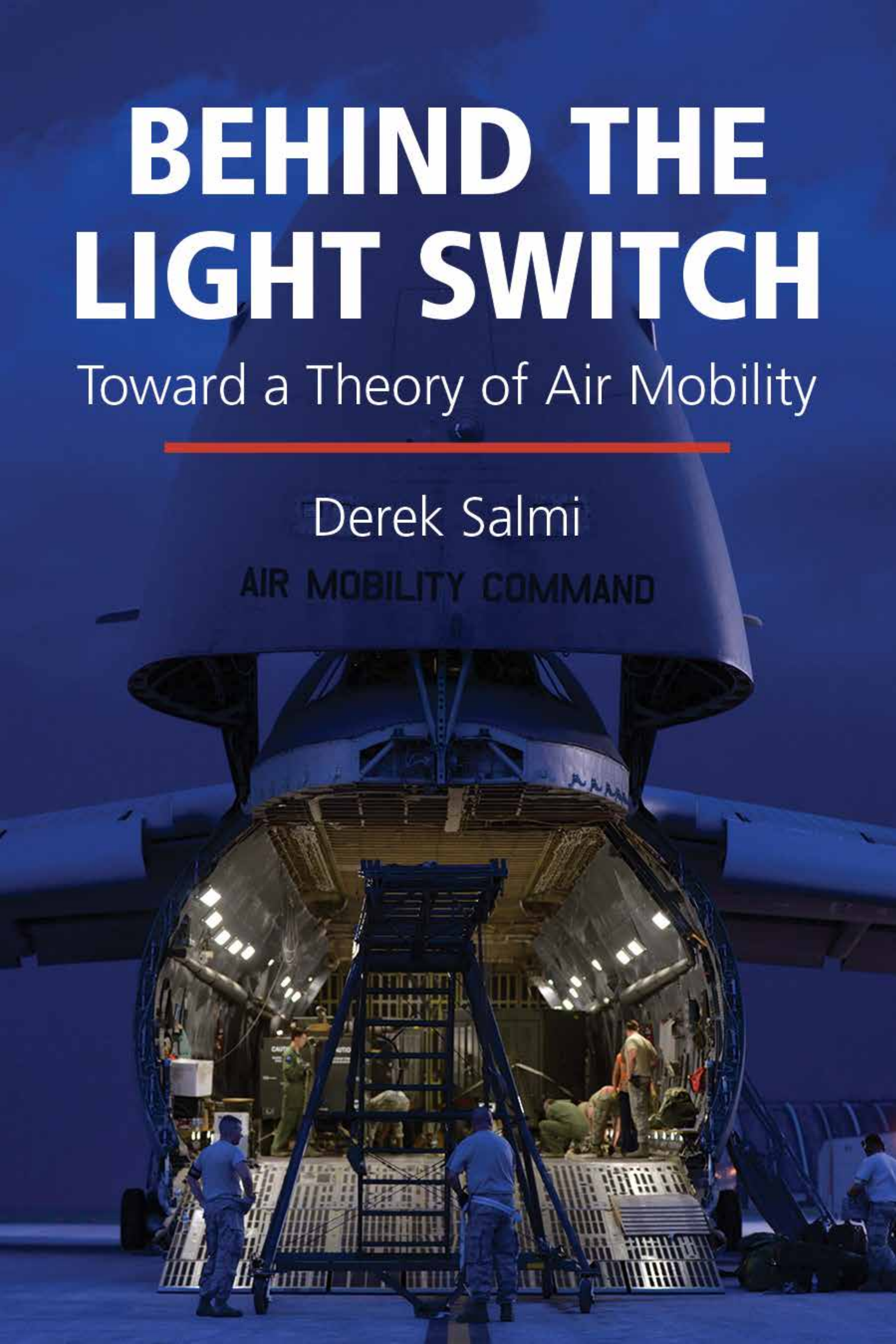
BEHIND THE LIGHT SWITCH

Toward a Theory of Air Mobility

Derek Salmi



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About the Author

Col Derek Salmi was commissioned through the United States Air Force Academy, graduating in 1998 with a degree in political science and a minor in military doctrine, operations, and strategy. He later earned a master's degree in organizational management from The George Washington University in 2005 as well as a master of philosophy in military strategy from the School of Advanced Air and Space Studies at Maxwell AFB, Alabama, in 2011. Colonel Salmi is a command pilot with more than 3,000 hours in the KC-135 Stratotanker and C-5 Galaxy aircraft. His staff tours include chief of strategy and plans at the 609th Air and Space Operations Center, US Air Forces Central, and on the Joint Chiefs of Staff and Air Staff at the Pentagon as an Air Force Intern. Prior to his current assignment as commander of the 92nd Air Refueling Wing, Fairchild AFB, Washington, Colonel Salmi commanded the 100th Operations Group, RAF Mildenhall, United Kingdom, and was a National Defense Fellow at the Harvard Kennedy School's Belfer Center for Science and International Affairs.

Preface

This study offers a theory of air mobility intended to assist practitioners and policy makers in analyzing the efficacy of air mobility operations. It begins by presenting a model of air mobility utility that incorporates the key airpower and logistical principles of velocity, capacity, attainability, and sustainability to graphically illustrate air mobility's effects within a campaign. Additionally, the five critical factors of freedom of movement, command and control, integrated logistics, technology, and training emerge as essential elements that must be addressed to determine air mobility success. Next the study applies the theory's model and factors to eight historical case studies, ranging from combat operations of the Second World War to recent humanitarian disaster relief efforts, which typify the broad air mobility mission set. To garner the greatest analytical insights, each case study examines the air mobility operation within the context of the larger military campaign it served as well as through the lens of the five critical mobility factors. The final chapter offers a summation of the theory's key points as well as future applications within the air mobility discipline.

Acknowledgments

I am very appreciative of the many people who gave so generously of their time and talents to help strengthen and improve this book. Specifically, I wish to thank Mr. Rudy Becker of the United States Air Force Expeditionary Center for his tremendous support throughout the entire project. He was always quick to provide valuable feedback, coordinate helpful materials, and facilitate contact with experts in the field, all of which greatly enhanced the research process. I am also indebted to Dr. Robert Owen of Embry-Riddle Aeronautical University and Dr. Richard Muller of the School of Advanced Air and Space Studies at Maxwell AFB, Alabama, both of whom shared their vast expertise in history and airpower theory while reviewing the model development and select case studies. Their invaluable edits came in addition to otherwise demanding schedules, a fact I greatly appreciate. Additionally, I owe a great deal to the outstanding, professional team at Air University Press, in particular Dr. Ernest Rockwell, who helped shepherd this project in its early publishing stages, as well as Mrs. Donna Budjenska, whose talents and efforts helped to see it through to its completion. For this entire team I remain very thankful.

Furthermore, I also wish to thank the scholars of the International Security Program at the Harvard Kennedy School of Government's Belfer Center for Science and International Affairs. Their perceptive questions and insightful comments sharpened my argumentation and, along with their helpful encouragement, resulted in a much better product than when I began. I also want to acknowledge the impact of Adm William McRaven's book *Spec Ops: Case Studies in Special Operations Warfare: Theory and Practice* as the genesis for my work. This book is an attempt to apply Admiral McRaven's theory structure to the discipline of air mobility, and—although a poor comparison to his groundbreaking work—I hope it serves as a useful contribution to the growing body of literature cataloging air mobility's vital contributions to the art of war.

Most importantly, I wish to recognize and say "thank you" for the tremendous support of my family, both immediate and extended, and especially my wife, who is a constant source of love and encouragement. I have been incredibly blessed with a family who provides unconditional support and understanding throughout the demands of both an Air Force career and during projects such as this one—for that I am incredibly grateful. To my wife and children, I dedicate this book.

DEREK SALMI
Colonel, US Air Force

Introduction

In April 2014, US Air Force Chief of Staff Gen Mark A. Welsh addressed the crowd of journalists and policy pundits assembled at the prestigious National Press Club in Washington, DC. His goal, as with many of the hundreds of speeches he had previously delivered as the Air Force's chief ambassador, was to further educate the audience on the contributions of the nation's Air Force to its national security.

To best accomplish this, Welsh began by relating the "light switch analogy" credited to then–Lt Gen David Goldfein, another key airpower advocate and future Air Force chief of staff. "When you walk into a room and look at a light switch on the wall," Welsh noted, "unless you are an electrician, you really don't have any idea what's behind the wall. But every time you flip the switch the light comes on. *Every single time.* That's the way our Air Force is."[1]

Welsh continued by directly linking this analogy to the air mobility enterprise, where its 130,000 members work to execute more than 600 strategic airlift missions a day, a rate equaling a takeoff or landing every two-and-a-half minutes. "I have never heard the question asked in Washington, DC: can we get it there?" said Welsh, while citing a range of ongoing and potential operations. "No—I've never even heard it *whispered*, which is an incredible compliment to the people who do this business."[2]

Indeed, it is a testament to the very concept of air mobility that, in a little more than a century since transport aircraft were first used during the 1911 Italo-Turkish War, airlift has "to an unprecedented degree . . . become a central element of the American way of war, not just a logistical adjunct to trucks, trains, and ships."[3] This maturation of the air mobility mission served to underpin the United States's similarly evolving strategic outlook, from one initially inward-focused and reflective of early isolationist tendencies to its current widespread, globally engaged posture. From the first airdrop of supplies to the 1918 Argonne Forest offensive's "Lost Battalion" to the massive logistical efforts of Afghanistan and Iraq and over countless operations in-between, air mobility has proven itself as much an instrument of national power as a compelling military force. The widely shared belief that the American flag stenciled on the tail of an air mobility aircraft sends a strong message to both friend and foe alike only further reinforces its critical role in deterrence, force projection, diplomacy, and humanitarian assistance.[4]

But despite this sustained and nearly unequaled record of success in support of national interests, there remains a shortage of scholarship on how air mobility forces may best accomplish these strategic ends. During airpower's formative years, when theorists at the Air Corps Tactical School and other advocates first sought to frame the role of the airplane in national defense, the emphasis was, naturally, on its offensive potential, in particular that of the bomber. As noted air mobility historian Dr. Robert Owen writes, "No official army or air corps publication discussed air transport in any level of detail beyond, perhaps, mentioning its importance. . . . For airmen, it seems, transport aviation was too simple a concept to merit much intellectual energy."[5] Subsequent air mobility studies in turn focused on a myriad of relatively benign subjects ranging from the best strategic-tactical airlift organizational models to detailed technical aircraft requirements to first-hand operational accounts, among other niche topics.

Absent from, but certainly informed by, these various analyses was a comprehensive theory of air mobility—a succinct compilation, apart from basic doctrine, of those key elements that when properly considered would likely lead to success in executing air mobility operations. To put it another way, what was missing were those critical ideas behind General Welsh's light switch analogy that few formally consider but ultimately prove vital to ensuring the necessary airpower capability is available when called upon.

This book seeks to add to the current body of work by first presenting a basic model of air mobility utility, then examining in detail the five key factors of freedom of movement, command and control, integrated logistics, technology, and training that prove vital to air mobility operations. After establishing the model and factors in the opening chapter, the remaining chapters are dedicated to case studies that further illustrate the factors' criticality to mission success. Importantly the cases examined are not all-encompassing of the diverse air mobility mission set but instead mirror broader mission areas with general applicability. Dien Bien Phu, for example, represents air mobility in a counterinsurgency environment. Stalingrad and Burma, in turn, reflect traditional air operations within larger theater campaigns while the Berlin airlift and Operation Nickel Grass were strategic campaigns in their own right. Haiti, then, reveals air mobility lessons within a humanitarian crisis context while the Young Tigers and Operation Inherent Resolve chapters explore air refueling operations.

Equally important, this work naturally builds upon principles already identified and well defined in approved doctrine such as Joint Publication 3-17, *Air Mobility Operations*—indeed the overlap is unavoidable. The primary goal of this study, however, is to provide a "one-stop shop" of key air mobility factors and examples for military practitioners and civilian policy makers alike to utilize in framing current possibilities while simultaneously spurring imaginative possibilities for the future. Like any useful theory, it hopes to provide a measure of "synthetic genius" borne out and distilled through the study of past experiences. It also seeks to promote not only the general canons of "air mindedness" but specifically those of the more distinct tenet of "air mobility mindedness."[6]

The need for the continued study of air mobility in theory and practice remains especially relevant. While the air service is more than 75 years removed from the attitudes represented by former Secretary of War Harry Woodring, who in 1937 saw no justification for investing in transport aircraft, the premature dismissal of the 2010 Haiti air relief efforts as ineffective by key US national security officials illustrates the educational task is far from complete.[7] That large-scale US operations against the Islamic State (ISIS) began with air mobility, specifically the August 2014 resupply of Yazidi refugees stranded in the Sinjar Mountains, only further highlights its continuing relevance and importance.[8]

As the famed Prussian military theorist Carl von Clausewitz noted, "Nothing is more common than to find considerations of supply affecting the strategic lines of a campaign and a war."[9] This maxim has held fast from the time of Alexander the Great, who notably made logistics the foundation of his strategy, to those 600 daily mobility sorties supporting today's global operations. In concert with this axiom, then, this work seeks to advance the discussion on those key supply considerations in order to best prepare air mobility practitioners and national security policy makers for the dynamic challenges of the future.[10]

Notes

(All notes appear in shortened form. For full details, see the appropriate entry in the bibliography.)

1. Welsh, "Speech."
2. Welsh.
3. Meilinger, *10 Propositions Regarding Airpower*, 70; and Owen, *Air Mobility*, 96.
4. Hutcheson, *Air Mobility*, 87.
5. Owen, *Air Mobility*, 23.
6. Winton, "Purpose of Theory."
7. Woodward, *Obama's Wars*, 342.
8. Ackerman et al., "US Carries Out Air Drops."
9. Clausewitz, *On War*, 131.
10. Engels, *Alexander the Great*, 119.

Chapter 1

A Theory of Air Mobility

The line between disorder and order lies in logistics.

—Sun Tzu

In his seminal work *Spec Ops,* retired Adm William H. McRaven chronicles a number of theories military strategists developed to explain differing facets of armed conflict. To general theories of air- and sea power, insurgency and revolution, war escalation and termination, McRaven then added one of special operations, noting the critical importance of the craft—this nearly two decades before serving as the principal architect on Operation Neptune Spear, the daring raid against Osama bin Laden's Pakistan hideout.[1] Absent from this list, however, is a definitive theory on air mobility operations, a deficit this chapter seeks to redress.

The Importance of Air Mobility

The significance of developing such a theory springs from the critical interplay between air mobility and national military strategy. Air Force doctrine recognizes that "airpower can be used to rapidly express the national will wherever and whenever necessary" while further noting it is more than "dropping bombs, strafing targets, [or] firing missiles. . . . It is also a way of influencing world situations in ways which support national objectives."[2] It is precisely this—air mobility's ability to influence across all levels of war and apart from purely kinetic effects—that demands greater examination of its operational potential. In a corollary point, following each air mobility campaign practitioners must assess whether they achieved their desired objectives and conducted operations as effectively as possible or if they might have attained additional logistical capability—and with it potentially greater strategic effects. A sound theory serves as a useful measuring tool in this assessment.

Furthermore, air mobility operations embody many key principles of both war and airpower. An inherently flexible force, air mobility is able "to exploit mass and maneuver simultaneously" while utilizing exceptional speed and range to shift, then concentrate, between objectives as necessary.[3] Along with providing persistent effects, air mobility forces also may increase the available offensive options while simultaneously preserving economy of force. Simply put, air mobility transforms the modern battlefield, and a comprehensive theory of its use helps further leverage these inherent strengths.

The Definition of Air Mobility

Developing a theory of air mobility begins by first defining its scope. In its purest sense air mobility "refers to the movement and delivery of personnel, cargo, or fuel by air transport and air-refueling aircraft."[4] Within this broad classification are the sub-functions of airlift, aerial refueling, aeromedical evacuation, and more recently air mobility support. Further delineations within these sub-elements include such specific mission sets as airborne troop operations, special operations support, and partner-nation air mobility training. In this study's proposed theory and case studies, however, the focus centers on the primary functions of airlift and air refueling while simultaneously capturing the critical elements of air mobility support within each instance. While opportunity certainly remains for additional study within the other, more specialized mission areas, the broader theory and factors presented here provide an important foundation for executing *any* air mobility operation in support of a larger campaign's desired objectives.

Basis for the Air Mobility Utility Model

The foundation of any logistical enterprise is to expertly achieve the customer's supply requirements—referred to, in military parlance, as the supported force. This is accomplished by meeting two key, sequential logistical principles: attainability and sustainability. Attainability is "the assurance that the essential supplies and services available to execute operations will achieve mission success," while sustainability is "the ability to maintain the necessary level and duration of logistics support to achieve military objectives."[5] These two principles exhibit complementary aspects, with attainability serving as the short, initial supply goal while sustainability addresses longer-term resource requirements.[6] Both principles are imperative in influencing military strategy—as author Julian Thompson notes, "Battles may be lost by one side or the other, but the war will end only when one side perceives the impossibility of sustaining its war-fighting capability in terms either of material, or the will of its soldiers and population—in some cases, both."[7]

Air mobility operations achieve these governing logistics principles of attainability and sustainability through one key element that differentiates them from other logistical forces: velocity, a factor military philosopher Sun Tzu professed was "the essence of war."[8] On one level, by exploiting basic aerial lines of communication, air mobility assets introduce a velocity dynamic that maritime and ground transport vehicles simply cannot match. Aircraft, free of many physical land and sea constraints, may range the globe in speeds measured in hours, not days or weeks. On a separate level, the collective output of the personnel, processes, and support assets comprising the mobility system—and apart from pure physical aircraft speed—adds additional velocity elements that distinctively speed the logistical chain execution.

Retired Gen Duane H. Cassidy, the former commander-in-chief of United States Transportation Command and Military Airlift Command, simplified this concept of velocity when he offered that, while "not a very sexy thing to talk about, *throughput* is the key to running an airlift operation"[9] (emphasis added). The concept of throughput emphasizes the maximum sustainable amount of aircraft and cargo through a port or logistics-handling area in a specific period of time. The same principle applies to aerial refueling as well, albeit measured in aircraft refueled in a set period. Supply chain management literature further frames this concept by introducing time utility or the "economic value added to a good or service by having it at a demand point [known as place utility] at a specific time."[10]

General Cassidy's emphasis on throughput highlights the critical role of velocity while also implicitly identifying another key factor: capacity. Modern mechanized armies face challenging resource "umbilical cord" constraints that mandate greater logistical capacity in concert with velocity.[11] In essence, the success of these maneuver forces is tied to the rapid access to and size of their supply base. Supply chain analysts further describe delivering the proper amount of resources to its demand point as "quantity utility" and consider this concept of capacity, along with time and place, as the triad for success within logistical processes.[12]

The Model of Air Mobility Utility

These elements—velocity, capacity, attainability, sustainability—form the basis for the model of air mobility utility. In essence the model asserts that, to provide the greatest possible logistical gains, air mobility operations must balance the competing facets of velocity and capacity to achieve first the attainability requirement, then sustainability, of the supported force. See figure 1.1 below for a graphical depiction of the air mobility utility model.

