units, but that number would increase.[27] Problems existed because of the lack of equipment, poor weather, congestion in the airspace, however, abbreviated training due to losses and the requirement for aircrew to move forward into units.[28]

In addition to supplementing OTU training once replacement crews arrived in England, "Freshman phase" sorties were incorporated for newly arrived crews. These sorties were meant to condition aircrew for large formation operations and get them accustomed to anti-aircraft fire. Freshman phase sorties were flown within a 100 nautical mile radius from the coast of England and usually struck shipping targets, docks, and airfields in France.[29]

LeMay's development of formation tactics was one of the innovations designed to increase accuracy and reduce the stress of training replacement crews. Another innovation was the use of the H2X radar receiver and the efforts of the 482nd Bombardment Group to develop its capabilities. The 482nd was taken out of bombing operations and set up a school at RAF Alconbury to train navigators and bombardiers on the radar's use.[30] As a primitive radar, the H2X offered enough resolution to distinguish

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[26] Revised Syllabus for Aircrew Replacement Training, 1 April 1942, Call # 520.168-1V1, IRIS # 00219321, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[27] History, History of the Eighth Air Force, 1942 – 1945, P. 106-107 Call #520.01, IRIS # 00219007, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[28] History, History of the Eighth Air Force, 1942 – 1945, P. 286, Call # 520.01, IRIS # 00219007, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[29] History, History of the Eighth Air Force, 1942 – 1945, P. 38. Call # 520.01, IRIS # 00219007, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[30] History, History of the Eighth Air Force 1942 – 31 December 1943, P. 196. Call # 520.01, IRIS #00219007, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.

coast lines and major city outlines. Synchronized with the Norden bombsight, an H2X could determine the drift and specific angle measurements needed by the Norden by flying over a point. The H2X also determined altitude and ground range, which could then be used by the bombardier to determine the ground speed of the aircraft and update the expected position of the target. These calculations led to the designation of an anticipated release point for the bomb without seeing the actual target. If the target was eventually seen, accuracy could be updated. H2X synchronized targeting only provided accuracies from 1,000 to 3,000 feet away from the target, but it provided a capability to release bombs without seeing the target and ultimately was the pre-cursor to radar targeting.[31]

H2X bombing officially began with the first twelve modified planes in September 1943 when they led 322 B-17s attacking the German port of Emden through an overcast cloud layer. Eventually the 482nd was able to put 75 radar navigators through a four-week training course each month. H2X bombing was successfully implemented in mass for the D-Day invasion to strike German coastal defenses and sever communication lines on the coast within close distances of the landing ships.[32]

Realism vs. Safety

Noble Frankland's asserted that Americans focused on daylight precision bombing because they believed heavy bombers, such as the B-17, were more capable during daytime than night operations, Air Corps leaders did not think British bombing was effective, and they wanted to operate independent from Britain's Bomber Command.[33] Biddle claims daylight precision bombing was executed more on faith and desire to avoid the ethical problems associated with area bombing, however, the initiation of the Air Corps portion of the CBO was more than just an American predisposition for daylight precision bombing.[34] U.S. bomber forces were specifically developed and trained for daylight bombing and intended on incorporating the technological

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[31] McFarland, *America's Pursuit of Precision Bombing*, 181-182.
[32] History, Hugh Odishaw, Radar Bombing – 8AF, P. 36, 50-59, Call # 520.04-5, IRIS # 00219182, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[33] Biddle, *Rhetoric and Reality in Air Warfare*, 209.
[34] Ibid., 209.

achievements of the Norden bombsight and massive bomber formations to accurately target Germany industry.

American aircrew lacked training and experience in the skill sets required for night flying and Air Corps leaders arrived at the conclusion that daylight bombing would be more efficient than night bombing. If American bombers were forced to operate at night in conjunction with British bombers, operational hazards and lack of safety would increase American losses.[35] Specifically, Gen Eaker worried about losses due to take-off and landings during night time operations.[36] For example, the British's Bomber Command suffered 2,681 accidents between 1943 to 1944, the majority due to training sorties at night and weather. During the height of U.S. bomber operations, the 18-month period between 1944 and the end of the war in 1945, accident rates resulted in 1,660 damaged aircraft, approximately 50 per 100,000 hours. Even during the daytime, accidents occurred while the large bomber formations conducted rendezvous procedures circling over beacons.[37] Heavy emphasis on safety during operations and training was put in place by both Bomber Command and Eighth Air Force.

Gen Eaker pushed for daytime operations so as not to fly in congested airspace at night and to minimize operational losses because of bad weather, low visibility, and navigation errors. As an alternative to Bomber Command's methods, the Air Corps chose to make bombsights more effective in the hope of more accurate targeting. Operational risk and loss due to enemy action would be minimized by the air forces with formation tactics and an attempt to achieve a higher degree of combat crew training to mitigate threats versus conducting night operations to avoid the threat.[38]

Eaker and Spaatz hoped to have the ability to operate strike forces of 300 heavy bomber aircraft, with sufficiently trained crews at a four percent loss rate throughout the

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[35] Wesley Frank Craven and James Lea Cate, eds. *The Army Air Forces in World War II*, vol. 2, *Europe: Torch to Pointblank, August 1942 to December 1943* (1948; imprint, Washington D.C.: Office of Air Force History, 1983), 302.
[36] Craven and Cate, eds. *The Army Air Forces in World War II*, vol. 2, 236.
[37] Mark K. Wells, *Courage and Air Warfare, The Allied Aircrew Experience in the Second World War* (London, UK: Frank Cass & Co. LTD, 1995): 31.
[38] Brig Gen Ira Eaker, Commander VIII Bomber Command, Plan for Initiation of U.S. Army Air Force Bombardment School Operations in the British Isles, 20 March 1942, Call # 520.168-1v1, IRIS # 00219321, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.

war. Ultimately, they proceeded cautiously until sufficient training and replacement programs were in place so as not to "ruin forever the good name of bombardment."[39] The results of the Combined Bomber Offensive were already being woven into conclusions that the U.S. could develop strategic bomber forces capable of achieving significant effects on enemy's war effort and morale independent of other forces.

Evaluating bomber aircrew training during World War II is unique compared to the next two case studies because training requirements, facilities, and capacity were developed without any precedence at the scale required. As aircrew arrived into theater OTU's in the United Kingdom, Eighth Air Force was able to evaluate what aspects of initial aircrew training was ineffective in achieving precision bombing. Ultimately, Eighth Air Force was forced to alter its tactics and rely on large bomber formations dropping off an experienced lead bombardier's signal. Despite the change in tactics and the technological capabilities combining bombsight and radar technology, the ACTS theory of precision daylight bombing did not manifest as a fully developed capability after World War II despite its reported success in assessments like the U.S. Strategic Bombing Survey.

Precision targeting with bombers was still not achievable without massive formations. Technological advances such as the H2X radar beacon and Norden bombsight, however, paved the way for advancing radar and beacon bombing capabilities in future conflicts. Even though air power theories miscalculated the ability to train and execute precision bombing with Norden bombsights, the theory did not disappear after World War II. Instead it would be overshadowed by the developing strategic bombardment with nuclear weapons.

Linebacker II

Theory vs. Experience

In contrast to World War II, during which air force doctrine, training, and force development were occurring simultaneously, the Vietnam War took place as a limited war in the heart of a Cold War confrontation. As Mark Clodfelter asserts in the *The Limits of Airpower*, civilian and military leadership believed that precision bombing of

[39] Craven and Cate, eds. *The Army Air Forces in World War II*, vol. 2, 236-237.