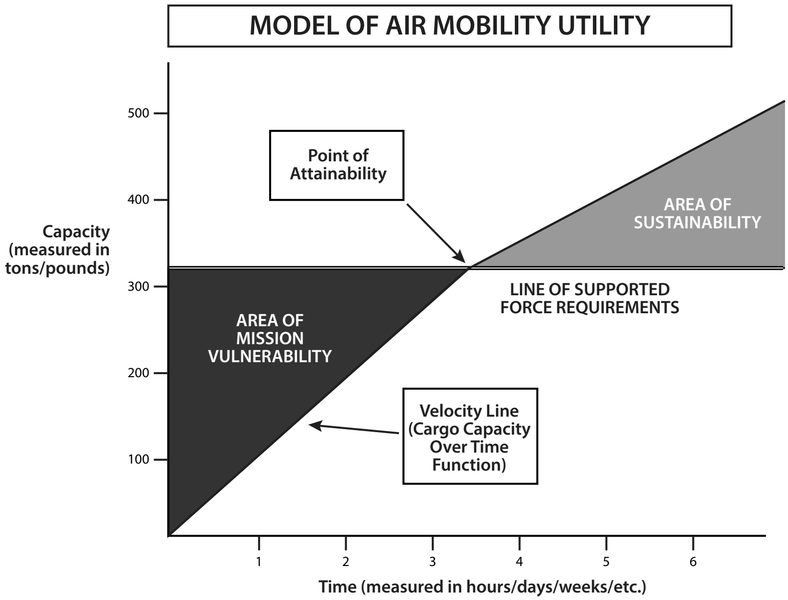

Figure 1.1. Air Mobility Utility Model

The x-axis denotes the time factor whether measured in days, weeks, months, or even years. The y-axis marks the capacity metric, in essence, the amount of supply resources either required or delivered. The horizontal line intersecting the y-axis identifies the supported force's requirements for the campaign or specific phase of operations, while the line projecting from the x- and y-axes point of origin illustrates materials delivered by air mobility forces as a function of time. This projection line ultimately represents the operation's velocity, and the point of attainability occurs where this line bisects the supported force requirements line. This intersection also differentiates the area of mission vulnerability (denoted in black as a threat to mission since logistics are under-resourced at this point) from the area of sustainability (commencing after the intersection point and conveyed in light gray because the supported force requirements are satisfied at this juncture).

Lt Gen William Tunner, considered by many as "Mr. Airlift" given his impressive World War II, Korean War, and Cold War credentials, clearly understood the conceptual importance of balancing velocity and capacity with operational success. He offered the pragmatic perspective of a practitioner by noting: "The actual operation of a successful airlift is about as glamorous as drops of water on stone. There's no frenzy, no flap, just the inexorable process of getting the job done. . . . The real excitement from running a successful airlift comes from seeing a dozen lines climbing steadily on a dozen charts—tonnage delivered, utilization of aircraft, and so on. . . . That's where the glamour lies in air transport."[13] Along with glamour, it is where mission success, or its increasing probability, also lies.

The Value of the Air Mobility Model

Ultimately the model in figure 1.1 provides a framework for conceptualizing an air mobility operation's efficacy. As such, it may be applied across entire campaigns or, conversely, to assess more specific phases and transition points within campaigns. Most importantly the model helps illustrate where practitioners should focus their efforts. Driving the point of attainability as far to the graph's left as possible, for example, reduces the area of mission vulnerability (see arrow 1 in fig. 1.2), while efforts to increase capacity also expand the area of sustainability, enabling greater flexibility in follow-on operations and subsequently enhancing the probability of mission success through a secure logistics base (see arrow 2 in fig. 1.2).

To borrow medical terminology, the proposed model depicted in figure 1.2 diagnoses what a successful mobility operation looks like. Sound prescriptions then follow sound diagnoses. This theory of air mobility proposes five factors that must be addressed to maximize the model's utility and best achieve air mobility's simple yet overarching goal: maximizing the correct amount and type of cargo, fuel, or people delivered to the proper place within a given time.[14]

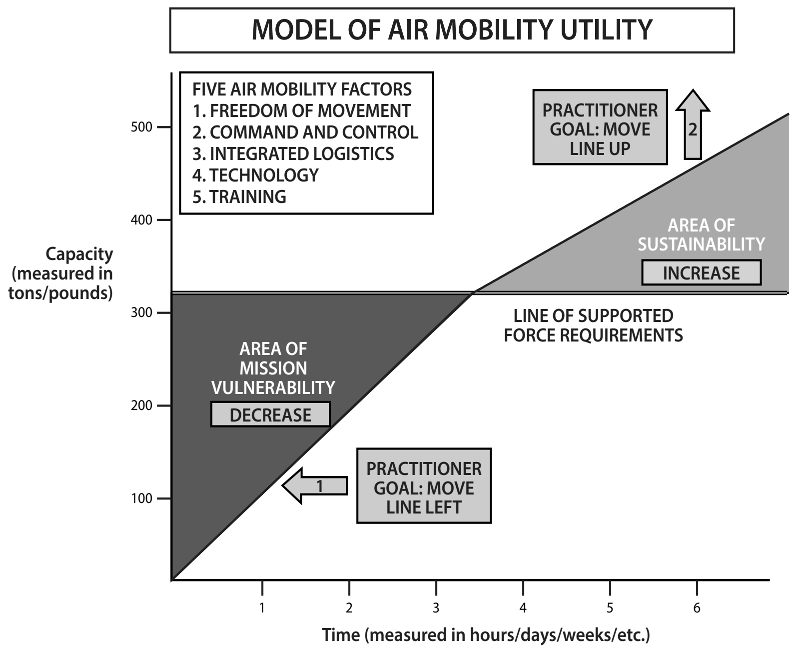

Figure 1.2. Air Mobility Utility Model, with five air mobility factors noted

The Five Principles of Air Mobility Operations

The following five principles presented in this chapter—freedom of movement, command and control, integrated logistics, technology, and training—were derived from a careful survey of historical air mobility operations where each factor figured largely in either the success or failure of the case examples. Additionally, doctrinal principles from commercial as well as joint and coalition logistics literature proved insightful; there are distinct corollaries between foundational NATO logistics principles and the British Army Pamphlet tenets of generative logistics and foresight, for example, and those of integrated logistics and command and control examined below.[15] Importantly, these factors form the key levers policy makers and practitioners should employ when seeking to favorably adjust the lines on the model of air mobility utility.

1. Freedom of Movement

At first glance, the freedom of movement tenet may seem so basic an ingredient to air mobility operations as to not warrant special consideration. This umbrella concept, however, encompasses several aspects requiring careful attention on the part of air mobility practitioners. The Military Airlift Transport Service (MATS), the United States's earliest postwar strategic transport force, first coined the term in early unpublished doctrine that stated "an effective air transport system had speed, range, *freedom of movement*, flexibility, and mobility. By freedom of movement, the only unusual term, it meant the ability to use routes unhindered by geographic or other obstacles, to execute evasive maneuvers, and to select alternate landing sites based on the tactical situation"[16] (emphasis added). In further dissecting MATS's doctrinal definition, this study focuses specifically on two critical elements: air superiority and access.

Air superiority. From airpower's earliest days, establishing air superiority has remained a foundational principle in support of full-spectrum operations. Air Force doctrine expounds on this notion: "With those characteristics considered, one should remember that air, space, and cyberspace superiority are the essential first ingredients in any successful modern military operation. . . . Control of the air, space, and cyberspace domains is not a goal for its own sake, but rather a prerequisite for all other military operations. Air mastery has allowed American land, naval, and air forces to operate where they want, at their own tempo, while creating the environment for success."[17]

Air mobility forces share this same basic requirement for operating in time and space free from the prohibitive interference of opposing forces. World War II Burma (examined further in chap. 3) illustrates a classic air superiority counterfactual. If Japanese attack aircraft had aggressively targeted the Allied transport aircraft supplying long-range penetrations deep into the Burmese jungles—instead of focusing on Allied combat aircraft—the overarching campaign results may have been dramatically altered.[18] The 1950 large-scale exercise Operation Swarmer offers additional evidence. Intended to apply the recent Berlin Airlift lessons to battlefield logistics, air mobility assets badly underperformed in the opening days as "Red Air" threats consistently hampered delivery schedules while claiming more than 70 cargo-aircraft kills. Transport operations achieved a measure of logistical success only following the increase of friendly fighter assets supporting the airlift.[19]

Successful air mobility operations, however, also benefit from an expanded definition of air superiority that accounts for ground-based antiaircraft weapons. These weapons, both in targeting vulnerable aircraft maneuvering in close proximity to the surface as well as parked aircraft engaged in extended loading or unloading operations, possess the powerful ability to impede if not outright halt airlift operations. Contemporary US government assessments peg the proliferation of man-portable air defense systems (MANPADS) that proved so effective during the Soviet-Afghanistan War at 500,000–750,000 missiles globally.[20] Militant groups have further demonstrated both the potential lethality and ease of employment of MANPADS technology by successfully targeting more than 50 aircraft in recent years, to include multiple US mobility air forces aircraft.[21] Unless properly mitigated, both air and ground threats to transport aircraft will impact the air mobility forces' ability to achieve the required delivery rates.

Access. Another critical component to freedom of movement is access. Air mobility assets require access to bases, infrastructure, and air routes to provide continuing operational support. In his landmark study *Supplying War,* author Martin van Creveld coined the term "critical distance" as "the maximum one at which armies can, with the aid of a given type of vehicle, be 'effectively' supported from base."[22] It is an idea that successive commanders have wrestled with in differing forms for centuries. Van Creveld further notes how managing critical distance has, in the mechanized age, only become more difficult as Clausewitzian factors of friction—such as maintenance reliability and fuel consumption rates—have countered some of modern transport's key benefits.[23]

The maxim bears truth for contemporary mobility forces. As US policy shifted toward an expeditionary force in the latter half of the twentieth century, the requisite basing and transit routes essential to power projection garnered increased importance. However, this requirement also proved problematic. As Keith Hutcheson notes,

> the principal problem with planning to use overseas bases for military operations is that those bases may not be available to the United States in times of crisis. There are several reasons this may be true: weather may preclude their use; the host country may not support the US decision to use military force to resolve the issue at hand and deny the United States access; the crisis may occur

in a part of the world in which there are no bases capable of supporting the military forces required; or an enemy may destroy the airfield or infrastructure.[24]

This complex requirement for basing rights, as well as country overflight clearance, places a premium on the necessary diplomatic engagement to secure these rights. This fact cannot be neglected. Air mobility author Maj Richard Hazdra further highlights the limitations imposed by access constraints, noting the lack of en route bases may easily reduce overall airlift capacity by 20 to 25 percent in a given operation.[25] The execution of Operation Nickel Grass in 1973 (further explored in chap. 7) likely would have faltered without the ability to stage aircraft and personnel out of Portuguese bases in the Azores.[26] Similarly, resupply efforts to Berlin in 1948 (chap. 4) would have been nearly impossible had Soviet authorities blockaded the air corridors, along with the ground routes, into the city.[27] In both cases Van Creveld's critical distance would have been too long to effectively attain, then sustain, the necessary logistical supplies.

2. Command and Control (C2)

Centralized command and decentralized execution is another foundational airpower tenet of critical importance to air mobility forces. Due to airpower's ability to direct influence across the tactical, operational, and strategic levels of war, doctrine calls for control "by a single Airman who maintains the broad, strategic perspective necessary to balance and prioritize the use of a powerful, highly desired yet limited force."[28] This Airman's primary task remains to "direct, integrate, prioritize, plan, coordinate, and assess the use of air, space, and cyberspace assets" in contingencies spanning the complete spectrum of operations to maximize airpower's (read, in this instance, air mobility's) flexibility and effectiveness.[29] In an important related point, this centralization enhances the overall planning process to mitigate the potential for sub-optimization (i.e., piecemeal application) among functional units while simultaneously retaining the merits of decentralized execution.[30]

The evolution of organized air mobility forces toward a centralized model, however, has not always been smooth. During the interwar years Maj Gen Oscar Westover, the Air Corps chief, rejected a proposal to centralize the Corps's burgeoning airlift capability in a dedicated transport group and instead allowed individual General Headquarters Air Force units to retain their organic lift assets.[31] Brig

Gen Augustine Robins, an early air mobility proponent, countered that "dispersing limited air transportation resources among many airfields and having several commanders determine when and where these resources would be used would lead to inefficient and ineffective use of aircraft."[32] His arguments were readily dismissed, however, despite similar conclusions reached by other fellow officers. Graduates of the Army War College Class of 1933, for example, recommended that "control of the airplanes in a theater of operations be centralized in the commander of the theater."[33] Meanwhile, senior US leaders marveled at the Luftwaffe's organizational ability to command the transport of 13,000 Nationalist troops and 270,000 kilos of equipment—over a mere 10-day period in 1936—to the Spanish Civil War.[34] Numbers on this scale were unmatched in the infant Allied transport organizations, largely owing to their piecemeal management and employment approach.

The global demands of World War II, however, further advanced the command-and-control debate toward centralization. As operations matured from basic aircraft ferrying operations to a complex, dedicated air supply system servicing multiple combat theaters, the need to maximize air mobility's limited resources proved paramount. In June 1942 the War Department issued an order to theater commanders prohibiting localized control of Ferrying Command aircraft that may be transiting that commander's area of responsibility.[35] This directive, intended to curb interference with the pre-established schedules and routes of higher-priority support requests, continued under the formation of Air Transport Command (ATC) later that same year. As author Charles Miller notes, "The ideal shaping the development of ATC was that of a strategic air transport system. Centralized control in conformity with the highest considerations of national security was the underlying theme. This concept brooked no interference from the theater commanders [except] . . . to protect the ATC operations themselves."[36]

Historian Richard Holmes further argues the principal legacy of World War II logistics was the critical expertise developed from supplying these far-off operations.[37] From postwar analytical studies (as well as the experience of important practitioners such as Tunner and Maj Gen Paul L. Williams in North Africa) emerged clear recognition that such success required the consolidation of as many airlift assets as possible under the control of one command.[38]

As Clausewitz contends, though, in war everything is simple, but the simplest things are difficult—especially for an organizational paradigm challenging the incumbent strategic and theater force-management structures. The contemporary US Air Force model attempts to balance the differing intertheater (strategic) and intratheater (tactical) missions with "separate but integrated command structures" that control assets based upon the assignment of the forces.[39]

These separate inter- and intratheater C2 structures share the connective tissue of basic mobility air force operations, albeit tailored for either global or theater-specific mission sets. The global air operations center, the 618th Air and Space Operations Center (AOC, colloquially known as the Tanker Airlift Control Center), focuses on the key command-and-control priorities for strategic missions while air mobility divisions (AMD) in theater AOCs perform the same function for theater-assigned assets under the Theater Air Control System (TACS). This arrangement, further facilitated by communication and organizational lines linking the two entities, is designed to ensure the smooth interaction of inter- and intratheater forces to achieve the supported forces' requirements in the most efficient and effective manner possible.[40] This is not to suggest, however, that established doctrine and practice have ended this now half-century-old organizational debate. The optimal structural discussion persists in both joint and intra–Air Force planning staffs and is continuously influenced by changes in technology, employment doctrine, and resources.

But within this current structure the key question turns to what, exactly, is command and control responsible for? Two functional elements of air mobility operations help address this question and, for added simplicity, will be identified as (1) operational and (2) support responsibilities.[41]

C2 operational responsibility. Command-and-control responsibility in the operational element focuses primarily on the management of the aircraft and aircrew necessary for executing the designated air mobility operation. This encompasses varying functions including aircrew and aircraft scheduling, proper maintenance for assigned aircraft, and monitoring/directing the actual flight execution. Additional responsibilities include mission flight planning, waiver authorities to operational and maintenance regulatory guidance, and station workload administration to ensure airfield "maximum on ground" limits for ramp space and aerial port support personnel are not exceeded.

C2 support responsibility. Command-and-control responsibility in the support function focuses primarily on administering the critical enabling elements to mission success. These include operational factors such as weather, intelligence, and tactics; diplomatic clearance and landing permissions; airfield suitability/support (including sufficient crash and rescue services and airfield radar and lighting); security; communications; aircraft load planning; and aerial port/logistics readiness capability at the intended stations. Though some of these elements may function outside the direct control of the C2 agency (such as airfield security, for example), they are nonetheless critical aspects to account for as part of the C2's overall mission risk assessment responsibilities.

Importantly, the separation of the operational and support divisions is just one method to conceptualize what successful command-and-control agencies focus on when conducting operations. In practice the two divisions likely blend into one seamless approach as the operational and support aspects work in close tandem to cover all critical air mobility C2 aspects. This idea speaks to a common but central concern across air mobility theory: the role of the system and how the distinct yet interrelated pieces fit together to ensure mission success.

Air mobility management in World War II's Pacific theater, where the tyranny of distance frequently threatened effective operations, yields further insight. Faced with intensive combat logistic demands, Miller details, "the [Pacific] air transports needed a system to properly handle the loading, unloading, manifesting, and dispatching of transport aircraft. It is only through a carefully and tightly managed *system* that the most efficient use of an extremely limited resource is achievable. . . . A proper command and control system for dispatch and scheduling is so vital its need is self-evident"[42] (emphasis in original).

A well-functioning command-and-control entity has the ability to integrate these varying capabilities into a force-multiplying system supporting the critical tenet of centralized control, decentralized execution regardless of the strategic or theater organization. Poorly functioning C2 nodes, on the other hand, risk the hazards described by former Air Force Chief of Staff Gen Ronald Fogleman, who noted "a commander without the proper C2 assets commands nothing except a desk."[43]

3. Integrated Logistics

"History," wrote the French statesman Cardinal Richelieu in the early seventeenth century, "knows many more armies ruined by want and disorder than by the efforts of their enemies."[44] Similarly, despite the rapid growth in the supply chain management discipline during the past two decades, the *perceived* value of integrated logistics has historically lagged its actual importance. Returning to his influential work *Supplying War,* Van Creveld anecdotally relates how Napoleon shared this view of integrated logistics: "While administration and supply at both ends of the [supply] pipeline were thus well regulated, it was typical of contemporary warfare that there existed no permanent machinery to control the zone of communications or exploit its resources. Here the Emperor would make *ad hoc* arrangements, usually by thrusting responsibility upon commanders whose achievements in the field he deemed unsatisfactory and to whom employment on such a task was *therefore something of a reprimand if not an actual punishment*"[45] (emphasis added).

For logisticians in general, and air mobility forces specifically, the concept of integrated logistics remains crucial. Researchers at Pennsylvania State University define military logistics as "the design and *integration* of all aspects of support for the operational capability of the military forces and their equipment to ensure readiness, reliability, and efficiency"[46] (emphasis added). Retired Lt Gen Gus Pagonis, the overall logistics chief during Operation Desert Shield/Desert Storm, calls logistics the "careful *integration* of transportation, supply, warehousing, maintenance, procurement, contracting, and automation into a coherent functional area; in a way that prevents suboptimization in any of these activities; and in a way that permits and enhances the accomplishment of a given goal, objective, or mission"[47] (emphasis added). The fundamental element to both definitions, thus, is the idea of integration.

This successful integration inherently requires a broad, holistic approach with active stakeholder participation across the logistic enterprise. As previously noted, air mobility operations may simply appear as the basic transport of required cargo, fuel, or people from one designated point to another. This simplified narrative, however, diminishes the complex range of activities actually at work—actions that include production planning and scheduling, materials handling, inventory control, facility location, transportation, and procurement, among other key supply chain management factors.[48]

In an air mobility construct, truly integrated logistics involves several important components: the development of effective air-transportable resources (i.e., vehicles, boats, standard shipping containers, etc.); a comprehensive cargo-handling system with properly equipped and trained personnel (usually executed through an aerial port); accurate systems for accounting for cargo and people while staging, in-transit, and at delivery; and robust planning functions to safely and effectively maximize aircraft load capabilities at the marshaling point.

The first point, the development of effective air-transportable assets, illustrates the breadth and depth required to satisfy the complexity of an integrated logistics chain. This element actually begins in earnest during national strategy formulation. As the most recent *National Security Strategy* reaffirmed the United States's commitment to rapidly project power across the globe, careful strategists must ensure the ways and means exist to achieve the desired ends.[49] This may take decades and requires all potential users of the air mobility system—across joint, interagency, and coalition entities—to certify their assets' air transport viability in a process linked to the research and development phase. Author Julian Thompson amplifies this point in noting, "although it may be argued that the air support of, say, the British in Burma was an air force problem, they were in effect acting as airborne truck drivers in response to an army requirement . . . as indeed transports are now."[50] Solutions in this arena, then, will be joint out of necessity to achieve the requisite level of integration required.

The second point, the implementation of a comprehensive cargo-handling system with proper equipment and personnel, remains equally central. As airlift doctrine from the mid-1960s identified, "Adequate aerial support is essential to logistical airlift operations to insure effective utilization of airlift aircraft and to provide timely handling of air shipments to the user. An effective port operation increases airlift capability by reducing aircraft ground/turnaround time, and reduces the in-transit time of critical high-value items. . . . Since the value of logistical support operations is largely measured by savings in in-transit times of user requirements [or velocity], the operation must be supported by an efficient aerial port function."[51] Importantly, these support professionals should be among the first forces introduced into an operation—even at the expense of initial combat power—to lay the foundation for the reception and forward movement of additional resources. The feasibility of host-nation support and local workforce integration as a means to rapidly build the support force at the earliest possible stage remains another critical consideration.

The last two additional elements of an integrated logistics chain—proper accounting for cargo and personnel throughout the logistics system as well as the capability for safe and efficient aircraft load planning—are normally addressed through an aerial port's robust planning functions, but the factors also merit further discussion. As perhaps the largest directed logistical movement in history, Desert Shield/Desert Storm offers many instructive lessons, chief among them the debilitating effects of poor cargo accounting and loading. One logistician noted that "a great deal of time and potential lift went to waste as airplanes showed up on ramps with no one around, loads improperly configured, and incomplete or improper documentation."[52] Lieutenant General Pagonis relates how 28,000 of 41,000 arriving containers had to be opened upon delivery just to ascertain their exact contents.[53] Advanced automation techniques such as in-transit visibility and aircraft planning software should continue to assist future efforts; however, this remains a critical concern for air transport experts, particularly given the logistics system's increasing vulnerability to cyberattack and disruption.

A well-integrated logistics chain promises to couple otherwise disparate elements into a cohesive and effective combat support entity. The resulting operational synergy produced may be decisive in its own respect as well as a marked departure from the status quo view of wartime logistics as "nothing but an endless series of difficulties succeeding each other."[54]

4. Technology

Johannes Steinhoff, one of the top Luftwaffe aces of World War II, reflected in his memoirs that "the war in the air is a technological war which cannot be won by a technologically inferior fighting force, however high its morale or dauntless its resolution."[55] Technological methods, Steinhoff continued, as well as the leaders who control them are the main components from which an air force derives its effectiveness.[56]

That airpower is the result of technology is indeed one of its 10 fundamental propositions.[57] The historical record of air mobility forces, however, reveals a long, slow evolutionary process toward dedicated, technologically advanced mobility aircraft and support equipment. Before coming of age in World War II, when General Eisenhower named the C-47 Dakota one of four essential assets to Allied victory,[58] air transport development suffered under small defense budgets and the Air Corps's overriding focus on offensive combat power. Indeed most transports were converted bombers, as top defense officials saw little utility in expending scarce dollars on support-type aircraft.[59] Of the 12,297 military aircraft in the US inventory at the beginning of 1942, a scant 254 were transports.[60]

Airlift's overwhelming success during World War II firmly secured a postwar role for transport operations while effectively silencing its body of critics. The debate continued, however, as to what exactly the air mobility fleet structure should look like. Dr. Robert Owen captures the essence of postwar congressional hearings on air mobility modernization when he writes, "The logic for such a broad-based modernization was compelling. In the realm of military operations, the United States had become an air mobility nation. . . . Military thinkers in all of the services recognized rapid global and theater mobility as essential to future war-fighting concepts. In the future, then, the modernization of air mobility forces would be a compelling matter for the American defense community. But its costs and importance to so many different potential users also would make it a contentious matter."[61]

This persistent debate, in the name of economy, centered largely on whether aircraft designed purely for civilian use could simultaneously fulfill military supply requirements. In 1934, Maj Gen Benjamin Foulois addressed this tension by stating, "The comparison between the commercial transport and the military cargo airplane is practically identical with that between the passenger automobile and the cargo-carrying truck. While it is true the passenger automobile can carry a certain amount of freight, true economy demands the use of a cargo truck for such purposes."[62]

Once air mobility forces ultimately earned a greater degree of recognition as an Air Force combat arm, serious investments in dedicated military transport technology followed.[63] Key technological advancements focused on aircraft with increased speed, range, and capacity; enhanced austere airfield operating capabilities to include short takeoff and landing and unimproved surface characteristics; easier loading and unloading systems better integrated with ground handling equipment; multiple delivery options to include airdrop; and improved crew operating systems for enhanced margins of safety. These technological advances—each of which remains exceptionally relevant today—were pursued with the vision of increasing the mobility force's overall operational flexibility, a factor that civilian-derived transport aircraft could not adequately address. The debate on the proper balance between purely civilian and military transport technology, however, has not completely ended and remains a persistent one.

Critically, advances in air mobility support elements should mirror aircraft technological advances. In response to shortcomings noted during reviews of the first Gulf War, the US Air Force significantly upgraded its materials-handling equipment fleet, acquiring more than 700 "Tunner" and "Halvorsen" advanced cargo loaders along with forklifts and other key logistics vehicles.[64] These extensive investments, validated during the high operations tempo of the early 2000s, remain critical to the efficient management of aerial port marshaling yards and operations across future years. Such efficiencies may be further boosted by the contemporary technological trends in automated pallet sorting and loading, advanced planning and cargo management software and systems, and advances in handling equipment (such as exoskeleton technology). Mobility forces are equally well served by investments in command-and-control technology as aircraft and en-route stations may be increasingly networked to controlling agencies through data-link and real-time communications infrastructure that in turn enhances mission velocity and agility.

Lieutenant General Tunner best captures the specific, symbiotic relationship between technology and air mobility when he writes, "The greatest asset of this country is our technology . . . but if we are going to make maximum use of our superior technology, we must have mobility and flexibility. . . . Supplies move through this pipeline at a speed determined by the means of transportation used."[65]

5. Training

Dating to ancient times, the value of focused, realistic, and challenging training has been readily recognized. "Excellence is won by training and habituation," wrote Aristotle in the fourth century BC. "We are what we repeatedly do. Excellence, then, is not an act but a habit."[66] "We must remember," added the famed military historian

Thucydides, "that one man is much the same as another, and that he is best who is trained in the severest school."[67] Operations on the complexity scale of the air mobility enterprise naturally benefit from similarly dedicated training regimes. This section focuses on two distinct and equally beneficial elements of training: individual-focused and group-focused training.

Individual-focused training. Individual-focused training ensures that each member has the knowledge, skills, and proficiency to perform assigned tasks. In an air mobility context, this translates to specific positions—ranging from aircrew and maintenance to logistics, intelligence, and airfield operations—possessing the ability to perform their particular assignments when directed. Well-trained pilots can then safely operate their aircraft (well maintained by proficient maintainers) in concert with well-trained aerial porters and cargo handlers who can efficiently load cargo bays, underpinned by well-trained intelligence technicians who can provide key threat analysis affecting missions, and so forth.

Truly effective training programs, however, go beyond basic abilities by recognizing and addressing those skill sets crucial to innovative practices and evolving mission trends. An early Ferrying Command pioneer, for example, reflected, "We learned early that there was a particular and definite expertise required in delivering planes over long distances, an expertise requiring techniques and training over and above those needed for the flying of combat missions."[68] Sustained efforts to resolve this shortfall in distance flying, one that had persisted since the 1920s and was highlighted by the Air Corps's disastrous 1934 airmail episode, paved the way for the successful expansion of rapid worldwide global operations during the Second World War.

Training also became a key factor in the postwar debates on airlift usage. The Hoover Report, a study chartered by Congress in the mid-1950s to investigate potential fiscal savings measures, recommended the Air Force "blueprint its airlift program by assigning as much of its peacetime and wartime traffic to the airlines as possible and then building a small military air transport arm to carry the rest."[69] Such a measure would have dramatically impacted a unique aspect of the air mobility mission: the fact that its peacetime activities largely mirror those of its wartime taskings and the great training transfer value that exists between the two areas. This characteristic holds true not only for aircrew but for the support system as well. For example, the lack of training in complex air cargo handling, such as preparing freight for shipment and aircraft loading, was a causal factor in numerous backlogged World War II supply areas.[70] Later MATS leaders stressed how its personnel must train "constantly in many areas" from maintenance to traffic management to cargo handling to best augment both ongoing and potential future operations.[71] Though an acceptable balance between civil and military mobility operations eventually evolved, this requirement for realistic, mission-focused training persists. Effective training programs thus seek to balance the correct combination of guidance, available resources, and requisite skills to support the desired training end-state for individual success.

Group-focused training. "Training sharpens skills but it also gets all members of the force on the same wavelength," declares Pagonis in *Moving Mountains*, his study of leadership and logistics from the Gulf War. "People have to know their organization's competitive position. I would argue that they want to know this information too."[72] This assertion speaks directly to the requirement for group-focused training. Building upon the individual-focused training level, group training concentrates on the areas where the individually trained components must join together to effect mission accomplishment. *Air Mobility: The Evolution of Global Reach* expertly captures this concept in noting, "Air mobility's responsiveness to future challenges depends on an active partnership with all the users of air mobility. Large numbers of users and applications of air mobility create 'seams' that are inefficient in the overall air mobility process. Therefore, through partnerships and collaboration, the Air Force must develop activities [training events] that minimize these seams."[73]

Air mobility's users, and by extension its training customers, are numerous and varied. Chief among these partners are the joint members of the US military who, as the focal point for the cargo requiring movement, play an integral role throughout the entire transportation process. By ensuring the cargo is properly configured and the associated air transport documentation is correct, joint partners can rapidly and efficiently expedite the shipping process at the point of both embarkation and debarkation. Within specialized mission sets, such as airdrop and air refueling, joint teammates play an even larger role.

The parachute-packing experts of the 2348th Quartermaster Airborne Air Supply and Packaging Company, for example, proved instrumental to the successful support of the Marine division battling southward from Korea's Chosin Reservoir battle.[74] Army parachute-packing teams in Afghanistan—whose service underpinned record-setting airdrop tonnage metrics as part of the wider International Security Assistance Force counterinsurgency campaign—emulated this earlier legacy.[75] US Air Force tankers refueled the carrier-based Navy strike fighters delivering the opening strikes in October 2001's Operation Enduring Freedom in a complex airborne symphony that required close planning and coordination between the two services. These unique but valuable skill sets, such as the airdrop and air refueling logistical chains, are perishable without proper training.

Additional air mobility users include both the US interagency team as well as allied partners who rely heavily on US military assets for rapid transport. Realistic training enhances air mobility capabilities, validates strategic planning assumptions, and augments interoperability among forces. These benefits may be best realized by conducting and hosting large-scale exercises, utilizing additional smaller-scale training activities with individual countries, and participating in educational exchanges, to name a few examples.[76]

A final but critically important partner is the Total Force team that includes joint Reserve and National Guard components. The Total Force Concept was the doctrine created by former Army Chief of Staff Creighton Abrams and Secretary of Defense Melvin Laird following the Vietnam War. In broad terms it sought to ensure public support for large-scale force commitments by placing sizeable numbers of support personnel in the reserve ranks.[77] The logic was simple: future significant force commitments could not be achieved without adequate support personnel whose activation from reserve status would force the necessary political dialogue regarding the utility of the military mission. As a consequence, however, it also levied a larger training bill on the joint reserve support forces to ensure readiness. Given that more than half of all air mobility forces are placed within the Guard and Reserve, including large numbers of vital tanker and intratheater airlift assets, ensuring integrated, realistic, group-focused training remains both a military and national imperative.[78]

Despite the best efforts of strategists and planners to predict and account for future operations and changing global trends, success in this endeavor remains understandably elusive. Adaptable training programs can help mitigate the challenges imposed by an uncertain future. Just-in-time training, conducted in a thoughtful, structured manner, may help address unforeseen circumstances. Additionally, by emphasizing innovative and bold thinking, training programs may also augment game-changing process improvements and technological adaptations that assist in mission accomplishment.

Interrelationships of the Five Factors

Although I examine each of the five factors in detail in the individual sections, it is their actual interaction with one another that provides the greatest efficacy and thus warrants further discussion. This interaction of the five factors may be viewed through two interrelated lenses. The first lens offers a sequential, linear view that may be further divided into two features: preparation and execution. See figure 1.3 below.

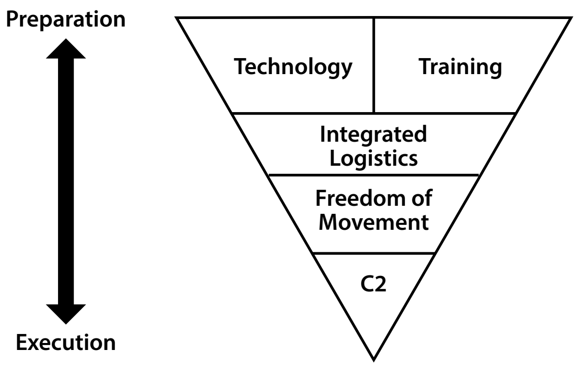

Figure 1.3. Five Factors Interaction Model

The inverted triangle illustrates the five factors as a measure of this preparation-to-execution time continuum and in relation to one another. For example, the factors of technology and training are long-term elements that form the force structure and employment foundation in an air mobility operation and thus the base of the triangle and the beginning point of the continuum. As such, their greatest contributions are during the preparation phase where, consequently, long-range staff planning functions should weigh the respective programmatic merits most closely. Conversely, in the execution phase of operations, the elements of integrated logistics, freedom of movement, and command and control of forces take greater precedent and, as the triangle narrows and the continuum progresses, will warrant increased focus during the actual operation. Importantly, none of the factors fit exclusively into one of the two sections, either preparation or execution—rather, all maintain some elements in both sections. The model, however, seeks to conceptually highlight the corresponding stages and factors where air mobility leaders across different war-fighting roles should invest the maximum effort to achieve the greatest gains.

This point introduces the second way to consider the interaction of the factors—by employing systems thinking. In contrast to reductionism, systems thinking operates from a position that one "cannot understand a *part* of a system without having at least some rudimentary understanding of the whole"[79] (emphasis in original). This may be accomplished by considering and even diagramming the linkages of the separate factors within the inverted triangle. In this manner, we may garner greater synthesis and ultimately synergy by examining how the various elements interact and influence one another and how changes in one factor may ultimately impact the others. For example, a well-trained aerial port may employ sophisticated materials-handling equipment technology to reduce aircraft ground time as part of the integrated logistics process. This reduced time ultimately lowers the aircraft's exposure to potential threats, ensuring freedom of movement and further allowing for dynamic retasking by flexible command-and-control assets.

This example is only one of many possible explorations of how the factors interrelate. It further testifies to the potential impact of airpower, which, as doctrine explains, "results from the effective integration of capabilities, people, weapons, bases, logistics, and all supporting infrastructure."[80] In the air mobility world this principal idea of integration is even more important because the air mobility mission thrives on the effective management of the system to such a degree that it has entered its basic operating vernacular as the "en route system." This idea of the system goes beyond its mere geographic points to the people, equipment, and processes that ultimately form its key mission-enabling structure. Author Keith Hutcheson expertly explains this concept when he writes:

> To accomplish their objective of supporting U.S. national strategy, air mobility aircraft must be able to operate anywhere in the world. This requires much more than just aircraft and crews; it also requires a robust, integrated air mobility system that gives air mobility forces the agility to operate effectively anywhere, anytime. This system must provide highly trained and skilled people; worldwide command and control capability; and equipment to onload and

off-load the aircraft. The system used by Air Mobility Command is called the "en route system"—the foundation of air mobility.[81]

This careful integration of the system—with its many varying yet complementary elements and simple yet complex parts—presents a key challenge to planners, practitioners, and policy makers. But, as trite as it may sound, with every challenge comes opportunity, and this study, through the application of the model and the five factors, will now delve deeper into eight cases to demonstrate the utility of the air mobility theory in explaining the success and failure of the air mobility system.

The case study chapters each follow a specific format. To best illustrate the important connection between strategy and military operations, the chapter opens with a brief introduction followed by a succinct description of the broader geopolitical environment and campaign leading up to the air mobility operation. A detailed narrative of the air mobility–specific operation follows this scene-setting synopsis. The chapter then concludes with the analysis of the air mobility campaign through the model and five factors. In this manner air mobility's critical role in implementing national security policy, as well as the intricate aspects of its execution that exist behind General Welsh's light switch analogy, should emerge more clearly.

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Chapter 2

Stalingrad

Where the German soldier once stands there he remains and no power on earth will drive him back.