Vietnam could achieve the political results desired, a stop of hostilities between North Vietnam and South Vietnam and security of the South Vietnamese democratic government, without starting a major war with the Soviet Union or China.[40] President Johnson unsuccessfully used air power as an escalatory measure in the Rolling Thunder campaign to attempt to coerce North Vietnam to the bargaining table while attempting to limit any cost to the United States. By 1972, President Nixon, without fear of war with the Soviet Union or China, was able to escalate the use of force through air power much more effectively in order to coerce North Vietnam. Nixon's largest constraint was to end the war before December 1972 and the potential decrease in Congressional funding for the conflict.[41]

Under the backdrop of the Cold War, survivability of forces and the risk of escalation to total nuclear war played a much larger role than precision targeting of strategic target sets with conventional bombs. The focus on the SIOP was reflected in the bomber force built and trained before the Vietnam War. SAC's dominance over the nuclear bomber and ICBM force flourished under the SIOP's assured destruction and later counter-force requirements. Attrition was expected in strategic bomber forces and thus a high number of aircraft were justified to maintain a counter force capability. By the late 1960s, ICBMs replaced much of this force, however, and resulted in the reduction of the manned bomber force from almost 800 to 422 aircraft by 1973.[42]

Gen Curtis LeMay had built SAC as a disciplined, highly standardized force to quickly employ counter value nuclear forces against Soviet industrial and military targets. While technical advances in radar bombing had been achieved in the Air Force since World War II, the sheer destruction of nuclear weapons made precise targeting less crucial. Also, survivability and the emphasis on quick counter-nuclear strikes through centrally pre-planned routes were the focus of the command.[43] In addition to radar

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[40] Mark Clodfelter, *The Limits of Air Power (*Lincoln, NE: University of Nebraska Press, 2006), 203.
[41] Clodfelter, *The Limits of Air Power*, 204.
[42] Steven L. Rearden, "U.S. Strategic Bombardment Doctrine Since 1945," in *Strategic Bombardment*, ed. R. Cargill Hill (Air Force History and Museums Program, 1998), 434.
[43] Marshall L. Michel, III, *The 11 Days of Christmas* (San Francisco, CA: Encounter Books, 2002): 4.

bombing, LeMay emphasized sortie generation rates, the number of aircraft available, large formations, and speed.[44]

Since "strategic" bombing of Vietnamese industrial targets was not feasible due to the lack of indigenous war production, early policies focused on saturation bombing of Vietcong positions in the jungle.[45] In 1964, SAC's commander, Gen Thomas Power, opposed General Westmoreland's request for the command's B-52s, protesting the use of his assets for conventional bombing in Southeast Asia. After Gen John Ryan took command of SAC in December 1964, he approved the use of B-52s as long as the command retained operational control of the assets.[46] Flying out of Andersen AFB, Guam, first and eventually U-Tapao Royal Thai Navy Base, SAC's B-52s and KC-135 tankers were a significant part of U.S. air power in Vietnam. The amplified use of SAC's B-52D aircraft provided the impetus to increase the internal bomb capacity from 27 conventional weapons to 84 conventional weapons. This improvement increased a B-52's conventional weapon capability to carry up to 108 bombs on a single aircraft and provided an area bombing capability for targets designated in the Route Package 1 operational area of Vietnam, Laos, and Cambodia.[47]

B-52 Arc Light missions were traditionally limited to less threatening areas of operation because of the threat of Vietnamese fighters and SA-2 missiles. By 1966, Vietnamese attempts to shoot down B-52s operating overhead were unsuccessful. The Vietnamese were successful, however, at causing B-52s to abort attacks whenever they activated an SA-2 radar in the target area because of SAC's desire to limit threats to its reduced nuclear force. Survivability for the nuclear deterrence mission was prioritized over any target sets in Southeast Asia.[48]

Despite the limited operational areas and restrictions, Project Corona Harvest--the Pacific Air Forces study on the effectiveness of air power in Southeast Asia--concluded

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[44] Phillip S. Meilinger, *Bomber: The Formation and Early Years of Strategic Air Command* (Maxwell AFB, AL: Air University Press, November 2012): 138.
[45] Michel, III, *The 11 Days of Christmas,* 11.
[46] Ibid., 12.
[47] Ibid., 14.
[48] Ibid., 17.

Arc Light missions were causing significant enemy dispersal and casualties because of the B-52s massive firepower capabilities. Recommendations focused on improving the flexibility of the bomber targeting process, since the latest a target change could occur was three hours prior to take-off.[49] The B-52 was making significant progress as a close air support asset from a strategic platform.

SAC's overall training focus, however, was orientated toward the SIOP mission as the higher priority. Often, because of limited numbers of aircraft and aircrews, B-52D model aircrew rotated between six months of Arc Light missions in SE Asia and six months of nuclear alert missions in the U.S.[50] Linebacker II operations would stress B-52 capabilities as the number of aircraft in Southeast Asia grew.

The B-52s experience in Linebacker II was significantly different than the previous Arc Light missions. Operation Bullet Shot began the build up of B-52s in Southeast Asia during the spring of 1972, eventually resulting in 207-B-52s split between U-Tapao and Andersen. At the start of Linebacker II, Andersen held 55-B-52D models and 98-B-52G models while U-Tapoa held 54-B-52D models.[51] The difference in B-52 models D and G created planning problems because B-52G's carried only 27 conventional bombs compared to the 108 bombs on modified D models. Half of the G models also employed an inferior ALT-6B electronic countermeasure (ECM) capability compared to the D models ALT-22 ECM suite.[52] From 18 to 29 December, B-52s from Andersen and U-Tapao flew 705 sorties. They dropped 15,237 tons of ordnance on 34 targets in and around Hanoi and the Haiphong area including electrical production facilities, airfields, storage farms, petroleum and gas supplies, and Hanoi radio sites. Ultimately, 80 percent of North Vietnam's electrical power capacity and a quarter of its

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[49] HQ PACAF, Corona Harvest: The USAF in SE Asia 1970-1973, Lessons Learned and Recommendations, P. 3, 47, Call # K717.0423 – 11, IRIS # 01009474, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL. Project Corona Harvest was the official HQ Pacific Air Forces study on the operational effectiveness of air power in Southeast Asia from 1954 to 1972.
[50] Michel, III, *The 11 Days of Christmas*, 17.
[51] History, 43rd Strategic Wing History 1 July 1972 – 31 December 1972, P. 3, Call # WG 43-HIv1, IRIS # 00914441, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[52] History, 43rd Strategic Wing History 1 July 1972 – 31 December 1972, P. 28-29, Call # WG 43-H1v1, IRIS # 00914441, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.

petroleum supplies were destroyed at a loss of fifteen B-52s.[53] North Vietnam's eventual return to negotiations after Nixon's halt of the Linebacker II bombing campaign provides another example of the appearance of successful strategic bombing. The evaluation o of Aircrew preparation for Linebacker II's mission in the highly standardized SAC is the focus of the next section.

Standardization vs. Improvisation:

The tradition of standardization in SAC was not necessarily required for the effective training of large numbers of incoming aircrew, like in the development of aircrew training during World War II. Instead it was a requirement for the employment of nuclear weapons. The planning of Linebacker II operations at SAC Headquarters in Omaha, NE limited the use of already established best practices because of SAC's dislocation from the theater and lack of experience in missions over Hanoi.

Nixon was willing to risk putting B-52s into the skies on the outskirts of Hanoi to force the North Vietnamese to feel the bombing pressure from the U.S.'s most destructive air asset. It was believed by Nixon and his staff that the risk of losing B-52s to Vietnamese surface-to-air defenses could be mitigated by the aircraft's ECM capabilities and tactics for penetrating similar Soviet defense systems to deliver nuclear weapons.[54] General J.C. Meyer, Commander of SAC, decided to plan the ingress and egress into the target areas for the B-52s at SAC Headquarters while Seventh Air Force planned the support operations including chaff missions, electronic warfare, and fighter escort.[55] Each B-52 mission required at least eight F-4 aircraft to supply the chaff corridor, eight F-105G or F-4C Wild Weasel enemy air defense suppressing aircraft, ten F-4 close escort, ten F-4 for distant escort, and three EB-66 electronic warfare aircraft.[56] Gen Meyer anticipated a 3 percent loss rate for the B-52s in Southeast Asia, but the SAC staff, with limited experience in Vietnam, struggled to plan the complex missions.[57]

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[53] History, 43rd Strategic Wing History 1 July 1972 – 31 December 1972, P. 114, 134, Call # WG 43-H1v1, IRIS # 00914441, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[54] Michel, III, *The 11 Days of Christmas*, 56.
[55] Ibid., 57.
[56] Thomas C. Hone, "Strategic Bombardment Constrained: Korea and Vietnam", in *Strategic Bombardment*, ed. R. Cargill Hill (Air Force History and Museums Program, 1998), 514.
[57] Michel, III, *The 11 Days of Christmas*, 59.

A typical SAC mission plan for nuclear strikes consisted of a single-ship, low-altitude ingress with minimal support against the Soviet Union or China, not a complex high-altitude multi-ship strike force.[58] Ironically, SAC had tested and trained to "basketweave" flight paths from 1958 to 1962 against the North American Radar Air Defense System (NORAD) to test the survivability of its tactics to deliver nuclear weapons against a radar threat.[59] In spite of this earlier test, SAC planners sent three waves of B-52s, 129 aircraft in all, across the targets at the same altitudes and headings, separated by four to five hours.

The planners made critical mistakes in the first couple of days. First, the waves of bombers attacking along the same ingress and egress headings provided plenty of warning for the North Vietnamese air defenses. Compression mission planning, executing strikes based on cycling times on target, had been a standard procedure for aircrew at U-Tapao for B-52 Arc Light missions, but the planners at SAC would be unfamiliar with the training and tactics accomplished in Thailand.[60] Second, the planned waves diminished the ability for the limited 7th Air Force package assets to protect the B-52s over Hanoi and strong winds in the target area quickly diminished or blew the chaff corridors off the planned course. Third, evasive maneuvers against radar threats were discouraged in the target area in order to maintain timing and planned course.

The combination of reduced jamming effectiveness against surface-to-air threats, the large post-target turn, and incorrect jamming techniques resulted in the degradation of B-52 electronic warfare jamming over the target area. Mission planners expected the B-52G's ALT-6B suites would not be effective at jamming Vietnam's surface-to-air systems, but, after the first four nights of bombing, tests of the B-52's jamming suite at Eglin against an SA-2 showed that all B-52 crews were inappropriately jamming electronic beacon symbols from the SA-2 missile. Tests also showed the ineffectiveness of B-52 cells with only two aircraft.[61] The inappropriate application of mission planning

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[58] Michel, III, *The 11 Days of Christmas*, 60.
[59] Ibid., 65.
[60] History, 43rd Strategic Wing History 1 July 1972 – 31 December 1972, P. 62, Call # K WG 43-H1-V1, IRIS # 00914441, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.
[61] Michel, III, *The 11 Days of Christmas*, 185.

and tactics had resulted in eight B-52's lost in two days of bombing. A total of fifteen B-52s would be lost during the eleven-day campaign.

On the eighth night of the campaign, SAC allowed Eighth Air Force at Andersen AFB in Guam to plan a large simultaneous attack against targets in Hanoi and Haiphong with 120 B-52 aircraft. Eighth Air Force would be allowed to plan the axis of attack, routes, and tactics to be used inside the target area. The result was a timed attack from two directions across four routes, compressing all 120 B-52s in the target area in 15 minutes. A massive chaff cloud would be laid over Hanoi to complicate North Vietnamese radars, and the compressed timing would permit ample support from Seventh Air Force and Navy aircraft.[62] Sound tactics replaced safety conscious planning and resulted in only two B-52 losses from formation cells with only two aircraft on the eighth night.[63] The application of the lessons learned from previous nights and the recognition that formation cells with three aircraft were more survivable than cells with two resulted in the loss of only two more aircraft over the last three nights of Linebacker II.

Throughout the Arc Light and Linebacker II missions, the importance of nuclear readiness was always apparent. As the number of B-52 aircrews and aircraft increased in theater relative to the total available for nuclear response, the requirement to maintain radar bombing proficiency and the aircraft's synchronous bombing certification for nuclear missions increased. One aspect of nuclear certification was the aircraft's synchronous bombing certification that was required to be completed by aircrew every 45 days. Because of this requirement, a radar bomb scoring (RBS) system was established in the Philippines in June 1972 for aircrew returning from Vietnam to train to the synchronous bombing contingencies. The strain placed on nuclear readiness by Arc Light sorties increased as crews lost over 50 percent of their RBS logged activities resulting in eighty-two G model aircraft and forty-two D model aircraft in theater being decertified to a non-synchronous, non-nuclear status.[64] Increased conventional operations

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[62] Michel, III, *The 11 Days of Christmas*, 188-189.
[63] Ibid., 202.
[64] History, 43rd Strategic Wing History 1 July 1972 – 31 December 1972, Call # K WG 43-H1-V2, IRIS # 00914441, USAF Collection, AF Historical Research Agency, Maxwell AFB, AL.

affected the ability for aircrew to train and remain certified for SAC's SIOP responsibilities.

Realism vs. Safety:

Arc Light sorties focusing on close air support and interdiction of supply lines in the jungles of Southeast Asia were a far cry from the low altitude penetration sorties for nuclear targets. Bravo and Delta targets, the highest priority for SAC's nuclear forces, included Soviet command and control, long-range bomber facilities, air defense systems and Soviet industry infrastructure.[65] Linebacker II targets in and around Hanoi and Haiphong would appear more like traditional Soviet radar targets. Because of the range associated with attacking strategic targets in the Soviet Union, however, SAC had limited training requirements for support aircraft. Instead, SAC incorporated ECM capabilities into the B-52 to defend itself against Soviet defenses. Meilinger highlights the technological advances required to solve range, electronic countermeasures, and targeting that were incorporated into the B-52 and in SAC's operational planning. In Linebacker II, the lack of experience in large supported packages, however, resulted in SAC planners focusing on safety of flight over the target area rather than on evading North Vietnamese SAMs.

The lack of effective training for the threat scenario that was present in Vietnam was criticized in both the fighter and bomber community and led to changes in both TAC and SAC after the conflict. Those changes were more apparent in TAC where losses were more significant over the entirety of the conflict as opposed to just the last eleven days of Linebacker II. SAC benefited in the next conflict, however, from changes in training in both communities.

Prior to Vietnam, precision strategic bombing with nuclear weapons remained the primary focus for SAC. SAC's B-52 strategic nuclear mission relied on low level ingress for survivability against Soviet threats, enhanced by new ECM technology. SAC's previous participation in Arc Light missions in a low-threat environment did little to change this opinion. The failures in the initial days of Linebacker II emphasized the need to incorporate other developed tactics, such as the basket weave ingress and integrated

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[65] Phillip S. Meilinger, *Bomber, The Formation and Early Years of SAC*, 302.

operations in a more coordinated environment to mitigate the radar surface-to-air missile threat. These principles led TAC and SAC towards developing more realistic training scenarios that incorporated the lessons learned from air combat in Vietnam, new tactics, and training for technology that provides more precise targeting and increased survivability against radar directed threat systems.

Desert Storm

Theory vs. Experience:

The Desert Storm conflict showcases the results of bombardment when increased training opportunities and technology are available prior to combat. This coupled with the unique build-up of air forces in theater and the gradual increase in focus on conventional bombing capability completed the favorable conditions for the employment of strategic bombardment.

During Desert Storm air operations, B-52 aircraft and aircrew flew 3.8 percent of all 46,000 strike aircraft sorties between 17 January and 28 February 1991.[66] Seven B-52G's from Barksdale AFB flew global power missions originating and returning to Barksdale AFB to release 35 Conventional Air Launched Cruise Missiles (CALCM) on military communication facilities and power generation facilities, marking the first time bomber aircraft employed weapons originating from the continental U.S. and returning home. B-52 aircraft also conducted the following sorties originating in theater or European airbases: 99 sorties conducted Offensive Counter Air strikes on airfields and aircraft, 303 sorties against communication and control, industrial, and petroleum facilities, and 1,175 sorties against targets of the Republican Guard divisions.[67] In less than 4 percent of the strike aircraft sorties, B-52s dropped 72,000 bombs--30 percent of the total U.S. tonnage.[68] Despite the use of the strategic bombing platform in an air campaign characterized by the identification of strategic center of gravity targets, B-52s

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[66] Thomas A. Keaney and Eliot A. Cohen, *Revolution in Warfare? Air Power in the Persian Gulf* (Annapolis, MD: Naval Institute Press, 1995): 156, 167. (Table 5 and Table 6).
[67] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations* (Washington, D.C.: U.S. Government Printing Office, 1993): 50-51.
[68] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 52.

flew the majority of their sorties against non-strategic target sets primarily responsible for interdicting Republican Guard and Iraqi forces in Kuwait and southern Iraq.