—Adolf Hitler

The decisive Battle of Stalingrad, noted one World War II historian, "entered the realm of legend almost as soon as the guns fell silent in the vast industrial city on the river Volga."[1] Apart from its mythical qualities, however, this celebrated engagement resonates precisely for its enduring strategic lessons. And as one of history's first large-scale combat airlifts, these lessons necessarily include the central role of air mobility. In the spirit of examination that believes defeat may prove more instructive than victory, the Stalingrad case study illuminates those key air mobility factors that, in Peter Paret's words, "deprived the Luftwaffe of any real chance of success" and instead contributed to an unmitigated German military disaster.[2]

Campaign Background

"The Russian is finished," proclaimed German Chancellor Adolf Hitler as the Wehrmacht launched a fresh and far-reaching summer offensive against the Soviet Union in 1942.[3] In an abrupt departure from the previous year's Operation Barbarossa, which targeted Moscow and the Baltic region, German forces marched instead toward the steppes of southern Russia.[4] The operation, codenamed *Fall Blau* or Case Blue, called for a two-pronged attack to first destroy Soviet forces west of the river Don then continued maneuvers to secure the rich Caucasus oil fields while threatening Allied interests in the Middle East.[5]

Under ideal tank conditions, the German army rapidly advanced throughout much of July and August. Case Blue, however, suffered from three major conceptual flaws: insufficient logistical preparations, an underestimation of Soviet strength, and the offering of a massive northern flank to Red Army forces.[6] These critical faults each manifested themselves as operations progressed. Although the Wehrmacht achieved a key crossing of the Don River and reached the westerly Caucasus oil fields in early August, lengthening supply lines and a strong showing by Soviet forces denied the decisive encirclement battle that German forces had mastered.[7]

At nearly the same time Hitler's focus turned increasingly to Stalingrad for its tremendous industrial and symbolic value. In deviating from Case Blue's original objectives, he demanded the city's capture in an order that largely substituted "a political goal for operational flexibility."[8] German forces reached Stalingrad's northern outskirts on 17 August and commenced heavy fighting that soon devolved into block-by-block clearing operations within the city.[9] On 14 October, Hitler ordered all German forces within Russia and the Caucasus to assume a defensive posture in support of the continued assaults around Stalingrad.[10]

One month later, on 19 November 1942, Soviet leaders who had carefully marshaled reserve forces behind the Volga River near Stalingrad unleashed Operation Uranus, a devastating counterattack against German Army Group B.[11] The Soviet forces quickly pierced the Romanian Third Army holding the northern flank and followed the next day with successful attacks against the Romanian Fourth Army and German Fourth Panzer Army guarding the southern flanks.[12] In four short days, Field Marshal Friedrich Paulus's German Sixth Army was cut off and isolated near Stalingrad. A total of 250,000 Axis troops, across 26 divisions and associated support units, lay trapped in a Soviet pincer movement that extended almost 75 miles westward to the Chir River.[13]

The German High Command now faced a critical decision: allow Paulus's forces to break out and retreat while resources and manpower permitted, or order the surrounded army to "stand fast" until reinforcements arrived.[14] The dilemma was, in fact, a false one as Hitler never entertained thoughts of retreat, either then or over the battle's 72-day duration—the loss of prestige was simply too great and he had made too many public promises to keep the city.[15]

A 23 November telephone conversation with *Reichsmarschall* Hermann Göring, the Luftwaffe commander-in-chief, allegedly reinforced his decision. When asked directly whether the aerial supply of Stalingrad was possible, Göring, who had not conducted any serious analysis with his staff, reportedly answered, "The thing appears feasible."[16] Armed with this response, Hitler subsequently dismissed the fervent appeals of his other air and ground commanders for alternate courses of action and immediately commenced planning for the Stalingrad airlift.

The Air Mobility Campaign

The Luftwaffe's first task was to determine the Sixth Army's exact supply needs within the Stalingrad pocket. It set initial requirements at 750 tons per day, a number extrapolated from successful airlifts to similarly encircled but smaller troop formations at Demyansk and Kholm earlier in the campaign.[17] While likely the most accurate estimate given the quarter-million-strong force, pessimistic German planners matching ends, ways, and means were forced, however, to refine this figure downward. Chief of the Army General Staff Kurt Zeitzler, who openly refuted Göring's casual assurances regarding the airlift's potential, summarized his staff's detailed calculations:

> Allowing for the stocks at present with Sixth Army, allowing for absolute minimum needs and the taking of all possible emergency measures [which included the consumption of thousands of horses no longer needed for transportation], the Sixth Army will require delivery of three hundred tons per day. But since not every day is suitable for flying, as I myself learned at the front last winter, this means that about five hundred tons will have to be carried to Sixth Army on each and every flying day if the irreducible minimum average is to be maintained.[18]

Zeitzler, in unanimity with other German commanders, considered even these reduced figures as impossible targets—yet Hitler was not budged from Göring's assurance and the 300-ton metric quickly became the Luftwaffe's daily supply benchmark.

In the ensuing days air force planners scoured the fleet for all available aircraft. Hundreds of Junkers Ju 52s, the ubiquitous German transport, arrived from North Africa as well as bases within training command. The Luftwaffe diverted Heinkel He-111 long-range bombers, initially conceived as an airlift platform, from action in Western Europe and repurposed Focke-Wulf FW-200s and Junkers Ju 90s to perform the cargo mission rather than long-range reconnaissance.[19] By early December Wolfram von Richthofen's *Luftflotte IV* (Air Fleet Four) now charged with executing the operation, had more than 500 aircraft available.[20]

The depth of the initial Soviet counterpunch meant Luftwaffe flight operations could only originate from the main bases at Tatsinskaya and

Morozovskaya, both in excess of 130 miles and 45 minutes' flying time from the Stalingrad pocket.[21] These distances translated into higher fuel requirements at the expense of cargo capacity, which was set at 2-1/2 tons for the Ju 52s and 2 tons for the He-111s. On the receiving end the pocket initially offered six airfields, although only two—Pitomnik and Basargino—were suitable for large-scale operations.[22] Additionally, only Pitomnik's radio navigation and lighting systems could sustain night operations.[23]

The twenty-fifth of November marked the airlift's first missions to Paulus's stranded forces. As the requested airlift assets continued to assemble from other theaters, German transports managed a paltry 75 tons each of the first two days before blizzard conditions halted further flights.[24] Far from an aberration, the harsh, unforgiving weather conditions proved a crucial element throughout the operation. Author Christopher Shepherd explained how warm air from Iceland combined with the bitterly cold air over Stalingrad to produce devastating mixtures of "fog, zero temperatures, snow storms, and sleet. Rubber tires froze and then cracked, fuel and oil froze, and mechanics forced to work in the open and frequently under blizzard conditions suffered in large numbers from frostbite on their hands and faces. Replacing any ordinary engine component," Shepherd continued, "became a major operation."[25]

From 19 to 21 December, herculean Luftwaffe efforts coupled with a break in the weather permitted the delivery of 700 tons of cargo.[26] This success, however, was fleeting. The return of blizzard conditions in the following days and weeks resulted in both severely limiting flight conditions and dramatic maintenance impacts. At any given time only 100 of the 320 Ju 52s—or less than one-third—were considered serviceable, while the heavy fog and whiteout phenomena meant only the most experienced crews could regularly operate into the austere airfields.[27]

Along with the debilitating weather conditions, a resurgent Soviet Air Force posed a far greater threat than previously encountered. A year removed from their smashing defeat at the hands of the Luftwaffe, the Red Air Force (*Voyenno-vozdushnyye sily* or VVS) now bested their German adversaries both numerically and qualitatively, with their most modern aircraft models comprising 97 percent of all fighters in the Stalingrad sector.[28] As the airlift progressed, VVS fighters increasingly focused their attacks on the lightly armed transports with devastating results, as fighters, well-positioned flak batteries, and weather claimed 490 aircraft.[29] These losses equaled five flying wings or an entire air corps whose capability would not be replaced during the remaining course of the war.[30]

As the situation grew more desperate Berlin dispatched Field Marshal Erhard Milch, armed with special powers and authority from the Führer, to command the Fourth Air Fleet in mid-January 1943. But with aircraft mission-capable rates hovering near 20 percent and the loss of key operating bases at Tatsinskaya and Morozovskaya to Soviet ground forces, there was very little even Milch's expanded powers could do to stem the impending defeat.[31] By this point Operation Winter Storm, a final German ground relief effort led by Field Marshal Erich von Mannstein, had also ended in failure.[32]

On 16 January, Soviet tank formations dealt a stunning blow with the capture of the Sixth Army's key airfield at Pitomnik. Five days later Gumrak, the last operable airstrip near Stalingrad, also fell to the Red Army.[33] The Luftwaffe persisted with a few insignificant airdrops over the following days until 2 February, when observers reported the headlights of Soviet mechanized columns advancing through the now unrecognizable German defensive positions.[34] The reports corroborated radio traffic that, two days earlier, recently promoted Field Marshal Paulus had surrendered the approximately 90,000 remaining soldiers under his command to the Soviet armies of the Stalingrad Front.[35] The Battle for Stalingrad—and a pivotal turning point in the course of the Second World War—was finally over.

In the final tally the Luftwaffe successfully delivered 8,350 tons to the trapped Sixth Army during the 72-day siege—an average of slightly more than 115 tons a day.[36] Additionally, the Luftwaffe achieved its 300-ton-per-day metric only three times during the course of the battle and never in successive days.[37] Along with the Sixth Army's destruction, the Luftwaffe was never be the same either after Stalingrad. To his postwar interrogators Göring lamented, "I always believed in the strategic use of air power . . . . [M]y beautiful bomber fleet was exhausted in transporting munitions and supplies to the army at Stalingrad."[38]

Analysis of Key Air Mobility Principles: Freedom of Movement

Air Superiority

The Luftwaffe's inability to establish air superiority during the Battle of Stalingrad turned an incredibly challenging mission from the outset into, quite simply, an impossible task. The lack of air superiority forced key tactical adjustments that produced rippling effects throughout the German air mobility enterprise supplying the Sixth Army.

By the end of December, for example, the Luftwaffe could muster only 375 single-engine fighters across the entire Eastern Front.[39] This fighter shortage translated into limited escort capability for German transports, particularly as Soviet advances forced the cargo aircraft to operate from increasingly distant bases. To compensate, transports that once operated in flights of three to five planes now flew in "packs" of 40 or 50, analogous to the mutually protective box formations employed by American Eighth Air Force bombers.[40] The collective defensive firepower was necessary given the Soviet threat; however, the large number of transports arriving simultaneously at the airfields repeatedly overwhelmed the poorly manned support personnel.[41] Subsequent ground delays also left the cargo aircraft unnecessarily exposed to accurate Soviet ground fire for extended periods of time.

Additionally, the Red Air Force proved adaptive to lessons from the previous campaign engagements at Demyansk and Kholm as well as to the changing environment at Stalingrad. As the German air force's options narrowed with the loss of both airfield and escort capability, the Soviets improved their air barricade capabilities and established continuous lines of flak batteries along critical transit routes to the Sixth Army's pocket.[42] This redressed a key weakness from the earlier battles where Luftwaffe aircraft effectively skirted antiaircraft threats to resupply Wehrmacht troops. At Stalingrad, however, the formidable flak positions forced German aircraft to detour around the increased threats, in turn trading precious cargo capacity for the extra necessary maneuvering fuel.

Access

Throughout the campaign, the loss of bases greatly impacted the Luftwaffe's tenuous operations by first extending, then invalidating, their critical logistical distance—or Van Creveld's idea of the maximum range from which the army may be supported. The loss of Tatsinskaya and Morozovskaya, two bases whose lengthy transit distances hampered the airlift's operational effectiveness from the beginning, underscored this concept. Once the bases fell in late December, the German Ju 52 fleet relocated to Salsk, more than 250 miles from Stalingrad, while the He-111s repositioned to Novocherkassk, 205 miles from the pocket.[43] In sum, these new bases added 140 additional transit miles and effectively reduced the number of possible missions from several to only one per transport per day. Along with the cost to velocity, the new basing constraints introduced corresponding increases in aircraft petroleum and oil consumption as well as aircraft reliability concerns.

With respect to access, the loss of existing airfields was not the singular determining factor to the Stalingrad failure. In his important study "The Ghosts of Stalingrad," Willard Akins asserts the Germans began the operation without enough suitable airfields to achieve success. In citing research by authors David Vaughan and James Donoho, Akins notes that "protracted combat operation demands at least one runway per ten thousand combat personnel" and the "Germans at Stalingrad would have needed 25 airfields to effectively resupply the besieged troops."[44] Instead they had just six within the pocket, and four were rough grass strips largely unusable in the harsh wintry conditions.

Command and Control

For many World War II historians the following maxim bears truth: the German war machine functioned exceptionally well at the operational level but failed equally spectacularly at the strategic level.[45] Stalingrad remains a textbook illustration of this paradox. While German military units honored the principle of command authority, these field commanders were invariably constrained by the strategic dictates of an increasingly disconnected Hitler. During the many acts comprising the Stalingrad drama, Paulus, Zeitzler, Richthofen, and countless other important Wehrmacht and Luftwaffe senior leaders had their military counsel repeatedly dismissed by the Führer. Richthofen perhaps captured the prevailing sentiments best with his diary entry from 25 November, the first day of the airlift: "The Führer heard everything we had to say, but decides against it because he believes the army can hold on and he does not think we could reach Stalingrad again. I stand by my opinion. Still, orders are orders and everything will be done pursuant to the orders received. It is tragic that none of the locally responsible commanders, although purportedly possessing the Führer's confidence, has any influence at all now. . . . As things are at present, operationally speaking we are nothing more than highly paid noncommissioned officers."[46]

Ultimately this crippling paradigm of inhibited command authority destroyed any faint glimmer of hope on the part of the German armies.

C2 Operational Responsibility

Importantly, the Luftwaffe leadership generally exercised solid operational command-and-control principles. This was evident in a number of key moves that included acquiring a satisfactory number of aircraft and aircrew to sustain operations; reorganizing *Luftflotte* 4 for greater command efficiencies as new aircraft and personnel arrived in theater; assigning units to bases according to aircraft type in order to maximize operational and maintenance advantages; and ruthlessly dismissing commanders who could not meet the demands of a heavy airlift operation, most notably General Horst Carganico (the early organizer of the pocket airfields).[47]

Despite these efforts, the leadership was unable to mitigate the combat limitations sufficiently to establish the regular aircraft flow so vital to successful airlift operations. Akins notes that, in order to meet the notional 600–750 tons per day requirement of the Sixth Army, the Luftwaffe required anywhere from 240–300 missions per day—an average of one aircraft transiting the forward bases every four to six minutes for the 24-hour duration![48] In practice, the Luftwaffe's flight operations never achieved any regular semblance of scheduled operations and aircraft turn-around times were measured in hours, not minutes, at both the main and forward operating bases.

Furthermore, Hitler's requirement for strict adherence to his orders inevitably seeped into the operational command levels with nearly disastrous results. In one example, the Stalingrad Air Supply Chief, General Martin Fiebig, hesitated in evacuating his Ju 52 fleet from Tatsinskaya despite the field's imminent capture because of a Göring order (issued from Berlin) forbidding retreat. The following exchange occurred:

> "*Herr General*," Lieutenant Colonel Lothar von Heinemann shouted between artillery bursts landing on the field, "you must take action! You must give permission to take off!"
>
> "For that I need *Luftflotte* authority canceling existing orders," Fiebig countered. "In any case it's impossible to take off in this fog!"
>
> "Either you take that risk or every unit on the airfield will be wiped out. All the transport units for Stalingrad Herr General. The last hope of the surrounded 6th Army!"
>
> "I'm of the same opinion," added Colonel Herhudt von Rohden, the Fourth Air Fleet Chief of Staff.
>
> "Right," Fiebig finally yielded. "Permission to take off. Try to withdraw in the direction on Novocherkassk."[49]

The remaining aircrew departed, in chaos, and survived to continue airlift support in spite of their commander's nearly devastating and blind obedience to injudicious orders.

C2 Support Responsibility

As with the German operational command-and-control element at Stalingrad, the C2 support responsibility function was generally good within very limited means. For example Major General Wolfgang Pickert, the 9th Flak Division commander within the pocket, "worked tirelessly to ensure that his two main airfields functioned as efficiently as possible and that the off-loading and transfer of supplies was always handled smoothly and quickly."[50] Like others in his position Pickert executed his duties with the utmost care, "realizing that the lives of an entire army depended on the Luftwaffe's ability to keep it supplied and fed."[51]

Fiebig and Milch proved equally devoted and focused their energies on important support activities that included maintaining the critical lighting and navigation capability at Pitomnik airfield; preserving motorized snowplows and other purpose-built heating equipment to clear runways and allow for continued ground support operations in the bitter cold; accelerating the production of air supply containers with the Luftwaffe's Technical Office in Berlin; and upgrading weather and communication facilities at the main bases, among other key initiatives.[52]

These efforts each augmented mission execution but none proved decisive, either alone or in sum. Critically, as the pocket collapsed under Soviet pressure, the quality of the remaining airfields rapidly deteriorated and a helpless Luftwaffe leadership could do little to reverse the trend. An earlier decision not to enlarge the runway at Gumrak now proved fateful. The base had previously served as Sixth Army headquarters, and Paulus and his staff refused any new construction that might invite Soviet attacks on their position.[53] In the end, with troops too weak from starvation to pack the runway snow and no radio beacon installed, Gumrak had extremely limited utility at its most critical time.

In the final analysis *Luftflotte* 4 was a combat air force attempting to conduct an air mobility operation outside of its normal skill set. Although it had organized ad hoc air transport commands overseeing both its Ju 52 and He-111 fleets, the end result was similar to the early stages of the Berlin Airlift, where the combat-focused United States Air Forces Europe (USAFE) command failed to maximize the air mobility assets and processes. Ultimately both of these primarily combat-oriented organizations struggled to adapt to the particular requirements demanded by a successful airlift.

Integrated Logistics

The German integrated logistics system simply could not keep pace with the unrelenting demands of the Stalingrad airlift. The numerous failures originated in the planning stage. When considering whether the airlift was even feasible, Luftwaffe supply officers based their estimates off of standard "250-kg" and "1,000-kg" air supply containers, not realizing until later that each module only carried approximately two-thirds of the stated weight.[54] The basic assumptions underlying the airlift's viability proved faulty from the outset.

As the operation progressed, the planning and loading functions devolved from a well-organized and coordinated joint process to one where planners failed to adequately prioritize much-needed supplies.[55] Initially the Sixth Army prized petrol and ammunition above all other resources. These priorities later shifted to an equal or greater emphasis on food and medical supplies. In a much-publicized anecdote, General Milch responded to rampant claims that useless supplies were entering the pocket by pointedly opening a shipment of airlift containers in front of an audience of soldiers. To his dismay many contained only fishmeal, which he promptly returned to the logistics unit while ordering the victualing officer hanged.[56] Other reports detailed tons of mosquito netting manifested with thousands of condoms, although analysts have been equally careful to note that, while undisputed, such impractical supply examples were the exception rather than the norm.[57] But many critical war-fighting supplies did not reach the front-line forces in a timely fashion.

As previously discussed, the Luftwaffe transports adopted tactical changes that quickly overwhelmed the ground support personnel through the sheer volume of aircraft requiring service within a given time. This problem only compounded as the airlift continued. Author Joel Hayward noted that in the airlift's beginning stages the "courage and skill of the aircrew were matched by the energy and growing efficiency of Pickert's ground personnel. . . . . They processed incoming planes quickly, unloading their cargo and dispatching them again, full of wounded soldiers, usually within two hours. They even drained from the planes all fuel not needed for the return flights, adding it to Sixth Army's meager and constantly shrinking reserves."[58] As operations progressed, however, Hayward notes "these teams were not able to sustain this high performance for long. The extreme cold and constant enemy harassment gradually destroyed their strength and morale. By late January, the aircraft turnaround time had risen to over four hours."[59] Eventually the ground support function stopped almost completely, forcing aircrew to unload their own planes. Delays and lost operational velocity increased exponentially.

Technology

The Luftwaffe's ability to press so many varying aircraft types into airlift service in the unforgiving conditions of the Russian winter testifies to the service's technological prowess and flexibility during the Second World War. The fact also speaks to the Luftwaffe's woeful neglect of air transport development and production, a critical and somewhat puzzling oversight given the pivotal role airlifters played during the 1936 Spanish Civil War. Hitler went so far as to boast that Spanish dictator Francisco Franco should erect a monument to the Ju 52 given its central role in his ultimate victory.[60] In spite of these and similar remarks on air transport's utility, as well as an interwar doctrine focused on air support to ground forces, the Luftwaffe and German leadership failed to allocate satisfactory resources to ensure a viable force to meet their operational and strategic goals.

The iconic symbol of the Stalingrad airlift, the Junkers Ju 52, underpinned the air force's limited achievements in the operation. Nicknamed the "Iron Annie," the Ju 52's ruggedness proved vital time and again in the wintry conditions that witnessed other German aircraft falter. The Ju 52's ability to operate out of austere fields also earned widespread acclaim throughout the war, especially at Stalingrad as the landing areas steadily decreased in both quality and size.[61] Equipped with ramps and side-loading doors, as well as dual bomb bays for air dropping supplies, the Ju 52 could readily execute either airland or airdrop missions as the dynamic combat situation dictated.[62] Furthermore, in an interesting departure from other nations' cargo aircraft, German transports were equipped with light armaments (usually a machine gun) to augment their defensive capabilities.[63] Despite its great capability, however, the relatively meager number of Ju 52s employed simply were not enough to mitigate Stalingrad's other operational challenges.

A final yet critical technological element concerns the lack of adequate cold weather preparation, particularly for the aircraft. Willard Akins notes how, in the frenetic push to receive additional aircraft from the North African theater, Luftwaffe ground elements at Kirovograd and Zaporozhe failed to properly winterize the aircraft for the severe environment they encountered.[64] This resulted in markedly lower aircraft utilization rates throughout the campaign and maintenance areas choked with non-mission-capable transports. Of the 29 fragile FW 200 Condors, for example, only one remained operational.[65] Across the remaining fleet almost 50 percent of the aircraft required 14 days or longer for repairs, many of which had to be completed in the Reich.[66]

Training

At Stalingrad the Luftwaffe found itself in a vicious, destructive training cycle with both immediate and lasting negative effects. In an interesting organizational paradigm, the Luftwaffe's highest-ranking air transport officer was also the commanding officer of the instrument flight school. Under this construct he served two masters, the quartermaster general and the chief of training. As Brigadier General Fritz Morzik explained, "Inevitably a certain amount of friction resulted . . . and a tug-of-war within the command headquarters ensued. The functions of the air transport officer and those of the commanding officer of the flight schools were united in one man who had two operational staffs under him, one for each of his functions. This unfortunate solution to the problem of the command of two important activities was bound to result in the unintentional neglect of one of them."[67]

The Ju 52's critical importance to both operations and training further complicated this dilemma. The air force's pilot training program relied heavily on the Junkers aircraft and the Luftwaffe never developed a replacement dedicated completely to this role. Subsequently all operational requests for Ju 52s came directly at the expense of training needs.[68] At Stalingrad, in order to attain the necessary aircraft for the campaign, Luftwaffe leadership stripped the training command of nearly all of its Ju 52s along with additional Ju 86 trainers. This move subsequently created an irreplaceable hole in the training pipeline as fewer assets translated into fewer students receiving training. Furthermore, the training they did do either was delayed or resulted in a lesser quality product.

At the same time, combat operations across multiple theaters did not diminish the insatiable need for additional aviators, including Stalingrad where the Luftwaffe lost more than 1,000 airmen.[69] Fresh pilots operating into the poorly marked fields of the pocket simply did not possess the aviation skills or experience to complete the demanding approaches either under fire, in poor visibility, or both. The exigencies of combat precluded any robust theater certification program, local area familiarizations, or additional confidence-building measures.[70] As such, these new pilots also experienced higher-than-average loss rates in a trend that perpetuated the cruel training deficit and imposed lasting operational and strategic liabilities upon the Luftwaffe.

For ground personnel, one significant training shortfall manifested itself with cold weather starting procedures. As aircraft mission-capable rates remained painfully low, Field Marshal Milch discovered most ground crews were unfamiliar with the engine cold-start techniques outlined in aircraft technical orders. To address this, he brought in 50 Ju 52 maintenance experts from the Luftwaffe's testing and development branch to instruct and supervise the correct starting procedures.[71] Milch added additional incentive by threatening court-martial procedures to any member found not utilizing the procedures.[72] By the time he addressed this training issue in late January it offered little hope as a panacea for significant productivity decreases.

In a final point the Stalingrad case study underscores the potential mission-enhancing effects of a well-trained, adaptable ground force. The combat demands of the collapsing pocket thrust many army and air force members into unfamiliar roles. Front-line infantry troops along with highly skilled antiaircraft gunners, for example, found their primary duties limited while materials handling, aircraft loading, and airfield preparation skills remained in high demand. It was within these new and unfamiliar roles that many members found themselves unprepared to execute the required tasks.[73] While this fact was not decisive to the final outcome, it may have played an important role in preserving options for the Sixth Army.

Final Analysis

At Stalingrad, the Luftwaffe conclusively failed to achieve either the tenet of attainability or sustainability except in a few isolated and ultimately insignificant instances. The Stalingrad model of air mobility utility (fig. 2.1) captures this assertion.

The true value of the Stalingrad case study does not rest with the analysis of the failures within the five individual mobility factors but rather in how systemically each factor interacted with and subsequently impacted the others.

The lack of air superiority, for example, required the Luftwaffe to group large flights of aircraft together to achieve some measure of defensive power against the VVS threat. This decision was also undoubtedly influenced by the longer flight times induced by increasingly limited base access and growing threats along the transit routes. But leaders failed to adequately manage or coordinate the larger formations without an effective command-and-control entity to minimize the impact to finite ground support capabilities. Consequently, overwhelmed support units—lacking sufficient equipment and training (since few were dedicated air support personnel)—could not turn the aircraft around fast enough, which in turn increased the aircraft's threat exposure and impacted its ability to conduct multiple cargo

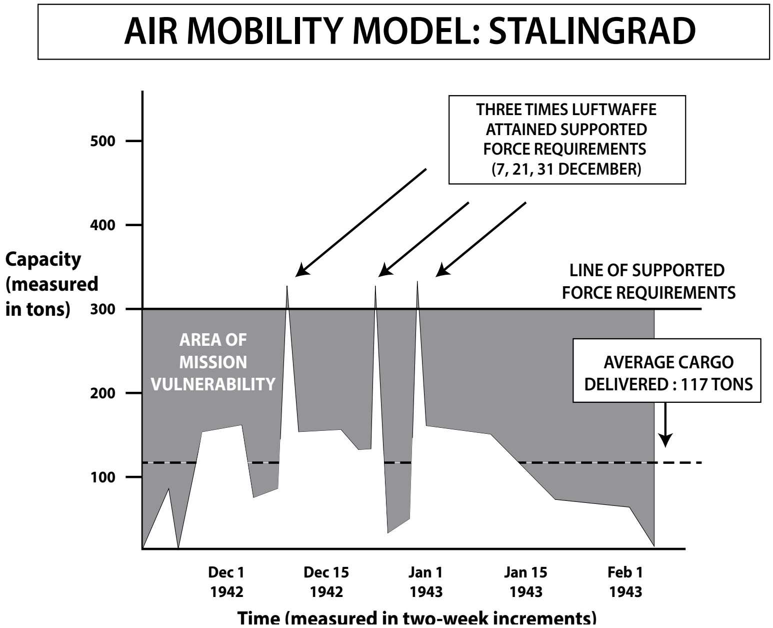

Figure 2.1. The Air Mobility Utility Model: Battle of Stalingrad

runs each day. This dramatically altered the amount of tonnage deliverable each day and sealed the fate for the trapped army. Prior investments in larger or more technologically advanced transports, in turn, may have been able to offset some of these cargo and fuel disadvantages.

Ultimately the Battle of Stalingrad underscores how extremely difficult combat airlifts are to conduct and what the ultimate consequences may be when they fail. At its best, Stalingrad remains a cautionary tale illustrating what factors planners must consider and address before committing to an air mobility–centric course of action. Most analysts concur that the Stalingrad airlift should have never happened. That it did, and that modern day practitioners may continue to learn from its precepts, continues to give Stalingrad a lasting place in the pantheon of military—and air mobility—history.

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Chapter 3

Burma

Supply and transport stand or fall together; history depends on both.

—Prime Minister Winston Churchill

After more than 70 years, Field Marshal Viscount Sir William Slim's Burma campaign remains an often-overlooked chapter of World War II, especially for American audiences. Dubbed by some the "Forgotten Theater," Burma stands out instead for the many warfighting innovations it inspired, particularly regarding airpower. Slim's campaign was arguably the single World War II operation that *required*—not just benefited from—air mobility for its success.[1]

Campaign Background

In early 1942, following their stunning victory at Pearl Harbor, the first elements of an eventual 330,000-strong Japanese force invaded Burma.[2] Their primary goal was to sever the famed Burma Road, the last remaining lifeline for American Lend-Lease supplies destined for Chinese Nationalist forces battling Japanese occupation troops in China.[3] Their secondary objective was to protect gains already made in South Asia while further preparing invasion plans for India, a move whose successful conclusion would likely knock the British out of the war altogether.

After first establishing air and sea superiority, the Japanese captured the capital and port of Rangoon before pressing the advantage north against retreating British forces who, despite instances of determined resistance, were quickly overwhelmed. Some 12,000 withdrawing British soldiers, along with an estimated 400,000 Indian and Burmese refugees, struggled for 900 miles along the poor road system until reaching India's outer defensive networks.[4] Only lengthening supply lines and the arrival of the monsoon rains in the spring of 1942 stopped the Japanese advance. But they had achieved their primary objective of severing the Burma Road—and capturing Burma itself.

The remainder of 1942 witnessed Japan consolidating its gains while British forces focused on improved jungle warfare training and developing the strategy for offensive operations within Burma. Despite the lessons observed during the opening retreat, where Allied Air Forces dropped more than 100,000 pounds of supplies and evacuated close to 20,000 casualties, an air mobility–centric campaign plan took time to mature for a number of reasons.[5] Owing to the exceptionally difficult terrain comprising rugged mountains and dense jungle, most military planners on either side did not view an eastward invasion from India as feasible; the British opted to instead explore a seaborne landing at Rangoon or an invasion across the northern Burmese mountains where ground forces would construct the necessary supply roads as part of the advance. In July 1942, however, Air Vice Marshal A. C. Collier commented in an air staff planning paper that “it is surprising to see no mention of transport aircraft for the solution of supply problems during the initial stage of an advance into Burma. In my opinion, the success or failure of operations . . . in this communicationless [*sic*] area would depend very largely on the intelligent use of transport aircraft.”[6]

Most planners, however, had difficulty envisioning such a strategy given that the enormous scale of supply required had never been previously attempted. Two key developments, however, proved instrumental in influencing the strategy moving forward. In December of 1942, British forces launched the first counteroffensive into the Arakan Peninsula in Burma’s southwestern corner, intent on recovering the prized airfield and port at Akyab Island.[7] After achieving some initial success, though, the two Allied divisions (one British, one Indian) stalled in the face of stout Japanese defenses. The Japanese then regained the initiative by employing their highly effective encirclement tactic where mobile Japanese forces maneuvered behind attacking British units to construct roadblocks along key roads of retreat.[8] Denied the wheeled transport so critical for resupply as well as casualty evacuation and fearing the now mythical Japanese ability to move through the jungle, Allied forces quickly retreated to India along the few remaining roads to avoid being cut off. After nearly four months of campaigning and more than 2,500 casualties, the British were back where they had started—although now armed with the knowledge that air supply might be the counter to Japanese battlefield tactics.[9]

At nearly the same time the second development proved a positive counterweight to the distressing news from the Arakan. In February

1943 the charismatic British officer Major General Orde Wingate assembled a force of nearly 3,000 soldiers trained in guerrilla tactics for operations deep behind Japanese lines.[10] Nicknamed the "Chindits" and moving on foot, his brigade-strength unit covered almost 1,000 miles while wreaking havoc on enemy supply and communication lines.[11] While most analysts agree the material effects were actually quite negligible, the boost to Allied morale was tremendous.[12] Even more importantly, the Chindits relied almost entirely on air supply, proving it was feasible to maintain a large force in the field by air dropping supplies alone. This set the conditions for an even more ambitious plan—and Slim seized it.

The Air Mobility Campaign

With sea-based invasion plans deemed unfeasible (as Allied planners required all available landing craft for the upcoming D-Day operations), Slim envisioned a campaign advancing across the entire Burma front but primarily anchored on two flanking movements, one from the north down the central plain and the other in the south from the Arakan, with both engagements relying heavily on air supply. To counter these anticipated Allied offensives, the Japanese devised two major operations of their own. In Operation HA-GO, the Japanese 33rd Army would defeat Allied forces in the Arakan while preventing reinforcements for their more ambitious Operation U-GO targeting the British IV Corps near Imphal and Kohima in Northern Burma.[13] If Operation U-GO proved successful, the Japanese would capture key logistical lines as well as the airfields supporting ongoing Hump operations (and the resupply of Chinese Nationalist forces) along with staging areas for the invasion of India itself.

British forces opened the Second Arakan campaign in late November of 1943. The steep hills of the Arakan's Mayu Range dictated an advance on three axes: the 5th Indian Division along the coast toward the key port at Maungdaw, the 7th Indian Division in the Kalapanzin Valley, and the 81st West African Division along the Kaladan River where, owing to the exceptionally difficult terrain of the valley, it became the first large army formation in history to be supplied completely by air.[14]

The Allied advance was slow and focused on linking the two Indian Divisions across the Mayu Range when the Japanese launched

Operation HA-GO in February 1944. Employing their encirclement tactics, the Japanese quickly struck the rear of the 7th Indian Division and threatened to cut off and destroy the large force. Blocking the Japanese advancement, however, was a small maintenance area at Sinzweya that was manned with little more than cooks, medical personnel, and other rear-guard administrative recruits.[15]

Now known as the "Battle of the Admin Box," this mile-by-half-mile jungle clearing proved to be the crucible that validated Slim's strategy for victory. In previous campaigns within Burma, Slim observed how the Japanese operated on tight logistical margins and thus relied on captured materials from fleeing enemy troops to sustain their movements.[16] In response Slim issued orders to all Allied units that, if outflanked, they were not to panic and retreat but rather fortify their positions and prepare to receive resupply from the air.[17] This tactic would correspondingly fix then consequently expose vulnerable Japanese supply lines to further Allied air interdiction.

For two weeks in February, RAF and USAAF transports flew 639 aerial resupply sorties, braving intense antiaircraft fire, enemy aircraft, and mountainous terrain to deliver critical supplies to a drop zone measuring 200 yards by 60 yards within the Admin Box perimeter.[18] While ammunition was in high demand, the transports also delivered newspapers, cigarettes, and mail to help, in the words of historian Michael Pearson, "instill into the men on the ground the idea that their situation was temporary, not hopeless."[19] Admin Box veteran George Hufflett noted, "We only managed . . . because the RAF and the Yanks came with their transport planes and dropped ammo to us on parachutes. Barrels of rum, and grub too—same old bully and beans, but it was more than the Japs had."[20]

Between support to the Admin Box battle, the 81st West African Division, and other Allied forces in the Arakan, RAF and USAAF transports delivered more than 10,000 tons of supplies during 3,000 combat sorties.[21] The demand was so great that Admiral Louis Mountbatten, Supreme Allied Commander of South East Asia Command, petitioned the Combined Chiefs of Staff for the temporary diversion of transports from the ongoing Hump strategic airlift, a practice the Allies repeated later in the campaign. Airmen released 25 C-46 Commandos to ensure that they could satisfy ground requirements, now topping 60 tons a day.[22]

Combined, these elements helped turn defeat into victory in the Arakan. Instead of an Allied loss, the Admin Box helped to trap the

Japanese HA-GO forces against British reinforcements advancing from the north, making 5,000 of the original 8,000 Japanese attackers battlefield casualties.[23] This became a significant boost to otherwise sagging Fourteenth Army morale while, perhaps equally important, battle-testing and verifying a winning formula.