The role of air power in Desert Storm distinguished its use between strategic and tactical target sets, shifting in focus between the Iraqi centers of gravity devised by John Warden's Checkmate and Black Hole groups in CENTAF and interdicting fielded Iraqi forces. Warden's plan for Instant Thunder and the strategic air campaign against Iraq consisted of striking leadership targets; key production targets such as electricity, oil, nuclear-bio-chemical weapon facilities; infrastructure; airfields; and surface-to-air missile threats.[69] This focus on offensive operations and establishing air superiority reflected his conclusions in *The Air Campaign,* where Warden stressed the importance of gaining air superiority before executing a ground commander's demand for interdiction unless circumstances required the increased risk to air assets from not gaining air superiority first.[70] Warden aimed to achieve victory by gaining air superiority and striking directly at Iraqi sources of power over targeting and destroying its massive forces in Kuwait and Iraq.[71] The concept that achieving strategic paralysis was possible by attacking specific targets, war-making capabilities, and creating enough confusion on the battlefield through offensive air power for air forces to win the fight alone.[72]

In reality, only 740 out of the 43,123 strikes documented in Keaney and Cohen's *Gulf War Air Power Survey: Summary Report* were against strategic targets of Iraq's "central nervous system."[73] Central nervous system targets consisted of leadership and telecommunications, electricity and oil, and the nuclear-biological-chemical warfare facilities. Navy Tomahawk cruise missiles (TLAM) and CALCMs launched by B-52s on the first night were responsible for approximately 15 percent of the strategic targets. Most were struck by F-117 aircraft in heavily defended areas around Baghdad and other Iraqi population centers.[74] Warden's Instant Thunder plan, adopted by CENTCOM as the

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[69] John Andreas Olsen, *Strategic Air Power in Desert Storm* (London, UK: Routledge, 2003): 161-162.
[70] John A. Warden, III, *The Air Campaign* (New York, NY: toExcel, 2000), 84.
[71] Olsen, *Strategic Air Power in Desert Storm*, *93.*
[72] Ibid., *85.*
[73] Ibid., *167.*
[74] Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey: Summary Report* (Washington, D.C.: Government Printing Office, 1993): 66-68.

offensive action during Phase 1 of the campaign, eventually incorporated the targeting of large portions of the Iraqi fielded forces. The air plan could accommodate attacking fielded forces because the large contingent of aircraft in theater allowed simultaneous air strikes to gain air superiority and the targeting of fielded forces. Another reason for striking fielded forces was the CENTCOM commander's desire to attrit Iraqi forces before his famous left-hook maneuver from Saudi Arabia.

As during Vietnam's Arc Light missions, most of the targets struck by B-52s consisted of the tactical interdiction of Iraqi forces. The ability to use B-52s in this manner started in Vietnam and was fully realized by Desert Storm. The availability of precision targeting in fighter aircraft with laser guided weapons, stealth technology, and the increased capabilities of surface-to-air threats restricted B-52 operations to lower threat areas. The survivability of bomber and coalition forces dictated target selection, employment parameters, and requirements for support assets. Precision targeting no longer relied on large bomber formations, and large bomber aircraft provided a greater effect on airfields or massed troop formations where large amounts of weapons could be utilized more effectively.

These changes created the perception that Desert Storm cemented itself as the formal shifting point for bomber operations from the nuclear mission to conventional capability. A 1993 General Accounting Office (GAO) report recommended that because of the reduced Soviet nuclear threat and rising potential for theater conflict, bomber aircraft should focus on conventional capabilities, however, in the mid to late 1980s, SAC's awareness of the potential for diminished nuclear requirements might have already occurred. B-52 organizational structure, training, and increased conventional capabilities started to reflect changes toward increasing its conventional capability.[75]

Lambeth states that the recognition of a larger conventional role for bomber aircraft was needed because of SAC's ability to "significantly add to this nation's capability to conduct successful conventional operations," as stated by CINCSAC Gen

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[75] General Accounting Office (GAO), *Operation Desert Storm, Limits on the Role and Performance of B-52 Bombers in Conventional Conflict*, GAO-NSIAD 93-138 (Washington, D.C.: General Accounting Office, May 1993): 2.

John Chain in 1988.[76] In addition to Gen Chain's realization of SAC's conventional capabilities, the Soviet conventional threat to NATO states in Europe as described by the Army's Air-Land Battle doctrine required aircraft capable of projecting power quickly, over long-ranges, and with overwhelming firepower.[77] Air-Land Battle and Field Manual 100-5 developed by the Army's TRADOC concentrated on attacking second-echelon Soviet forces and the lines of communication and staging areas to enable a NATO counter-offensive in Europe. SAC envisioned its role in Air-Land Battle as conventional deep strike interdiction, similar to its role in the Vietnam War.[78] By 1988, Gen Chain focused SAC modernization on conventional capabilities. It developed a tactical munitions dispenser for the B-52G to carry combined effects munitions and cluster munitions, and it developed a conventional cruise missile, AGM-86 or CALCM.[79]

During the construction of Operational Plan 1002-90 (OPLAN), SAC also took a different approach to organizing its forces for the theater commander. Gen Chain did not want to control bomber, tanker, and reconnaissance forces in the same manner as his predecessors during the Vietnam War. In an interview on SAC's process of organizing for war, Gen Chain advocated the transfer of operational control (OPCON) of SAC assets to the Joint Force Air Component Commander in a theater war, thereby alleviating any tension in priority or control of forces in theater. SAC practiced and trained to these changes in authority during the 1989 CENTAF Bright Star, Gallant Eagle, Gallant Knight and Blue Flag command and control exercises.[80] When B-52Gs arrived at Diego Garcia on August 12, 1990 under CENTCOM's Operational Order, OPCON transferred from SAC to the theater commander. Contributing to Gen Chain's willingness to transfer OPCON to the theater commanders was the fact that the original B-52 deployment consisted of a conventional-only unit from Loring AFB, not responsible for a SIOP

[76] Lambeth, *The Transformation of American Air Power*, 164.
[77] Ibid., 164.
[78] Ibid., *85-86.*
[79] Ibid., *165.*
[80] Diane T. Putney, *Airpower Advantage, Planning the Gulf War Air Campaign 1989-1991* (Washington, D.C.: Air Force History and Museums Program, 2004): 7.

mission. Again, Gen Chain's maneuver to shift towards conventional missions, particularly in certain squadrons, initially paid off for force deployment to CENTCOM.[81]

Standardization vs. Improvisation:

One of the criticisms of strategic bomber employment during the Vietnam War and throughout the nuclear age focuses on the rigidity and standardization of the nuclear forces. Laslie's assertion in *The Air Force Way of War* that SAC was "forced to change its perception of itself through participation in TAC exercises" captures the assessment of SAC's inability to adapt itself to new missions and technology after the Vietnam War.[82] As long as the strategic bombing nuclear mission remained the priority, training and emphasis remained in nuclear deterrence. As the threat of nuclear conflict diminished in the late 1980s and the conventional use of bombers became formalized in Air Land Battle, SAC quickly oriented portions of its bomber fleet towards conventional mission sets as evidenced by General Chain's direction as CINCSAC. It is true that B-52 crews, like fighter crews, benefited from the increased realistic training opportunities provided by participation in large force exercises such as Red Flag, but other factors contributed to SAC's transition in conventional training and employment.

GAO's critique on the limits of the role and performance of B-52s in Desert Storm states the B-52 contributions to the conventional fight was indistinguishable from other tactical aircraft. First, the tasking of B-52s against mobile ground force targets did not capitalize on their capabilities to attack fixed targets, using them instead in the same manner as tactical fighters. Second, preparation for the nuclear mission inadequately prepared the B-52 for medium and high altitude strikes with tactical fighter support. The third criticism covered the difficult re-supply effort for the B-52s stationed at Diego

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[81] Putney, *Airpower Advantage, Planning the Gulf War Air Campaign 1989-1991*, 93. Eventually the increased deployment of B-52 aircraft affected 65% of the SIOP bomber force, but the risk was accepted based off the decreasing threat of the Soviet Union. Also, the SIOP mission was affected more by the preponderance of SAC's tanker force deployed in the CENTCOM theater.

[82] Laslie, *The Air Force Way of War: U.S. Tactics and Training after Vietnam*, xiii.

Garcia because of the high rate of munition usage and the proximity of the deployed B-52s to other bases.[83]

Describing the B-52 contribution as indistinguishable from fighter aircraft discredits some of its effects against specific target sets and its ability to provide massive firepower. Cruise missiles launched from B-52s provided a statistically small but qualitatively significant contribution to the air campaign. The 14,000 mile round-trip flight demonstrated SAC's ability to provide global power anywhere in the world from the continental U.S., validating its Giant Voice navigation and training exercises conducted during the Cold War. The 35-hour mission demonstrated the significant global reach capability by requiring five air-refueling events for seven B-52s.[84] Plus, the 35 CALCM's, the only GPS guided conventional weapons used in Desert Storm, struck command and control and electrical facilities on the first day in northern Iraq, which were outside the range of other coalition aircraft.[85]

Additionally, CENTAF's planners producing the Phase III operations against the Iraqi ground forces recognized the B-52's ability to provide massive strikes against Iraqi ground forces. During the Internal Look planning exercise in July 1990, CINCCENT Gen Norman Schwarzkopf used B-52s to strike massive Iraqi troop concentrations. In November, STRATFOR representatives along with the Black Hole planners and Lt Gen Buster Glosson intended to use B-52s against Iraq's fielded forces in Kuwait. Within the first days of the air campaign, CENTAF implemented the Phase III plan and B-52s proceeded to strike Republican Guard units every 3 hours for the duration of the war.[86]

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[83] General Accounting Office (GAO), *Operation Desert Storm, Limits on the Role and Performance of B-52 Bombers in Conventional Conflict*, GAO-NSIAD 93-138, 3.
[84] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 311.
[85] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 251. The CALCM used GPS guidance for enroute navigation to the target and terminal guidance to hit the pre-programmed target coordinates. Desert Storm's other guided, precision weapons used laser or a sensor-guided terminal guidance (such as a High-Speed Anti-Radiation Missile -HARM) for precision targeting.
[86] Putney, *Airpower Advantage, Planning the Gulf War Air Campaign 1989-1991*, 324-325.

B-52 strikes are credited in the Gulf War Air Power Survey (GWAPS) with producing major psychological effects on the Republican Guard and regular Iraqi forces.[87]

Other examples of standardized SAC training carried over to Desert Storm conventional operations included the initial low-altitude strikes on airfields and area targets during the first three days of the war. An example is the initial B-52 strikes from Diego Garcia on an Iraqi airfields on the first morning of the air strikes. At 0400L, thirteen B-52s flying lower than 400 feet above ground struck airfields with CBU-89 mines and British 1,000 pound bombs.[88] B-52s used low altitude penetration to strike petroleum refineries near Uwayjah on the third night. After this attack, planners limited all subsequent B-52 strikes to medium or high-altitude because of the damage received at low altitude to one of the bombers. This restriction was later applied by CENTAF to all coalition forces.[89]

The GAO report highlighted a B-52 training deficiency because of its emphasis on low-altitude strikes, but standardized training for the B-52's NATO-centric mission used low-altitude ingress to minimize the Soviet radar surface-to-air missile threat and maximize the B-52's unguided bomb accuracy for both conventional and nuclear munitions. The focus on a conflict in the NATO Central Region that required low-altitude ingress and targeting was not just a problem for B-52s. The original design for coalition strikes, as noted by the GWAPS assessment, during pre-conflict training required execution in the low-altitude environment. All strike platforms had to compensate for the transition from low altitude to medium- and high-altitude ingresses to increase the accuracy of unguided weapons from high-altitude.[90] Most assets only

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[87] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 246.
[88] Richard G. Davis, "Strategic Bombardment in the Gulf War," in *Strategic Bombardment*, edited by R. Cargill Hall (Air Force History and Museums Program, 1998): 568.
[89] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 51.
[90] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 87.

dropped unguided weapons, out of all weapons dropped by coalition air forces in Desert Storm, only 10,468 were precision weapons versus 209,625 unguided weapons.[91]

Individual B-52 training defined by SAC Regulation 51-52 delineates the emphasis on low-altitude employment in its semi-annual training requirements for all aircrew. Low-altitude conventional bomb runs require nearly twice as many number of executions in the semi-annual period compared to high-altitude conventional bomb runs. For example, a mission ready pilot requires six low-altitude SIOP training bomb run events compared to just one high-altitude bomb during a semi-annual period. Low-altitude conventional bomb runs require eleven events compared to six high-altitude events during a semi-annual time-period. Based on experience, the increased level of difficulty for low-altitude bomb runs requires an increased number of executions.[92] For many platforms leading up to Desert Storm, optimizing training for employment at low-altitude was within the guidelines for established tactics and procedures, and the decision to conduct initial strikes at low altitude took advantage of the way aircraft trained and operated against the anticipated threats.[93]

Once execution at high altitude began, aircrew overcame the inaccuracies of unguided bombs because of the pre-Desert Storm training that occurred in theater during Desert Shield. One example is the realization that aircrew needed to correct consistent 500-foot errors during high-altitude bombing. The discovery of the errors occurred during high-altitude bombing in stateside exercises such as Desert Warrior in October 1990. Discovering these errors was a product of the many exercises in preparation for Desert Storm and the implementation of new electronic television ordnance scoring systems (TOSS) at U.S. ranges to grade bomb hits more accurately.[94]

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[91] Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey: Summary Report*, 103, 203. Unguided weapons are depicted in the GWAPS Summary Report Table 3. Guided weapons are depicted in the GWAPS Summary Report Table 8. Only guided / un-guided bombs are tabulated in the figures cited in this paper.

[92] Strategic Air Command Regulation 51-52, *B-52 Aircrew Training*, 1 January 1992, Call #ANSER-26, IRIS # 00875749, P. 4, 33-35. USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.

[93] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 355-356.

[94] Putney, *Airpower Advantage, Planning the Gulf War Air Campaign, 1989-1991*, 326.

Another example of pre-Desert Storm innovation that provided benefits during the conflict is the weapon released by B-52s on Iraqi airfields. The UK 1,000-pound bomb provided a more capable means to deny the use of an airfield because of its ability to detonate at random intervals. After identification of the weapon in September 1990, SAC was able to modify B-52G bomb racks, test the weapon, provide training, and deliver the munition to Diego Garcia for use by B-52Gs during the initial strikes of the first days of the air campaign.[95]

Because of the massive build-up of air forces starting in August 1990, CENTAF and unit commanders realized the need to continue training while deployed in theater. Agreements made in August with the Royal Saudi Air Forces (RSAF) established training airspace for coalition air forces to use by September 1990.[96] Exercises started in October and continued through December and January to practice all aspects of the mission – including command, control, and airspace procedures; close air support missions; and search and rescue missions.[97] B-52 aircrew training at Diego Garcia was initially limited based on the amount of resources on the island base, but gradually included training profiles emphasizing formation cell departures, secure communication, air refueling, low-level training, electronic counter measures, multiple axis attacks, and simulated bombing runs.[98] The result was that 80% of SAC aircrew participating in Desert Storm felt prepared for those operations.[99]

Realism vs. Safety

Prior to Desert Storm, deployed aircrew took part in realistic training and exercises as a portion of Desert Shield flying operations. The success of Red Flag exercises provided a model for stimulating the need for integrated training to simulate the potential combat environment. Since 1975, TAC had provided at least three Red Flag

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[95] Putney, *Airpower Advantage, Planning the Gulf War Air Campaign, 1989-1991*, 218.
[96] Ibid., *117-118.*
[97] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 409. A detailed list of all air exercises executed by CENTAF starting in October 1990 is described in Appendix E of GWAPS Volume IV.
[98] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 438.
[99] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 439.

exercises each year to season aircrew in training environments against simulated enemy threats.[100] At Red Flag exercises, a composite air force of different aircraft types had the ability to train together against realistic Soviet threats such as the SA-2, 3, 6, and 8 missile systems. The last Red Flag prior to Desert Storm, RF 90-4, included three B-52 units flying 44, 41, 33 sorties respectively in a three-week period alongside the same fighter support that would be used in Desert Storm.[101]

During Desert Shield, the importance of mission rehearsal towards the preparation for combat seems apparent. As airspace became available to train, CENTAF exercised all aspects of the anticipated execution. Initial Look in October 1990 exercised command and control procedures, Desert Force was dedicated to combined joint-strike integration and D-Day execution, and Fish Barrel focused on close air support.

Another example of an exercise with the specific goal of identifying and targeting fielded forces was CENTAF's Night Camel, held weekly from 1990 to January 1991. Night Camel aided B-52, F-15E, F-16, and F-111F aircrew in identifying Iraqi ground forces with Advanced Synthetic Aperture Radar Systems (ASARS), Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) pods, or other organic sensors.[102]

The execution during Desert Storm benefited from a unique opportunity. Most aircraft were available in theater to participate in realistic training starting in September and October 1990. CENTAF and SAC's leaders, having lived through Vietnam, realized the importance of conducting realistic training in anticipation of combat action. Prior to the execution of Desert Storm, it was possible to exercise almost all aspects of the air campaign. The right training environment provided aircrew the ability to flex ingrained skill-sets such as low altitude employment to a new environment.

While the GAO report criticized B-52 nuclear training for not allowing flexibility towards conventional missions, the reality is that SAC had already begun a transition

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[100] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 421.
[101] Eliot A. Cohen et al., *Gulf War Air Power Survey*, vol. IV, *Weapons, Tactics, and Training and Space Operations*, 427.
[102] Putney, *Airpower Advantage, Planning the Gulf War Air Campaign, 1989-1991*, 260.

towards conventional training and reaped benefits from participating in Red Flag exercises and Bright Star exercises in Egypt. In addition, the application of the first use of aircraft-launched stand-off weapons and CONUS-launched strikes beckoned a new way of using conventional bombers as a global power projection that is now ingrained in Air Force doctrine.