While fighting intensified in the Arakan, another trial waited in the hills surrounding Imphal and Kohima. On 10 March 1944, Lieutenant General Renya Mutaguchi, commander of the Fifteenth Army, launched Operation U-GO, the Japanese main effort in Burma.[24] True to Japanese doctrine, Mutaguchi envisioned a swift encircling victory that would capture critical supplies from the key Allied logistic bases in the Indian region of Assam. While generally anticipating this move, Slim was surprised at the speed with which his 150,000-strong IV Corps was surrounded and subsequently moved to quickly secure key areas, particularly the six airstrips around Imphal that proved vital during the course of the battle.[25]

When the Japanese completed the encirclement on 29 March 1944, Allied ground forces dug in and awaited aerial resupply—and the transports responded. During the nearly three-month-long battle, air mobility assets airlifted 14 million pounds of rations, nearly one million pounds of gasoline, more than 1,000 pounds of mail, and 40,000 cigarettes.[26] The IV Corps ultimately required 540 tons of supplies a day, much of which was also airdropped to the similarly besieged fortifications at Kohima where the governor's tennis courts served as one convenient drop zone.[27]

Along with delivering critical supplies, the flexibility of air mobility assets allowed Troop Carrier Command (TCC) to airlift vital troop reinforcements—the 5th and 7th Indian Divisions from the Arakan—to first hold, then defeat, the overextended and exhausted Japanese forces. But this capability was not without cost. Between the Second Chindit expedition, protracted operations in the Arakan, and the large Imphal/Kohima requirements, scarce airlift assets remained in high demand. Admiral Mountbatten again acted quickly in requesting the diversion of Hump aircraft to help sustain operations. Fearing another delay in the approval process, however, the Southeast Asia Command (SEAC) commander wired British leadership his intention to divert 30 C-47s in three days unless he heard otherwise.[28] While ultimately approving the diversion of 20 C-46s, the JCS also chided Mountbatten for exceeding his authority.[29] They denied a subsequent supplementary diversion request in March but did redirect five additional squadrons originally bound for Europe to cover Burma's transportation shortfall.[30]

In the end, Imphal constituted the critical turning point in the Burma campaign as Slim executed his strategy to overextend then defeat the Japanese forces on a strategic scale. This, the largest land defeat the Imperial Japanese Army ever suffered, was underwritten by air mobility's capacity to rapidly resupply both material and personnel under dynamic combat conditions.[31] Dr. Joe Taylor, the foremost expert on Burma air supply operations, assesses that "Imphal was the final testing ground for air supply. The experience gained . . . in the Arakan, in 3 Indian Division operations, and at Imphal convinced air and ground commanders that air supply could sustain an offensive of great enough magnitude to drive the Japanese from Burma. The pursuit of the remnants of the Japanese Fifteenth Army began immediately, and with the end of the rains Fourteenth Army lunged forward to finish the war in Burma."[32]

Before the final offensive began in October 1944, General Slim reiterated to Fourteenth Army that "the whole plan of battle" was based on Allied air support as it swept southward toward Rangoon—a remarkable endorsement of air supply with respect to a large field army on campaign.[33] While the retreating Japanese army entrenched at Mandalay, the Allied armies attacked instead through a bold right hook aimed at Meiktila, 100 miles to the south. Initially Slim considered an airborne operation to seize the Meiktila airfield, but the unreliability of dedicated air mobility assets—chiefly US—warned against this. Events soon proved the wisdom of his caution as three C-47 squadrons, totaling 75 aircraft, departed without forewarning to assist the deteriorating combat situation in China.[34] Even with the combined efforts of the Combat Cargo Task Force, the 74,000-ton-per-month ground requirement meant that any loss of airlift capability had a tremendous planning impact that was mitigated only through careful coordination at the headquarters staff.[35]

Fierce fighting continued throughout the month of March 1945 with the Meiktila airfield changing hands numerous times before the Allies secured it. With the central Burmese plains now secure, Japanese resistance slowly melted away and the Allies raced to secure the Burmese capital and ports before the onset of the heavy monsoon rains in May. Rangoon ultimately fell after an 800-member airborne operation on 1 May 1945, effectively ending the battle for Burma.[36] In the final push American, British, and Commonwealth transports airlifted more than 330,000 tons in support of Allied forces.[37]

As the campaign drew to a close, General Slim wrote in one of his Orders of the Day: "Every corps, division and brigade has played its part in this Fourteenth Army victory. None could have done it what it did without the help of the others. There could not have been any victory without the constant ungrudging support of the Allied Air Forces. The skill, endurance and gallantry of our comrades in the air, on which we have learnt so confidently to rely, have never failed us. It is their victory as much as ours."[38]

Analysis of Key Air Mobility Principles: Freedom of Movement

Air Superiority

During the initial invasion in 1942, aircraft of the Japanese Army Air Force's 5th *Hikoshidan* effectively overwhelmed the small and poorly resourced Allied defensive air elements and subsequently established air superiority over most of lower and central Burma.[39] This greatly hampered any Allied strategy relying on air transport as these slow and difficult-to-maneuver aircraft—mostly C-47s—proved highly susceptible to enemy aircraft action.

By mid-1943, however, Allied forces had made significant progress in re-establishing air superiority and had generally achieved its goal by early 1944 when air mobility played its most critical campaign role. Importantly, Taylor notes, "Even after Allied superiority was established, the few Japanese Air Force planes in Burma were a serious threat to air supply operations. Had they been employed effectively, large-scale air supply might have been impossible. . . . For fighters to attack front-line targets when the air a few miles away was full of helpless transports was as uneconomical as for a submarine to devote its efforts to shore bombardment while full-laden merchantmen passed over the horizon."[40] Additionally, while US and British transports still faced significant ground-based threats, such as accurate and high-volume small arms fire around drop zones, these hazards were unable to substantially alter supply operations.

Access

General of the Air Force Henry “Hap” Arnold noted, “Modern war is a war for airbases; the bulldozer must accompany the plane,”[41] and indeed, within Burma, the criticality of airfields greatly influenced overall campaign design. The Allies launched the first and second Arakan operations with the intent to capture a key airfield near the port city of Akyab while strengthening defenses in the Imphal and Kohima zones to protect the six essential airfields nearby as well as the nearly 150 newly constructed all-weather fields supporting both Hump sorties and in-country action.[42] During the campaign’s critical final push toward Rangoon, where air mobility proved so vital, Slim demanded airfields separated by no more than 50 miles to best manage the critical supply distance and maximize the limited air resources in concert with ground maneuvers.[43] In an important corollary point, these close airfields proved essential since airland operations—or supplies flown directly from airfield to airfield as opposed to those air-dropped directly to ground forces—stands as a vastly more efficient and economical means of transport in terms of total tonnage delivered.

Command and Control

Another distinctive aspect of the WWII Burma Theater was its byzantine command structures, a natural by-product of complicated coalition operations but one also exacerbated by the divergent strategic interests of Great Britain and the United States.[44] The United States, while controlling the majority of air mobility assets in theater, largely viewed Burma as a means to an end in its support of China’s ongoing fight against Japanese occupation forces. Great Britain’s main weight of effort, however, was decidedly within Burma as the British sought to reclaim the country as part of its colonial empire. These conflicting strategic aims imbued friction within the highest policy circles that also filtered down to the operational level. While the theater still used an integrated air headquarters in the form of Eastern Air Command (EAC) and employed its tenets in other subordinate organizations such as the Combat Cargo Task Force, certain distinct national force requirements ensured a persistent degree of divided command with resultant, significant impact.[45]

C2 Operational Responsibility

Within the operational command-and-control element, the management of scarce aircraft and aircrew was both the primary consideration and the overwhelming point of conflict. The differing end states Britain and the United States pursued, as well as strong personalities such as American general Joseph Stilwell, ultimately precluded a unified ground command in Burma to synchronize operations with the Eastern Air Command. This subsequently required the division of air supply resources between the American Northern Combat Area Command and Slim's Fourteenth Army area of operations.[46] Although possible to shuttle aircraft and personnel between the two commands, such moves often disrupted well-developed plans and proved less effective than envisioned despite Eastern Air Command's efforts.[47] Taylor concludes, "Probably the separation of theater air transport resources into two parts was the best solution to the problem that existed in India-Burma, but there can be little doubt that a single transport headquarters coordinated with a single ground force headquarters would have permitted more flexible and more efficient air supply."[48]

The unified air-ground headquarters construct would have served an even greater role in coordinating allied operations across the entire theater of Burma, India, and China. Mountbatten acted expeditiously to secure additional air resources when needed by borrowing from the American strategic airlift force piloting the Hump route. Despite his timely efforts this contest for limited resources inevitably affected operations within Burma. As Slim's army began its final, successful push across the central Burmese plains in 1945, for example, his ground force commander circulated a memorandum stating that "without extra resources of transport aircraft [from the Hump operations] not only would the advance to Mandalay and beyond be arrested but that he might be forced to withdraw beyond the Chindwin for the 1945 season."[49] Such a retreat would have naturally prolonged hostilities in Burma with equally damaging strategic consequences to British and American objectives across the theater. A single, seamless air headquarters empowered to coordinate plans with a single ground headquarters would have likely secured the unity of effort so critical to an efficient and effective campaign execution.

C2 Support Responsibility

The command-and-control support responsibilities proved a mission-enhancing success within Burma. Residing within the air headquarters staff, a sampling of these functions included a robust radio communication system for aircraft and outlying control stations that increased force flexibility, comprehensive airfield suitability surveys under rapidly expanding combat conditions, extensive weather forecasting services that allowed continued operations despite the debilitating monsoon rains, and a cargo priority system to allocate limited aircraft capacity followed with load planning and execution oversight.[50]

Importantly, Taylor further notes that effective command in Burma was "never achieved in any manner that could be clearly demonstrated on a command chart."[51] It was realized, rather, through the close liaison on the part of thousands of individual soldiers and airmen from commanders through packing crews that ultimately fostered "efficient and effective air supply operations [as] the rule rather than the exception."[52] In other words mission success ultimately occurred almost, but not quite, in spite of the tangled command relationships in World War II Burma.

Integrated Logistics

As the "Forgotten Theater" Burma often competed with, and lost to, the other combat theaters regarding resource support. This levied a requirement for even greater efficiency and innovation throughout the command's integrated logistics chain. In turn the Fourteenth Army and its supporting air forces largely responded.

Benefiting from relatively secure supply areas in India's Assam region, the primary logistics challenges centered on ensuring uninterrupted support to the advancing field armies under dynamic and unforgiving jungle conditions. To address this problem set, ground forces established organizations at both the departing and arriving logistics terminals to assist with supply management. The rear airfield maintenance organizations (RAMO) oversaw the packing and loading of supplies (for both airdrop and airland missions) while unloading and disbursement duties fell to the forward airfield maintenance organizations.[53] These units expertly enlisted the help of the abundant host nation support to augment their stretched forces, most notably the indigenous elephant population for loading heavy cargo supplies.[54]

While fundamentally effective, postwar analysis revealed several areas for improvement. Army administrators at certain RAMOs, for example, preferred to stock a single item per air base for both economy and ease of supply accounting purposes.[55] In practical terms, however, this often required aircraft to transit multiple airfields to prepare an effective, varied combat load for field soldiers. This also resulted, predictably, in a corresponding loss of velocity and the expenditure of valuable flying hours. Additional, albeit relatively minor, problems included lack of adequate storage and disbursing facilities, the unnecessary airlift of foodstuffs readily available through local procurement, shortfalls in aircraft unloading and servicing capacity, and damage to goods through poor packing procedures.[56]

With regard to packaging effectiveness, theater logisticians largely preferred the direct airland delivery of supplies (more than airdrop methods) in part due to the nearly 25 percent reduction in damaged goods that airland provided.[57] When operational necessity required airdrop, however, creative parachute management ensured the uninterrupted flow of supplies. At one point almost 5 percent of the cloth in India had been requisitioned, along with 400 high-powered English sewing machines, to manufacture airdrop-capable parachutes.[58] Slim, however, believed that a cheaper and more readily available chute could be fashioned from jute, a long, shiny vegetable fiber plentiful in the region. At 1/20 the cost of the silken version, and 85 percent as efficient, the "parajute" was born to sustain critical Allied air resupply operations.[59]

In the book *Drop Zone Burma*, Squadron Leader Peter Bray, of the RAF's 31 Squadron, described the last phase in the integrated logistics process—a typical supply drop in Burma.

> The Dak[ota] flew straight and level over the DZ at around 300 feet. . . . Some runs from a much lower level, 50 feet or so. . . . The dispatchers would manhandle the first of the packs, chute on top, and weighing in at well over 100 pounds, to the sill of the door—always open, ready to go. The static line would be hitched to a roof cable, and a dispatcher would stand on each side of the pack, while another sat behind, feet up against it and back against the fuselage wall. There they would wait—eyes on the two lights on the door.
>
> The Dakota would be brought onto the approach into wind, and about 100 yards from the dropping point, it was "red light on," and the dispatchers would brace themselves ready. At the green light it was time to heave, the man at the

> back shoving with every ounce of strength his legs could muster, and out the pack would shoot into the slipstream. The static line yanked the chute open, and down the pack floated.
>
> The lead dispatcher would lean out the door and check on the drop's progress. If it was in the middle he'd give a thumbs up to the pilot and round they'd go again—and again and again, for up to two dozen passes, and for anything up to an hour or more. Then it was back to base—through the water and the Japanese fighters.[60]

The successful accomplishment of these airdrop missions required the synthesis of many separate actions spanning from the original supply procurement to the packaging and loading processes to the final delivery method of the "kickers," so named because they literally kicked the invaluable supplies out of the aircraft and toward the destination. By utilizing innovation, organization, and communication skills, the Allied planners and practitioners were able to profitably integrate the many logistics processes to meet mission demands.

Technology

At the outset of the campaign, Allied planners assigned an insufficient number of outdated aircraft to Burma. During the long retreat in 1942, ground forces relied completely on a small number of battle-worn DC-2s, one of the earliest civilian airline transport designs.[61] In April of 1942, American businessmen donated three additional DC-3s in what marked the Burma debut of one of the war's greatest and most iconic aircraft, the ubiquitous Douglas C-47 Dakota (or Gooney Bird to her crews).[62] Based on the popular civilian DC-3 model first flown in the mid-1930s, the 10,000-plus military versions benefited from enhanced fuselage strength, reinforced cabin floors for heavier loads, a larger side door for cargo loading and troop drops, and increased engine performance.[63] Additionally its ruggedness, reliability, and adaptability—including a payload of 6,000 pounds ranging from jeeps to combat troops—contributed to its reputation as the finest airborne delivery platform in the war.[64] This ruggedness included a superior ability to absorb battle damage, aided by self-sealing fuel tanks, while its adaptability was evident in the miniscule 1,200-foot airfield operating requirement.[65] Both attributes proved pivotal in the Burma campaign.

Additionally, the C-46 Commando, the other primary airlifter in theater, added valuable contributions within Burma. Although utilized primarily for Hump missions, its twin cargo doors and increased passenger capacity augmented the transport of the 5th and 7th Indian Divisions (both certified as completely air transportable by Slim) between the Arakan and Imphal/Kohima during the critical siege period.[66] Of particular note, C-46s performed well during poor weather conditions (prevalent over the Hump and in Burma) and were able to overcome the pervasive downpours and flooded airfields that defined the monsoon season.[67]

Apart from aircraft, a less recognized but equally important technological element was the theater communication system. With a combination of long-range radio net relays and the critical secure wire teletype, field units could quickly and accurately coordinate specific supply drop actions or relay their priority requests for future planning purposes.[68] This technology underpinned the massive synchronization required to manage the complexity of fast-paced, Allied combat operations.

Training

In the build-up to World War II, the United States faced a dramatic shortage of both aircrew as well as support forces, particularly in the weather and communication specialties.[69] While the rapid expansion of Ferrying Command helped to grow the number of experienced personnel in each career field and later employed this expansion to great effect within Burma, training remained a key (and daunting) focus area until the war's conclusion. In response to increased pilot demand, the Air Corps lowered the cycle of primary, basic, and advanced flight training, first from 12 to nine months before cutting another two months in 1940.[70] The service also turned to established global civilian carriers, namely Pan American Airlines, to supplement key aeronautical skills such as practical aerial navigation.[71] These combined efforts, in concert with similar initiatives followed by the Royal Air Force, paid dividends as aircrew could execute varying missions ranging from Chindits' special operations to the Admin Box combat airdrops to the traditional airlift operations of Imphal and Kohima.

On the support side, experienced logisticians frequently adopted familiar American industrial techniques from their previous civilian employments. These practices, focusing on process improvements in the Frederick Taylor management tradition, passed easily to incoming personnel and included, among others, standardized production-line packing methods and efficient building layout to cut waste and speed processes.[72] This "just-in-time" training permitted both army and air force personnel to rapidly adapt to and exploit synergies in the logistics environment.

Final Analysis

As the model demonstrates, throughout Burma the airlift largely met tenets of attainability as well as sustainability, although there were distinct phases where this achievement remained in considerable doubt. For example, a myriad of reasons delayed the entire offensive campaign until 1944, chief among them the lack of air superiority in Burma. Figure 3.1 below reflects this assertion as an elongated period of mission vulnerability that was only satisfied once transport aircraft could operate freely in support of ground forces.

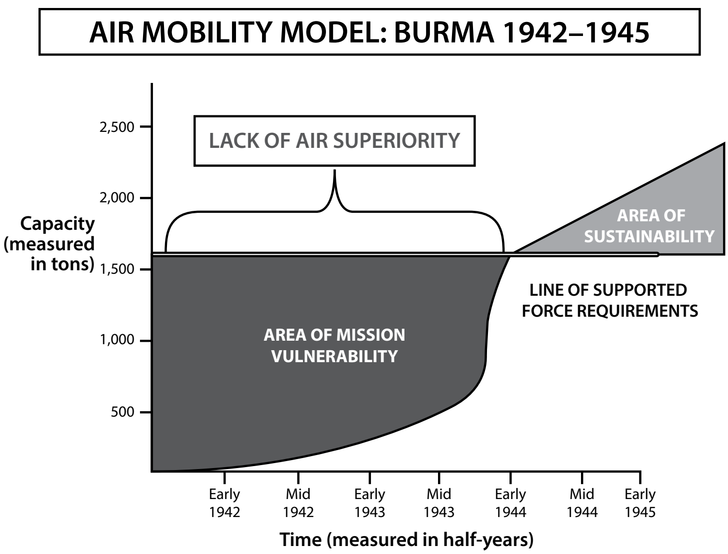

Figure 3.1. The Air Mobility Utility Model: Burma campaign of 1942–45

For planners, then, the goal of establishing air superiority became paramount to address, then minimize, the large window of mission vulnerability. During this same period the Allied forces made rapid gains in technology, training, integrated logistics, and command-and-control organization that ultimately helped accelerate and sustain operations once air superiority had been achieved. The only persistent threat to operations consisted of breakdowns in command and control, which occurred twice—once during the sustained sieges of Imphal and Kohima in the spring of 1944 and again in early 1945 when the Fourteenth Army had to halt its final phase of operations. A lack of available aircraft to conduct the requisite support missions induced both instances. Although Mountbatten's timely and forceful interventions resolved the situations, the impacts (as illustrated in fig. 3.2) remained significant.

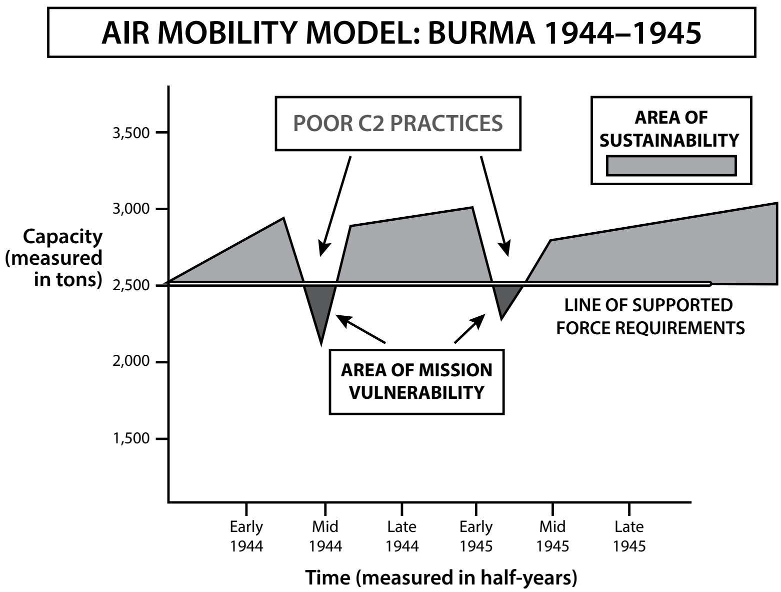

Figure 3.2. The Air Mobility Utility Model: Burma, with areas of poor command-and-control practices highlighted

Ultimately Slim's Burma campaign remains a lasting testament to the strategic impact air mobility may have within an operational campaign. In a scenario where other courses of action proved unfeasible—either through lack of amphibious assets or the time and costliness of building a complete ground road network—air mobility was able to underpin an entire ground scheme of maneuver with momentous and far-reaching effects. Innovative applications of air mobility by Slim, his staff, and the airmen involved made these openings possible—in essence, their combined "air mobility mindedness" in the normalization of air supply processes. As Slim himself later wrote, "A most distinctive aspect of our Burma war was the great use we made of air transport. It was one of our contributions towards a new kind of warfare . . . that . . . later passed into general use."[73]

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Chapter 4

Berlin Airlift

Operation Vittles, We'll soon be on our way,
With coal and wheat and hay. And everything's okay
As in the sky we go, we won't forget to blow
A kiss to Uncle Joe . . .