Chapter 4

Overcoming Organizational Inertia

How bomber training structure transitioned from a nuclear centric emphasis to a combined nuclear and conventional force is grounded in organizational change as much as changes in technology and training. Advocates for conventional bomber forces pushed for ways to increase conventional capabilities by adding GPS, targeting pods, and new weapon types to strategic bomber capabilities. Air Force leaders, such as CINCSAC General George Butler, wanted to ensure that B-52s, B-1s, and the soon-to-be operational B-2s did not resort to only a nuclear role and lose the lessons learned from previous conflicts.[1]

Position papers such as the *Strategic Review's* "Strategic Airpower in Conventional Warfare: Some Considerations," published in the Spring of 1991 focused on the required numbers of bombers necessary by showing the limitations of a small bomber force at 2 percent, 5 percent, and 10 percent attrition rates.[2] For example, with 100 bombers at a 2 percent attrition rate, slightly less than the B-52's Vietnam loss rate, only 30 operational bombers would be available after 60 operational days. Supporters for a conventional bomber force, such as Arthur Metcalf from the *Strategic Review*, argued the demonstrated capabilities of global reach, refueling, and dual conventional and nuclear role of bombers as reasons to maintain high levels of bomber aircraft as the end of the Cold War and post-Desert Storm draw down occurred.[3]

After Desert Storm, RAND also focused on promoting a conventional over nuclear role for the management of training, organization, and bomber structure decisions. Citing the increased payload and range capabilities of bomber aircraft over fighter aircraft, RAND sought to prove the unique advantages of a bomber force in conventional theater conflicts such as Desert Storm. The success of B-52s launching

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[1] Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca, NY: Cornell University Press, 2000), 166.
[2] Arthur G. Metcalf, "Strategic Airpower in Conventional Warfare: Some Considerations," *Strategic Review* (Spring 1991): 35.
[3] Metcalf, "Strategic Airpower in Conventional Warfare: Some Considerations," 40.

cruise missiles during Desert Storm proved bombers, when packaged with support aircraft, could provide a long-range strike capability. These concepts foreshadow the future use and role of the B-2. RAND concluded that bombers needed to develop and train to the ability to strike "tactical" targets and mobile tactical targets with a variety of weapons and sensors such as targeting pods.[4] Glen Buchan's conclusion on challenges for defense planning during the new era suggested "the most pressing need is for a new way of thinking about how to employ bombers as flexible tactical aircraft," focused on sensors, weapon system integration, and counter measures providing survivability.[5]

Gen George Butler considered SAC's B-52 missions during Desert Storm as demonstrating the same proficiency as bomber forces as at the end of World War II.[6] Proposing that the bombers were having difficulty getting weapons on target because of SAC's reluctance to give up the nuclear mission discredits SAC's efforts to organize and train bomber aircrew for conventional missions. SAC had already delineated conventional only units, using those in Desert Storm, and had demonstrated the incredible preparation required to provide global strike using cruise missiles during the outset of the war. Nonetheless, the dissolution of SAC and the combination of strategic bombers with tactical fighters in Air Combat Command (ACC) completed a transition for the strategic bomber force.

The reasons for dissolving SAC by General Butler and General Merrill "Tony" McPeak, the USAF Chief of Staff from 1990 to 1994, are not the focus of this paper, but the combination of SAC and TAC into ACC drastically changed the Air Force's strategic bombing operational and training focus. Gen Butler addresses this change as a focused effort to change SAC's effort from nuclear missions to a conventional mission. As Gen Butler stated, "at the core, Strategic Air Command was a nuclear outfit, had always been, was, and would always be. I knew that unless that perception changed, the air assets that

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[4] Glenn C. Buchan, "The Use of Long-Range Bombers in a Changing World: A Classical Exercise in Systems Analysis," in *New Challenges for Defense Planning: Rethinking How Much is Enough*, ed. by Paul K. Davis (Santa Monica, CA: RAND Corporation, 1994), 417.
[5] Glen C. Buchan, "The Use of Long-Range Bombers in a Changing World," 445.
[6] Lambeth, *The Transformation of American Air Power*, 165. From a speech given by General George Lee Butler, and transcribed into "Disestablishing SAC," *Air Power History*, Fall 1993.

traditionally had been assigned to SAC would wither and be lost."[7] Desert Storm's display of conventional strike and the dissolution of the Soviet Union reduced the apparent appeal for the SIOP role in deterrence and increased the requirements for theater war.

The Vietnam War changed fighter aircraft training, while Desert Storm may be the defining moment for the change in training and equipping of strategic bombers. Self-assessed strategic bomber failures in Desert Storm as well as impending budget and force reductions created the institutional impetus for force structure change. Total USAF bomber aircraft number decreased from 422 in fiscal year 1988 to 290 in fiscal year 1991 and 183 by fiscal year 1995. USAF fighter aircraft decreased in similar proportions 2,978 in 1988 to 1,763 1995.[8]

As a method for organizational behavior, Graham Allison and Philip Zelikow define their Model II system to characterize organizational activity not as deliberate choices but according to set standard behaviors or patterns.[9] Gen Butler strove to break SAC's standard pattern of behavior associated with nuclear alert and the nuclear deterrence SIOP plans developed in the 1950s and 1960s. Allison and Zelikow assert that an interference pattern explains or predicts how an organization will act.[10] Based on the application of this explanation to SAC and Butler's perception of SAC, unless major organizational change occurred, SAC would return to the nuclear mission. The gradual adaptation occurring in SAC before Desert Storm including the creation of conventional only squadrons, addition of conventional cruise missiles, and the tactical munitions dispenser provided foundations for some success in Desert Storm. The transition of SAC and TAC to ACC, however, formalized the now dominant focus on theater war and the integration of strategic bombers into the changes in training already emphasized in TAC.

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[7] Lambeth, *The Transformation of American Air Power*, 166. From a speech given by General George Lee Butler, and transcribed into "Disestablishing SAC," *Air Power History,* Fall 1993, 8.
[8] Frederick J. Shaw, ed., *Locating Air Force Base Sites, History's Legacy* (2004, Washington, D.C.: Air Force History and Museums Program, United States Air Force, 2014), 152.
[9] Graham Allison and Philip Zelikow, *Essence of Decision*, 2nd ed. (New York, NY: Longman, 1999), 143.
[10] Allison and Zelikow, *Essence of Decision*, 175.

Debating the effectiveness of strategic bombardment, whether deconstructing the Combined Bomber Offensive and the results quantified in the U.S. Strategic Bombing Survey or analyzing the operational constraints on B-52 operations in Vietnam and Desert Storm is heavily dependent on the conditions and goals of each period. The Casablanca Conference in 1943 focused the strategic air objective as the "destruction and dislocation of the German military, industrial, and economic system and the undermining of the morale of the German people."[11] The U. S. Strategic Bombing Survey portrays air power as decisive in Western Europe because of the volume of aircrew training and aircraft production to achieve air superiority over the German Luftwaffe. This superiority allowed the air forces to mass enough bomber aircraft to achieve some effects on German industrial targets.[12] Even with the most advanced bomb-sight and radar equipment and training, bomber formations were only able to achieve 20 percent accuracy of weapons striking within 1,000 feet of the aimpoint because of operational constraints – poor weather, flak, fighters, or the size of the target.[13]

During World War II, bomber aircraft and large formations were the only way to strike large industrial targets defined at the Casablanca Conference and the bombing survey's assessment as strategic. After the Vietnam War and Desert Storm, however, tactical fighter aircraft could strike strategic target sets with precision weapons surpassing existing bomber capabilities. John Warden's *The Air Campaign* re-emphasized the requirement for offensive operations in addition to interdiction, close air support, and the requirement for air superiority against centers of gravity such as an enemy's military equipment, logistics, command and control, personnel, and operational support facilities.[14]

The training and exercise emphasis that occurred in TAC's forces after Vietnam enabled the combination of specialized skill-sets to provide air superiority, defend against complex threat systems, and execute precision strike. Laslie among other writers

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[11] *The United States Strategic Bombing Surveys* (September 30, 1945, repr., Maxwell AFB, AL: Air University Press, October 1987), 14.
[12] *The United States Strategic Bombing Surveys*, 37-40.
[13] *The United States Strategic Bombing Surveys*, 13.
[14] John A. Warden III, *The Air Campaign* (New York, NY: toExcel, 2000), 34.

highlights the change in USAF methods of training after Vietnam as resulting in the success of tactical fighter aircraft in Desert Storm and thereafter. Laslie credits successive Commanders of Tactical Air Command through 1978 as re-inventing the tactical air force. Gen Walter Sweeney, a prior B-29 pilot, increased realism and risk in daily training missions by allowing larger numbers of aircraft to engage aircraft in air-to-air training and growing close air support and tactical air-to-ground operations training.[15] This only increased under Gen William Momyer and Gen Robert Dixon with the eventual establishment of Red Flag exercises and dissimilar air combat training (DACT) under Gen Dixon's command.

Innovation in training methods was possible with Gen Sweeney, Momyer, and Dixon providing the means to develop new methods for training and wartime simulation for the air force during peacetime. Stephen Rosen asserts military innovation is possible during peacetime when respected senior officers provide a framework for new capabilities, technology, and organizational structures because of a changing security environment or mission. Vietnam's air campaign, focused on interdiction and supporting bombing aircraft against ground-based radar-threats in addition to air threats, provided this opportunity to develop new training and employment methods.[16] By maintaining focus on the SIOP mission, the bomber force did not realize the same opportunities for innovation. TAC developed interdiction and the Air Land Battle theory of employment supporting the army and used advances in precision guidance technology, electronic attack, air warfare simulation to train to the theory.

Lambeth's *The Transformation of American Air Power* characterizes the changes made by TAC in the air superiority and ground-attack missions in between Vietnam and Desert Storm by changing requirements for aircrew proficiency, equipment performance, and the concept of operations.[17] The concept of operations changes for force structure and training is most notable in the Designed Operational Capability (DOC) system. DOC

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[15] Brian D. Laslie, *The Air Force Way of War: U.S. Tactics and Training After Vietnam* (Lexington, KY: The University Press of Kentucky, 2015), 35.
[16] Stephen Peter Rosen, *Innovation, and the Modern Military: Winning the Next War* (Ithaca, NY: Cornell University Press, 1991), 21.
[17] Lambeth, *The Transformation of American Air Power*, 56.

statements, recommended in 1972 at TAC's fighter symposium at Nellis AFB, described primary and secondary missions for multi-mission aircraft. This allowed units to focus aircrew training on specific missions and geographic areas of responsibility for more specialization in those areas. In addition to specific focus areas, three proficiency levels, basic proficiency, mission-capable proficiency, and mission-ready status were developed. Specialization enhanced by new technology created conditions for increased aircrew readiness.[18]

Introduction of DOC statements, proficiency standards, and the graduated combat capability programs delegated out in Multi-Command Manual (MCM) 51-50 represented the formalized changes occurring in aircrew training. Maj John Jumper's, 1978 Air Command and Staff College "Tactics, Training, and Evaluation: Toward Combat Capability" research report focused on the development of the building block training concept for fighter aircraft. Maj Jumper, who became the 17th Chief of Staff of the Air Force, argues that aircrew were only motivated to pass ORI's and checkrides and had limited ability to conduct adequate continuation training after mission qualification status. He identified the fact that aircrew had limited experience at low altitude, a lack of air combat tactics training, and limited scenario-based training. These deficiencies were compounded by the increasing and expanding threats and mobile defensive systems active at the time.[19]

Jumper identified a requirement for more training ranges, the central publication of tactics training manuals, and the ability to develop flexible combat scenarios for continuation training.[20] Instead of focusing on just flight hours or the number of sorties, performance during scenarios and events would qualify training, starting with basic skill sets for each mission type, air-to-air, air-to-ground, and specific weapon type employments and growing towards more difficult scenarios. Eventually, the commands could promote the elevation of the evaluation of tactics and aircrew performance into the

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[18] Lambeth, *The Transformation of American Air Power*, 65.
[19] General John P. Jumper, "Tactics, Training, and Evaluation: Toward Combat Capability," Research Report 1210-78 (Maxwell AFB, AL: Air Command and Staff College, 1978), 10.
[20] Jumper, "Tactics, Training, and Evaluation: Toward Combat Capability," 12-13.

formal evaluation process, combining weapons and tactics and standardization and evaluation to determine combat capability. Red Flag scenarios would become a part of the evaluation process reflecting actual war-time tasking and increasing in difficulty as exercises progressed.[21]

Gen Dixon, TAC Commander, approved the implementation of Red Flag in July 1975. The purpose of the exercise was to consolidate the tactical and threat resources located at Nellis AFB and the USAF Tactical Fighter Weapons Center (TFWC). The initial charter was to "fuse together tactical/threat resources under a central manager to provide continuous combat training in a realistic environment."[22] The plan specifically tied the exercises to a unit's DOC statement requirements and focused on using the new air combat maneuvering instrumentation (ACMI) equipment and dissimilar aircraft aggressor unit aircraft to evaluate tactical proficiency. The first Red Flag occurred in December 1975 with the intent to provide the first eight to ten combat missions to aircrew in a realistic environment for fighter aircraft first, with the expectation to expand Red Flag to SAC and joint partners such as the Navy and Marine Corps in Phase II.[23]

By April 1976, SAC participated in its first Red Flag with B-52s launching from a home base, refueling, and landing at Nellis AFB to participate in debrief with the rest of the exercise. Initial bomber participation was limited. Red Flag 77-1 in October 1976, for example, included only three B-52 aircrew from the 96th Bombardment Wing at Dyess AFB. But bomber participation existed from the beginning of Red Flag.[24] Laslie describes SAC participation as forced into TAC's exercises and slow to learn the lessons of tactical integration.[25] Red Flag offered a complement to exercises such as SAC's Giant Voice, however, which concentrated on SAC's nuclear generation, bombing accuracy, and navigation requirements. Red Flag offered the opportunity to mission plan, brief, and integrate with fighter aircraft to provide lessons for survivability in threat environments. Bombers were apart of TAC exercises from the start, focused on

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[21] Jumper, "Tactics, Training, and Evaluation: Toward Combat Capability," 88.
[22] Tactical Air Command, *TAC Programming Plan 20-75*, 11 November 1975, A-1.
[23] Tactical Air Command, *TAC Programming Plan 20-75*, 11 November 1975, A-2-A-3.
[24] History of the 96th Bombardment Wing (Heavy), October – December 1976, P. 24, Call # K-WG-96-HI, IRIS # 01017243, USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.
[25] Laslie, *The Air Force Way of War*, 66.

survivability, and provided an opportunity in training to focus on the lessons learned that occurred in Vietnam during Linebacker II.

Finally, the MCM 51-50 series documents formalized aircrew classification based on required mission status and experience level, delineating required training based on experience level. For example, aircrew required to be in a mission ready status met certain requirements for number of training events for each task based on their experience level. SAC's Regulation 51-52 designated aircrew as being either mission ready capable, highly experienced, or superior performance and experience. Mission ready aircrew were expected to execute generic training events and SIOP events at a certain number over a semi-annual flight period. The more experienced an aircrew, the less events were required by regulation to fulfill requirements during the semi-annual period.[26]

Mission events in the MCM and SACR documents are not graded to proficiency standards unless executed during a mission qualification training, initial qualification training, or upgrade program. Continuation or proficiency training is based on executing the appropriate number of events, stressing Maj Jumper's call to ensure evaluation standards appropriately merged with tactical execution standards. The MCM standards existing in the early 1990s have not changed in intent. The tracking of events still occurs on a monthly and annual basis according to the experience level of the aircrew.

Currently, Air Force Instruction 10-201 defines readiness reporting instructions for commanders including combat air forces aviation training to report the status or health of aircrew training. The number of qualified aircrew that exist in a squadron, the number of sorties each individual fly, and what missions or events occur during training sorties is designated in accordance with each aircraft's aircrew performance standards. Units classify individual aircrew as either Combat Mission Ready, Basic Mission Capable, or other standard to determine the number of mission tasks required for training. Training directives and tasks specified by the Chairman Joint Chief of Staff (CJCS) or

[26] Strategic Air Command Regulation 51-52, *B-52 Aircrew Training*, 1 January 1992, Call #ANSER-26, IRIS # 00875749, P. 4, 33-35. USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.

Combatant Commander (CCDR) operational plans define Mission-essential training items for each airframe.[27]

DOC statements still exist to simplify and consolidate directed requirements composed of core mission-essential task lists (METL), war and mobilization plans, and the numbers of required equipment and people. DOC statements no longer task or provide an authoritative source for expected capabilities, however. Instead, core METL's, and the Air Force Universal Joint Task List (UJTL) provide the CJCS, MAJCOM, and CCDR required tasks to units.[28]

The CJCS Universal Joint Task Lists separate into strategic theater, strategic national, operational, and tactical tasks within CJCS Instruction 3500.02A and B, the *Universal Joint Task List Program,* 15 January 2014. Strategic bombing universal tasks include conducting global strike and providing global strike capabilities.[29] CCDR's supplement CJCS requirements by providing further reporting instructions and mission-essential training items for each airframe to conduct before arriving into a theater. Reporting instructions provide classified skillsets each deployed unit needs to be familiar and fully capable of executing within the theater.