—Composer Irving Berlin at Rhein-Main USO Show, 1948

On 25 April 1945, US Army 1st Lt Albert Kotzebue's reconnaissance team paddled across the Elbe River in north central Germany where, on its far eastern bank, the Soldiers encountered forward elements of the First Ukrainian Front.[1] This first field meeting of advancing American and Soviet forces, in the waning days of the Second World War, proved a fleeting symbol of cooperation between two wartime allies. Three short years later the heavy aura of the Cold War was unmistakable as competing ideologies and armies faced off in a tense showdown across Europe and the globe. With Berlin as the focal point of the rising tensions, the United States Air Force delivered what many consider one of history's greatest displays of airpower—the Berlin airlift.[2]

Campaign Background

During the spring of 1945, as victory against the Axis forces appeared increasingly imminent, the Allied conferences at Yalta and Potsdam played a critical role in determining the disposition of postwar Germany.[3] Here diplomats settled on a model dividing the former Nazi state into three temporary sectors with the eastern portion under Soviet administration and the western zone divided between the United States and Great Britain and eventually France.[4] Additionally, the envoys decided Berlin, situated nearly 100 miles within the Soviet-occupied region, would also be divided among the four powers while remaining the administrative capital during Germany's occupation period.[5] The Allies completed the movement of occupation troops on 4 July 1945, and the Allied Control Council, the four-power agency charged with governing authority within Germany, first met at the end of July.[6]

Significantly, during these deliberations Allied planners overlooked one critical detail—no formal agreement guaranteed Western access to Berlin by surface transportation.[7] All parties tacitly agreed to the right of access and, as such, denial-of-passage scenarios did not warrant enough consideration for otherwise valuable conference time. Equally important, however, the Allied Control Council negotiated three 20-mile-wide air corridors in late 1945 that, while limited by altitude restrictions and potential Soviet flight interference, provided the written, formal basis for air activity into Berlin.[8]

Although the United States initially desired a short-term military and political presence in Europe, its growing recognition of a stable Germany's importance to European security, along with its mounting concern with Soviet military activity, led to a dramatic shift in policy. Coinciding with the appointment of Gen Lucius Clay as American military governor in Germany, the United States pursued a secure, democratic German state as a bulwark against Stalin's subversive strategy to first consolidate communist power in Eastern Germany then export it to the ensuing unified (and thus pro-Soviet) German government.[9] Additionally, the benefits of a solid ally in Central Europe—in the form of a stable, democratic Germany—were also readily apparent to the Allied forces.

The Western powers' actions in Germany worked in concert with other, broader geopolitical policy efforts. In response to the Soviet-backed socialist movement in Greece, Pres. Harry Truman announced the Truman Doctrine in 1947 that promised US assistance to any nation resisting communist imperialism.[10] That same year the United States also unveiled the ambitious European Recovery Plan, more commonly known as the Marshall Plan after then–Secretary of State George Marshall, offering aid and economic integration for any participating nation—including the Soviet Union and Eastern Bloc nations.[11]

The Soviets viewed these moves both as a challenge to their recent Eastern European advances—gains that only intensified with the shocking Czechoslovakian coup d'état in 1948—as well as an aggressive economic strategy intended to consolidate a larger Western European coalition in further opposition to their desired strategic goals.[12] Beginning in January 1948, Soviet troops selectively harassed British and American trains and ground transports destined for Berlin. In March Soviet forces restricted all Berlin-bound military and passenger traffic in hopes of further influencing perceived French reluctance for Western political initiatives within the sectors.[13] This necessitated a "Little Lift" of modest supplies via airlift to sustain the Berlin military garrisons throughout April. Known as the "LeMay Coal and Feed Company" after the famous Airman who was then serving as the United States Air Forces in Europe (USAFE) commander, this operation proved a significant precursor to later Allied air operations.[14] Soviet analysts, however, mistakenly judged this small-scale airlift a failure, a factor that weighed heavily in their later calculus to isolate Berlin entirely.[15]

On 18 June 1948, the Western powers instituted a long-awaited currency reform within their sectors.[16] The introduction of the German deutsche mark, while registering a stinging protest from the Soviet delegation, helped to chart the path of economic integration for the emerging state of West Germany. Subsequent negotiations concerning the economic reforms broke down between the occupation powers, and on 24 June 1948, the Soviet forces—citing "technical difficulties"—severed all ground and water communications between the Western sectors and Berlin.[17] This set the stage for the Berlin Airlift.

The Air Mobility Campaign

In the days following the closure of the roads, rails, and waterways into Berlin, Allied planners scrambled to develop resupply methods for the Allied garrison and German citizens isolated in Berlin's Western sectors. General Clay's initial course of action called for a heavily armored column to force its way into the city along the blockaded roads and bridges.[18] President Truman, cognizant of the 400,000 Soviet troops in the region matched by only 10,000 US combat troops (and 60,000 Soldiers overall), balked at the overly provocative proposal.[19] Clay then turned to the Air Force to commence airlift operations, a task that began with a benign phone call to LeMay:

> Clay: "Curt, have you any planes that can carry coal?"
>
> LeMay: "Carry what?"
>
> Clay: "Coal."
>
> LeMay: "General, we must have a bad connection. It sounds like you are asking whether we have planes for carrying coal."
>
> Clay (annoyed): "Yes. That's what I said. Coal."
>
> LeMay (after a long pause): "The Air Force can deliver anything."[20]

Flight operations began the next day, 26 June, with 30 European-based C-47s arriving at Berlin's Tempelhof Airfield with the first 80 tons of supplies for the 2.5 million beleaguered residents.[21] The British effort had started the day prior into Gatow, another Berlin airfield in the Western zone. General LeMay, quickly recognizing that burgeoning supply requirements dwarfed his organic airlift capability, requested all available Douglas C-54 Skymasters in the US Air Force inventory.[22] Headquarters Air Force responded by dispatching four squadrons, a total of 54 aircraft, from units ranging from Texas to Alaska. The first Skymaster arrived on 1 July and immediately began cargo runs into Berlin.[23]

At the start of the Berlin blockade most analysts believed it would be a short-lived affair resolved quickly through diplomatic measures. As the situation unfolded, however, such optimism appeared increasingly misplaced. Accordingly, in a National Security Council meeting on 22 July, General Clay pressed the case for the further resourcing of the airlift into Berlin. Despite strong opposition from the Air Force Chief of Staff, Gen Hoyt Vandenberg, who worried about the strategic risk of investing so many airlift assets in one operation, President Truman ordered the airlift's continuation while also directing each service to give it the fullest possible support.[24]

This decision also introduced Lt Gen William Tunner into the airlift—and further into the history books. After witnessing episodes of disorganization in the operation's opening days, LeMay initially placed Brig Gen Joe Smith, a career staff and combat forces aviator, in command. Smith, in the words of Robert Owen, "surprised the daylights out of everyone."[25] Along with terming the airlift Operation Vittles (matching the Royal Air Force's wittier Operation Plainfare), he instituted many important operational improvements that included installing a string of advanced navigational beacons along the air routes to Berlin; lowering air traffic control separation requirements from 25 minutes to 3 minutes in instrument flight conditions; consolidating C-54 operations at Rhein-Main airport and C-47s at Wiesbaden to leverage increased efficiencies; and enhancing billeting, messing, and support facilities and processes.[26] Despite Smith's well-received efforts, however, the airlift still delivered only roughly 1,200 of the 4,500 daily required tons of food, coal, fuel, medicine, and additional supplies.[27]

Tunner, who had established his airlift credentials commanding the daunting resupply flights over the Himalayas in World War II's

China–Burma–India Theater, arrived at the airlift at the end of July 1948. Along with his staff he brought a proven formula for success through the standardization and precision of all facets of an airlift operation—planes, maintenance, cargo handling, dispatch, infrastructure, support activities—to maximize the tonnage throughput.[28]

In building upon Smith's foundation, Tunner's team initiated substantial reforms to improve efficiency. Specific modifications included standardizing flight routes, climb profiles, and timing procedures into and out of Berlin; requiring ground controllers to direct all approach and landings according to a strict script; mandating only one landing attempt for aircrews into Berlin that, if unsuccessful, necessitated a return to base with the full cargo load; and compelling aircrew to remain at their aircraft during ground operations while support personnel unloaded the cargo and delivered weather reports, flight plans, additional paperwork, and basic refreshments.[29]

Apart from the operational improvements, Tunner's team also focused on refining ground logistics procedures where seemingly "every aspect required regulation."[30] In one instance Tunner traveled to a freight loading yard where Soldiers filled sacks with coal, one of the principal yet most difficult supplies for air transport. He found "great carelessness on the part of the Army . . . that some bags which were supposed to weigh 100 pounds would be 120 or 80."[31] This seemingly small production error induced numerous other complications ranging from overloaded aircraft safety considerations to inaccurate planning factors for tonnage delivered.

These standardization efforts, replicated many times over and applied to details both large and small, from the complete aircraft maintenance process reorganization to attractive Red Cross volunteers meeting aircrew plane-side with coffee and paperwork, were as much about philosophy as the actual procedures.[32] Tunner emphasized no wasted effort or resources in establishing what analysts have described as the "bicycle chain full of interchangeable, constantly rotating links . . . more suited to Henry Ford's Detroit than [the] Chisholm Trail" that underpinned the throughput so critical to the airlift's effectiveness.[33] In his autobiography *Over the Hump*, Tunner uses the three-minute aircraft separation interval to espouse his approach to success:

> Why the emphasis on three minutes? Because it provided an ideal cadence of operations with the control equipment available at that time. There are 1,440 minutes in a day. At three-minute intervals, this meant 480 landings at, say,

> Tempelhof, in a twenty-four-hour period. . . . This meant that a plane landed either landed or took off every 90 seconds. There was little time wasted sitting at the ends of the runways. It is this beat, this precise, rhythmical cadence, which determines the success of an airlift. This steady rhythm . . . became the trade-mark of the Berlin Airlift . . . [along with] regimentation. I insisted on complete regimentation in every aspect of flying . . . . There was only one best technique for each flying maneuver. . . . No variations. I wanted no experimenting on anyone's part.[34]

Another contributing factor to success was the establishment, in October 1948, of the Combined Airlift Task Force (CALTF). Born out of the American utilization of the new British base of Fassberg in Western Germany, where C-54s could increase their sortie rate into Berlin due to the shorter transit distance, the unified CALTF command sought to better coordinate the tremendous growth in aircraft of varying capabilities now operating in close proximity within the narrow airlift corridors.[35] With Tunner as commander and RAF Air Commodore John W. F. Merer as deputy, the organization set to the task of delivering "in a safe and efficient manner, the maximum tonnage possible, consistent with combined resources of equipment and personnel available."[36]

The synergistic benefits of these actions allowed the Allied forces to not only defeat "General Winter"—one of the coldest and foggiest on record since the 1860s—but also to steadily increase the amount and variety of critical supplies into (and out of) Berlin.[37] Tonnage rates increased from 74,000 tons to 115,000 tons per month by December with a daily throughput of almost 6,000 tons of food, medical supplies, and energy resources—well above the city's 4,500-ton daily requirement that had proven so elusive in the airlift's early months. In an unequivocal signal of strength to the simultaneously amazed and appalled Soviet leadership, the Allied forces staged a maximum effort surge on Easter Day of 1949 where more than 1,300 flights delivered nearly 13,000 tons of cargo into Berlin.[38] The airlift had also normalized to such a degree that aircraft departing Berlin ferried out manufactured goods—proudly stamped "Made in Blockaded Berlin"—as further proof of the city's continuing economic recovery.[39]

Less than one month after the "Easter Day Parade" the Soviets, quietly and without fanfare, removed the restrictions on surface access to Berlin. Although 12 May 1949 commemorates the end of the major Berlin airlift efforts, operations continued until September as Allied planners ensured an adequate stock of supplies existed within the city for contingency purposes. When USAF Capt Perry Immel piloted the last C-54 into Berlin—loaded, fittingly, with coal—it was the 276,926th flight of the Berlin airlift.[40] In a little more than one year, a total of 689 aircraft flew an estimated 124 million miles and airlifted over 2.3 million tons into Berlin's western sectors.[41] The last RAF Dakota, departing Lubeck for Gatow, bore the appropriate inscription from Psalm 21:11—"For they intended evil against thee; they imagined a mischievous device which they are not able to perform."[42]

Analysis of Key Air Mobility Principles: Freedom of Movement

Air Superiority

Given the noncombat nature of the Berlin airlift, the establishment and maintenance of Allied air superiority during the 15-month operation was nearly a given. The Soviets recognized the escalatory consequences of downing an unarmed humanitarian transport aircraft, particularly given recent precedent. On 5 April 1948, during the "Little Lift" operation, a Soviet Yak-3 fighter buzzed a British Viking passenger airliner operating within the recognized corridors.[43] The two planes collided with no survivors among the 10 passengers and crew. In response Allied leadership immediately arranged for armed escorts to accompany transport missions to prevent future mishaps. Marshal Vasily Sokolovsky, the Soviet military governor for Germany who initially sought to exploit the incident in order to limit Western air activity, abruptly reversed course, apologized, and assured no further interference.[44]

Soviet provocations, however, continued by other means. Author Arthur Pearcy catalogued a US report of harassment activities from August 1948 to August 1949: searchlights (103); close flying events (96); radio interference (82); buzzing (77); flares (59); ground fire (55); flak and chemical laying (54 each); air-to-ground firing (42); ground explosions (39); bombing (36); air-to-air firing (14); balloons (11); UFOs (7); and rockets (4).[45] Airlift crews anecdotally reported Soviet live-fire exercises, conducted by fighters strafing towed banners, in close proximity to the routes and intended almost exclusively to intimidate the cargo aircraft.[46] These cumulative actions impacted the overall operation in various ways while stopping shy of any overt, direct action that would constitute an act of war—and for good reason. As author Keith Hutchison notes, "Although the Soviets could easily have disrupted the corridor of flights to Berlin using force, they did not want to risk a war with the only country that possessed atomic weapons."[47]

Access

The designation of the three air corridors during earlier postwar Germany planning conferences underscores the critical symbiosis between diplomacy and military operations. Without the legally binding routes, negotiated months and years in advance of their required use, the Western powers would have faced the Berlin crisis with limited and unappealing military options. Instead, through the painstaking work of diplomats the Allies possessed a firm foundation from which to build their ambitious resupply plans for Berlin's more than two million residents.

Germany's airports proved nearly as important to these plans as the corridors. The United States and Great Britain benefited from numerous, airlift-capable airfields scattered throughout Western Germany. In the summer of 1948, however, the Western air forces had access to only two airports within Berlin. This was a "critical choke point," notes author and historian Roger Miller, as neither field was "built to handle the tremendous pounding by heavily laden aircraft every few minutes, twenty-four hours a day, day in and day" that the airlift required.[48] Both Gatow, the British hub that was once a former German fighter training base, and the American-operated Tempelhof, a one-time Messerschmitt factory and the city's first major civilian airport, had previously undergone repairs to strengthen runways and add additional parking aprons and taxiways.[49] But the alarming deterioration rate continued.

Recognizing the threat to the airlift's throughput requirements, Tunner acted quickly. His priorities focused on three key lines of effort: repairing Tempelhof's main runway while adding an additional airstrip; expanding the aprons and taxiways at Gatow, which facilitated quicker turnaround times and leveraged the shorter distance to Fassberg; and constructing a new, permanent airport at Tegel three months ahead of schedule, a monumental task in its own right.[50] Tunner and his staff effectively accomplished these feats by sequencing the necessary airfield construction equipment between other priority airlift requirements, employing scores of local workers, and salvaging the extensive rubble remaining from the ruined city for the scarce runway materials. Once complete, Berlin's enhanced airfields permitted the fundamental access points necessary to sustain the airlift's ever-increasing operations tempo.

Command and Control

Arguably one of the Berlin airlift's greatest contributions to airpower—and air mobility—theory continues through its powerful example of effective command and control. This paradigm began when Tunner assumed command in July of 1948 and, with messianic zeal, sought to demonstrate what professional airlift specialists could achieve. In his memoirs Tunner writes, "Far more successful than the Russians in hamstringing the Berlin Airlift were the same old bugaboos I had experienced in India—divided command for one, and conflict between [those] . . . dedicated to the technical and strategic functions of the Air Force and those of us who had built up some *expertise* in air transport"[51] (emphasis in original).

Armed now with both the knowledge and the authority, Tunner implemented sweeping organizational changes, most notably by establishing the previously discussed Combined Airlift Task Force. This change linked British and American administrative functions and resources and led to cascading improvements in efficiency across all operational facets.[52] Most notably the unified organization's key metric shifted from satisfying the *minimum* daily tonnage requirements to now exploiting a *maximum* possible daily tonnage approach.[53]

C2 Operational Responsibility

Tunner's effect within the operational C2 element, with its focus on aircraft and aircrew management, was immediate and enduring. His team applied the same regimented approach to the task force's maintenance practices that had borne earlier success with the aircrew flight standards. This reflected a broader understanding that, in spite of the successful management of other, single airlift elements, the lack of mission-capable aircraft would ultimately limit the operation's overall capability.

Despite a poor working relationship with the parent command, USAFE, Tunner convinced the headquarters to reactivate the former World War II maintenance depot at Burtonwood in the United Kingdom. Tunner was seeking to mitigate the impact of necessary but time-consuming inspections on his C-54 fleet; at one point Airmen ferried 67 Skymasters to the US for required inspections and, due to process delays, returned only 18.[54] Notwithstanding chronic supply and personnel shortages, Burtonwood's production line management (PLM) techniques culminated with nearly half-a-dozen aircraft inspections each day, a feat that alleviated an otherwise heavy burden levied on the already stressed operational bases.[55]

Tunner and his staff also took strong measures to enhance the morale and welfare of the personnel under his command, specifically the aircrew. As the operation grew in both size and duration, Tunner continually pursued upgrades in aircrew quarters, facilities, and recreational activities.[56] He instituted a long-overdue rotational program to curb assignment concerns, ensured solid communication through public affairs channels to highlight individual and team accomplishments, and stressed flight-safety initiatives to improve the overall mishap rate.[57] Collectively, these initiatives, from improved flight standards to maintenance processes to aircrew morale, greatly augmented Tunner's pursuit of maximum airlift effectiveness.