Unlike the spin-up exercises executed prior to Desert Storm, which were conducted to ensure aircrew were prepared for the Desert Storm environment once in theater, the repetition and predictive cycle of deployments have formalized close air support and dynamic targeting into formal training programs at home stations.

In 1991, B-52 mission sets included: air interdiction, offensive counter-air, maritime, chemical warfare, and nuclear operations, but individual training events remained relatively standardized between conventional, nuclear, mine-laying, and defensive employment at low- and high-altitude.[30] Strategic employment concentrated on fixed target sets. Today, increased sensor capabilities and the ubiquity of laser-guided

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[27] Air Force Instruction 10-201, *Force Readiness Reporting*, 3 March 2016, 57-58.
[28] Air Force Instruction 10-201, *Force Readiness Reporting*, 3 March 2016, 10-11.
[29] Chairman Joint Chief of Staff Instruction CJCSI 3500.02B, 15 January, 2014. UJTLs are provided through the Joint Electronic Library and can be further defined through individual Service tasks lists located at the following link: https://jdeis.js.mil/jdeis/index.jsp?pindex=43.
[30] Strategic Air Command Regulation 51-52, *B-52 Aircrew Training*, 1 January 1992, Call #ANSER-26, IRIS # 00875749, P. 4, 33-35. USAF Collection, Air Force Historical Research Agency, Maxwell AFB, AL.

and GPS-guided weapons create dynamic targeting requirements for all platforms including bombers. Technologically advanced sensors not only make weapons more precise but also more effective against mobile targets, something B-52 and other strike aircraft toiled with in Desert Storm. Bomber operations also focus on stand-off weapons, dynamic targeting, and close-air support in addition to the traditional maritime and surface attack missions.

Chapter 5

Conclusion

> *If you take off from a base and go to a range that you are intimately familiar with which has nothing but very rudimentary equipment, no threat equipment, and you perform what amounts to calisthenics – you do the same thing day in and day out in a very unreal atmosphere – you are betraying the purposes of training; you are betraying the readiness of the crews.*
>
> General Robert J. Dixon, July 1984.

How have air force doctrine, organizational structure, and technology affected the evolution of training within the Air Forces' strategic bombers? That is the fundamental question of this paper. By looking at the training requirements of strategic bomber forces prior to the Combined Bomber Offensive, Linebacker II, and Desert Storm, similarities exist in each case study across the competing interests of theory and experience, standardization and improvisation, and realism and safety.

The fundamental theory of offensive air power and daylight strategic bombing still drives the doctrine for employing strategic bombers. The first question asks if existing air power theory of employment predicted the experience in combat for bomber forces? In each case study, strategic bomber forces adapted to the nature of the conflict for individual missions, but the intent remained focused on an offensive, strategic bombing capability. Precision bombing theory created the need for institutions devoted to specialized training. Bombardier training focused on the use of bombsights, such as the Norden bombsight, for accurately identifying and striking targets while advanced gunnery schools and formation procedures developed the means to defend against strengthening threats. When precision and survivability were unachievable, mass, and fighter or pursuit escort compensated for the theory's shortcomings while the ability to interdict ground forces benefited from the advancement of precision bombing technology.

The belief in precision strategic bombing continued with the use of strategic bombers in Vietnam. In contrast to the central focus of daylight precision bombing, strategic bomber forces trained to the skillsets required for nuclear deterrence despite deploying to conduct conventional strikes in close air support and interdiction roles.

Doctrine's influence on training overpowered experience resulting in the misapplication of standardized procedures to the high risk strikes by B-52s over Hanoi during Linebacker II. This focus on nuclear employment continued up to Desert Storm, but the ability to transition to conventional missions in a short amount of time show how commonality between mission, aircraft, and training provided benefits during the short run up to Desert Storm.

The second question asks how technology changed training requirements for bomber aircrew in each case study? Technology infused itself in strategic bombing training from the beginning. Where realistic training rarely occurred before World War II because of the lack of resources, aircraft, airspace to practice, precision bombing and gunnery training used simulation methods as a training alternative. Link trainers and gun camera footage set the stage for developing technology to make training more realistic. The increase in technology to solve problems in precision targeting and survivability also create the requirement for training. Developments in radar bombing during World War II, which attempted to solve the problem of precision when targets were obscured by weather or conditions were inadequate for visual bombing, created new requirements for aircrew training in combat on the new systems. Each case study exemplified instances of adapting training to new technology or changing employment because of failures of technology.

The third question asks how well the Air Force manages the requirement to standardize training while allowing innovation to respond to theater commander needs? The ability to provide realistic training became a central focus throughout all levels of command, but success occurred when theater commanders were able to shape training for specific requirements in their respective theaters. The central effort of strategic bomber forces in Europe during World War II or the ability to mass forces in theater and execute mission rehearsal exercises prior to Desert Storm may not be possible in future conflicts. Therefore, prioritizing specific missions for bomber forces and maintaining theater specific reporting instructions will be crucial to defining training requirements.

The central tenet of precision attack still exists as doctrine. In Brian Laslie's opening chapter of *The Air Force Way of War,* he asserts that "proper training led to

changes in tactics, and in turn changes in tactics led to changes in doctrine."[1] An examination of the three case studies reveals that the theory of strategic bombardment still drives bomber aircrew training requirements. The ability to precisely strike or hold at risk any target in the world requires bomber forces to continue to train to the original ACTS theory of precision bombing. What has changed is that technology has enabled precision strategic targeting to occur on a smaller scale, and by any strike aircraft. Doctrine should be the foundation for the development of tactics, without determining the execution of those tactics.[2] Training should link doctrine to tactics. The continued development of training resources and technology will be necessary for future challenges.

[1] Brian D. Laslie, *The Air Force Way of War, U.S. Tactics and Training after Vietnam* (Lexington, KY: The University Press of Kentucky, 2015):34.
[2] Everett Dolman, *Pure Strategy* (New York, NY: Routledge, 2011): 193. Dolman states "Doctrine should be the foundation for tactics, and if allowed to determine it, the ruin of strategy."

Glossary

ACMI - Air Combat Maneuvering Instrumentation

ACTS – Air Corps Tactical School

AFI – Air Force Instruction

ASARS - Advanced Synthetic Aperture Radar Systems

ATO – Air Tasking Order

AWPD – Air War Plans Division

BMC – Basic Mission Capable

CAF – Combat Air Force

CALCM - Conventional Air Launched Cruise Missiles

CBO – Combined Bomber Offensive

CCDR – Combatant Commander

CENTAF – United States Central Command Air Forces (now AFCENT)

CENTCOM – United States Central Command

CINCSAC – Commander in Chief Strategic Air Command

CJCS – Chairman Joint Chiefs of Staff

CMR – Combat Mission Ready

DACT - Dissimilar Air Combat Training

DOC – Designed Operational Capability

DoD – Department of Defense

ECM – Electronic Counter-measures

GAO - General Accounting Office

GHQ – General Head Quarters

GPS – Global Positioning System

GWAPS – Gulf War Air Power Survey

ICBM – Intercontinental Ballistic Missile

ISR – Intelligence, Surveillance, Reconnaissance

JP – Joint Publication

LANTIRN – Low Altitude Navigation and Targeting Infrared for Night

MCM - Multi-Command Manual

MDS – Mission Design System

METL - Mission-Essential Task List

NDS – National Defense Strategy

NORAD - North American Radar Air Defense System

OPCON – Operational Control

OPLAN - Operational Plan

OPORD – Operational Order

ORI – Operational Readiness Inspections

OTU – Operational Training Unit

RAP – Ready Aircrew Program

RBS - Radar Bomb Scoring

RSAF - Royal Saudi Air Forces

RTM – RAP Tasking Message

SAC – Strategic Air Command

SIOP - Single Integrated Operational Plan

STRATFOR – Strategic Forces

TAC – Tactical Air Command

TLAM – Tomahawk Land Attack Missile

TOSS - Television Ordnance Scoring Systems

TRADOC – U.S. Army Training and Doctrine Command

TFWC - USAF Tactical Fighter Weapons Center

UJTL - Universal Joint Task Lists

USSBS – U.S. Strategic Bomb Survey

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