C2 Support Responsibility

While Tunner's team effected a host of improvements within the command-and-control support element, from airfield management to aircrew support and cargo processing, three areas deserve particular attention: air traffic control, communication, and weather. One of Operation Vittles's most significant but generally least recognized elements was the key role exercised by the ground control approach (GCA) operators. "The extensive use of GCA at every airlift base," writes historian Miller, "aided by the close relationship between the controllers and the aircrews, was probably the most important single technical factor in the success of the Berlin Airlift."[58]

Importantly, as Tunner amended flight separation minimums and instituted single-pattern-only criteria, he matched these policy changes with major investments in GCA and air traffic control (ATC) technology and personnel. After losing 31 airlift missions to a GCA outage in October, his staff worked endlessly to upgrade radar capabilities given its central role during the frequent low-visibility periods that mark German winters. The December 1948 addition of the latest CPS-5 radar further increased controllers' range and allowed for greater aircraft spacing flexibility into the congested Berlin airspace. Tunner also engaged with the Military Air Transport Service (MATS) to release more experienced ATC personnel, eventually garnering 19 veteran controllers that allowed for greater balance in expertise throughout the task force.[59]

Tunner's communication units also worked tirelessly to enhance the airlift's operational capability. Frequency experts amplified the range and power of the navigation and communication beacons while simultaneously frustrating Soviet attempts to deny these services. Additionally, Tunner's team also examined the best airfield lighting systems for reduced visibility conditions and successfully diverted novel D-2 high-intensity approach lighting to Germany from previously approved installations in the United States. At Tempelhof, tall residential buildings blocking the approach path necessitated the runway approach light installation through a German cemetery.[60]

Throughout the airlift weather forecasting services notably developed greater accuracy and timeliness. Tunner aggressively pursued personnel and organizational changes to promote this competency and established the 2105th Air Weather Group, dedicated solely to the airlift, at Wiesbaden. To synchronize forecasts within the task force, the weather officers established a master control weather station to produce and disseminate the most accurate reports possible.[61] Forecasters slashed the initial six-hour forecast window to hourly updates for controllers, and weather aircraft, usually B-17s providing real-time updates to the weather agencies, also helped determine prevailing corridor conditions for the transport aircraft.

These various support efforts, in concert with others Tunner and his team initiated, combined to ensure the airlift achieved its peak efficiency.

Integrated Logistics

Perhaps more than any other air mobility operation, the Berlin airlift confirms the old adage "amateurs talk tactics—professionals study logistics." Indeed, as Tunner and his team skillfully refined many operational practices, he rarely missed the opportunity to trumpet the accomplishments of the logistics professional, particularly in contrast to non–air mobility personnel. "Things like that," Tunner would crow about packaging or loading processes, "are what a transport man knows."[62]

As the airlift progressed, the supply chain management function flourished following the establishment of the US Airlift Support Command, itself modeled after a British air transport organization.[63] In the planning phases organizers became more skilled at marrying different supplies into single cargo loads to maximize valuable aircraft space and weight capacity.[64] Instead of flying fully baked bread into the city, for example, aircraft transported lighter and more malleable flour, thus freeing space for other prized cargoes such as petroleum during the cold winter months.[65] This philosophy extended to the warehouses at the main bases where logisticians similarly organized and separated supplies to enhance the planning and loading processes.[66]

Innovative practices permeated the supply chain. Coal, for example, proved especially difficult to transport given its corrosive effects on aircraft and the unwieldy bags subsequently required for shipment. In response, German companies developed inexpensive multi-ply sacks manufactured specifically for the airlift, slashing the monthly costs from $250,000 to a mere $12,000.[67] Aircraft used conveyer belts that could load 20 tons of coal in approximately 35 minutes, almost half the time of hand-loaded cargo.[68] Planners introduced production control officers whose simple directions were "to expedite all activities pertaining to aircraft turnaround."[69] These officers coordinated all logistical details, from aircraft parking based on planned cargo load to managing the large national workforce that, in literal terms, formed the backbone of the operation. As Miller reflected, "most of the two million tons of cargo delivered to Berlin was carried at least part of the way on someone's back," usually in exchange for a daily ration of 2,900 calories.[70]

With the clear focus on reducing inefficient handling time, the professional logisticians methodically and relentlessly pursued gains throughout the supply chain. In the end their efforts paid dividends as, despite the challenging and varied cargo loads, the average on-load time steadily dropped from multiple hours to 1 hour and 25 minutes at the main base and a 49-minute average at the off-load points.[71]

Technology

The Berlin airlift occurred during a time of tremendous technological change regarding airpower. Almost daily, cutting-edge fighters pushed the boundaries further beyond Chuck Yeager's epic sound barrier achievement as the Air Force sat on the cusp of the great jet age. But this seismic shift in focus did not include transport aircraft. Nearly another decade passed before jets entered the mobility inventory as airlift aircraft retained more connective tissue with their piston-driven World War II counterparts than the sleek models now rolling off American assembly lines. For transport aircraft, instead, technological change gravitated toward increased size with improved speed as a secondary consideration.

In the Berlin airlift context, this meant little room for the veritable workhorse of the Second World War, the Douglas C-47. While Airmen heavily employed Dakotas in the operation's opening months, C-54 Skymasters, another WWII airlifter with extensive service, especially over the Hump, replaced them entirely by October.[72] The C-54's cargo capacity was nearly three times larger than the smaller C-47s and boasted well-designed loading features.[73] The Skymasters also garnered a well-earned reputation for reliability, a critical element in a theater where spare parts and experienced mechanics were in short supply.[74]

Tunner, a visionary who believed the nascent global mobility force's future lay in large aircraft, masterfully used the Berlin airlift to advance his cause.[75] He introduced two heavy transport aircraft into the mission flow, the Douglas C-74 Globemaster and the Fairchild C-82 Packet.[76] Both aircraft proved especially valuable for delivering outsized cargo, to include the critical airfield construction equipment not available in Berlin, although ironically both proved more damaging to the runway surface environment than the other airlift aircraft. This fact, along with a larger support equipment bill, limited their collective employment. In a related point, however, Tunner's vision had merit: 17 modern C-5 Galaxys could have replaced the entire tonnage capacity of the 308 Allied planes employed in the Berlin airlift.[77]

The technological advancements in air traffic control (specifically GCA) as well as communication and navigation equipment are worth noting again as the linchpin to the overall effectiveness of the airlift operation.

Training

Initially the Berlin airlift benefited from a strong cadre of experienced WWII-era transport pilots, many of whom served with Tunner in the China–Burma–India Theater.[78] These pilots quickly adapted to the rigorous procedural standards mandated by Tunner and, as Hump veterans, were capable of piloting though the poor weather conditions symptomatic of central European winters. As the airlift's duration continued, however, morale and force management considerations dictated unavoidable personnel rotations. Indeed, in the operation's later stages, over 17 percent of the pilots were replacement crews requiring certification in airlift procedures.[79]

To address this training need, the Air Force transferred the MATS training school from California to Great Falls, Montana.[80] As Miller explains, "Great Falls proved an ideal location for the replacement training unit. The winter weather was similar to that in Germany and planners made every effort to duplicate the conditions that the men would face on the airlift. The magnetic course used at Great Falls copied that on the approach to Berlin, and the aircraft had to land on the first part of the runway in order to simulate the short runway at Tempelhof. Sandbags gave the aircrew experience handling heavily loaded Skymasters, and each one had to make three landings at seventy thousand pounds gross weight before graduating."[81] The realistic training program was a resounding success that actual Berlin airlift missions validated. Along with producing 29 trained crews a week, Great Falls also sharpened the GCA skills for controllers operating from replica German facilities.[82]

In an important corollary point, the Berlin airlift played a pivotal role in shaping the fledgling Air Force's approach to training. During this time period, a concerned Air Force chief of staff, Gen Hoyt Vandenberg, commissioned famed aviator Charles Lindbergh to conduct an examination of the force's combat readiness. Lindbergh's report, in turn, was damning. In an attempt to model Air Force elements after the pre–World War II Air Corps, Lindbergh found, "some pilots and crew members, forced to learn several flying and nonflying jobs, failed to master any of them and the continual programs of individual training left no time to prepare realistically for combat."[83]

The solution, Lindbergh continued, required greater specialized training in simulated potential wartime missions.[84] In essence, the report called for more professional training that eschewed a jack-of-all trades approach. The Great Falls–Berlin airlift training program presented one such realistic model that, for Tunner and the rest of the mobility practitioners, produced both immediate and lasting results.

Final Analysis

As the model demonstrates, despite building a solid foundation that achieved some success in the Berlin airlift's early phases, practitioners failed to meet the logistical tenets of attainability and sustainability. Once Lieutenant General Tunner was placed in command, however, his team of professionals implemented many key modifications that ultimately enabled success. The most significant changes occurred in command and control as Tunner created the Combined Airlift Task Force to leverage synergies within a constrained and complex operating environment. His focus on operational and support entities and procedures also paid large dividends throughout the course of the operation.

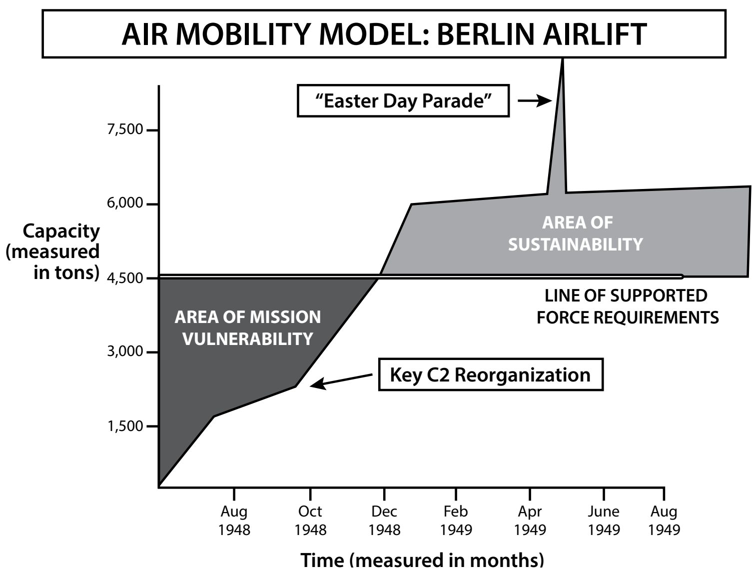

Figure 4.1. The Air Mobility Utility Model: Berlin airlift and the key role of command and control

Perhaps Tunner's greatest influence, however, endures through his relentless pursuit of improvement across all five key air mobility factors. Tunner firmly believed that successful air mobility operations benefited from a methodical approach focused on maximum productivity and the elimination of waste across the integrated system. "Our operating policy," he would say, "was that each plane must be flying, be undergoing maintenance, or be in the process of loading or unloading *every second of every day*"[85] (emphasis added).

The Berlin airlift demonstrates the effects such an approach may produce. Interestingly, one may argue that Tunner ran the airlift "too well" and ultimately masked its overall complexity to outside policy makers and military leaders. Here the model of air mobility utility serves a useful purpose as a conceptual framework to evaluate Tunner's accomplishment. The model (fig. 4.1) graphically illustrates the results as the tonnage line steadily increased with improvements in freedom of movement (bases), integrated logistics (processes), training (Great Falls), technology (C-54s and GCA), and C2 elements (CALTF and Tunner's philosophy). The operation's overwhelming success, then, cannot be credited to one singular person or factor alone but rather the combination of key elements working in concert to achieve mission accomplishment.

The Berlin airlift lives on in history as one of the greatest Western victories of the Cold War—a strategic victory won without a single shot fired.[86] "The Berlin Airlift proved," adds Charles Miller, "among many other things, that airlift could rise to incredible challenges and that it was a fundamental tool of diplomacy in the new political order of war."[87]

Notes

1. Cherny, *The Candy Bombers*, 14.
2. Muller, "The Berlin Airlift."
3. Sutherland and Canwell, *The Berlin Airlift*, 5–6.
4. Miller, *To Save a City*, 4.
5. Sutherland and Canwell, *The Berlin Airlift*, 8.
6. Miller, *To Save a City*, 9.
7. Harrington, *Berlin on the Brink*, 21.
8. Donovan, *Bridge in the Sky*, 26.
9. Shlaim, *The United States and the Berlin Blockade*, 20.
10. Shlaim, 82.
11. Mills, *Winning the Peace*, 22.
12. Tillman, *LeMay*, 85.
13. Miller, *To Save a City*, 20.

14. Tillman, *LeMay*, 85.
15. Miller, *To Save a City*, 23.
16. Harrington, *Berlin on the Brink*, 71.
17. Pearcy, *Berlin Airlift*, 7.
18. Kozak, *LeMay*, 275.
19. Boyne, *Beyond the Wild Blue*, 41.
20. Cherny, *The Candy Bombers*, 252.
21. Owen, *Air Mobility*, 71.
22. Donovan, *Bridge in the Sky*, 53.
23. Miller, *To Save a City*, 53.
24. Owen, *Air Mobility*, 75.
25. Owen, 73.
26. Owen, 74.
27. Owen, 74.
28. Provan and Davies, *Berlin Airlift*, 20.
29. Provan and Davies, 144.
30. Slayton, *Master of the Air*, 168.
31. Slayton, 168.
32. Provan and Davies, *Berlin Airlift*, 46.
33. Slayton, *Master of the Air*, 136.
34. Tunner, *Over the Hump*, 174–75.
35. Miller, *To Save a City*, 103.
36. Tunner, *Over the Hump*, 187.
37. Cherny, *The Candy Bombers*, 465.
38. Owen, *Air Mobility*, 82.
39. Sutherland and Canwell, *The Berlin Airlift*, 90.
40. Pearcy, *Berlin Airlift*, 111.
41. Pearcy, 111.
42. Pearcy, 111.
43. Miller, *To Save a City*, 25.
44. Miller, 25.
45. Pearcy, *Berlin Airlift*, 104.
46. Tunner, *Over the Hump*, 185.
47. Hutcheson, *Air Mobility*, 12.
48. Miller, *To Save a City*, 108.
49. Sutherland and Canwell, *The Berlin Airlift*, 20.
50. Miller, *To Save a City*, 110.
51. Tunner, *Over the Hump*, 186.
52. Tunner, 186.
53. Tunner, 187.
54. Slayton, *Master of the Air, 195.*
55. Owen, *Air Mobility*, 79.
56. Owen, 79.
57. Donovan, *Bridge in the Sky*, 112.
58. Miller, *To Save a City*, 121.
59. Miller, 121, 123, 125.
60. Miller, 123, 125.
61. Miller, 126, 127.
62. Slayton, *Master of the Air*, 168.
63. Miller, *Airlift Doctrine*, 180.
64. Miller, 180.

65. Provan and Davies, *Berlin Airlift*, 70.
66. Slayton, *Master of the Air*, 168.
67. Miller, *To Save a City*, 153.
68. Miller, *Airlift Doctrine*, 180.
69. Slayton, *Master of the Air*, 168.
70. Miller, *To Save a City*, 146.
71. Miller, *Airlift Doctrine*, 180.
72. Harrington, *Berlin on the Brink*, 353.
73. Cherny, *The Candy Bombers*, 262.
74. Provan and Davies, *Berlin Airlift*, 23.
75. Tunner, *Over the Hump*, 197.
76. Miller, *To Save a City*, 112.
77. Miller, *Airlift Doctrine*, 327.
78. Tunner, *Over the Hump*, 165.
79. Sutherland and Canwell, *The Berlin Airlift*, 59.
80. Miller, *To Save a City*, 140.
81. Miller, 142.
82. Miller, 143.
83. Nalty, *Winged Shield, Winged Sword, vol. 1*, 431.
84. Nalty, 431.
85. Tunner, *Over the Hump*, 118.
86. Meilinger, *10 Propositions Regarding Airpower*, 13.
87. Miller, *Airlift Doctrine*, 225.

Chapter 5

Dien Bien Phu

A year ago none of us could see victory. There wasn't a prayer. Now we can see it clearly—like a light at the end of a tunnel.

—General Henri Navarre
French Commanding General, 1953

In the aftermath of the 11 September 2001 terrorist attacks, the United States military pursued large-scale, high-intensity counterinsurgency operations in Afghanistan and Iraq while simultaneously supporting numerous smaller missions across the globe.[1] These efforts continued a form of warfare that has persisted for centuries between enemies of disparate power levels and will likely endure into the foreseeable future. Air mobility's role in recent counterinsurgency operations has been both impactful and lasting as its operational tenets have enabled mass, maneuver, and flexibility to combat an adaptable and dynamic enemy. But the lessons drawn from less-successful experiences, such as the bitter French defeat at Dien Bien Phu, may prove equally if not more informative. While not a perfect substitute for classic counterinsurgency warfare, the French colonial war in Indochina that culminated with the disaster in "The Last Valley"[2] may appreciably inform contemporary students of key air mobility considerations in the grey areas outside of conventional conflict.

Campaign Background

The First Indochina War has its roots in the waning days of the Second World War when Vietnamese nationalist Ho Chi Minh established a nascent communist government under the Viet Minh banner in the fall of 1945.[3] The French government was unprepared to grant independence to its ancient colony and vigorously drove Viet Minh forces out of the cities and villages and into the Tonkin region's rural countryside. The international community largely viewed French actions with hostility and considered them out of step with postwar anticolonial sensibilities, at least until the summer of 1950 when Kim Il Sung's communist North Korean forces shocked the free world by invading democratic South Korea.[4] The war against Viet Minh forces suddenly melded into the wider effort to halt the domino-like spread of communism throughout Southeast Asia, and large-scale American aid began pouring into the French effort.[5]

In characteristic Mao Tse-tung fashion, the Viet Minh sought to entangle the French in a lengthy conflict to exploit strategic weaknesses while simultaneously allowing time and space to build, train, and equip their own indigenous forces.[6] The French strategy, in contrast, was firmly anchored in the Western tradition of the decisive battle, and commanders repeatedly attempted to engage the Viet Minh, under General Vo Nguyen Giap, in direct combat where France could bring its advantages in firepower to bear.

The following eight years witnessed a series of campaigns throughout North Vietnam showcasing French airborne and airpower superiority. Despite these advantages, it was increasingly apparent by 1953 that the war was not going in France's favor. A succession of commanders—six in all—had failed to pacify the Viet Minh insurrection, and large swaths of territory in both Vietnam and neighboring Laos now fell under communist control.[7] Politically the war was growing progressively unpopular with a French citizenry weary of war in general.[8] In response French Premier Rene Mayer appointed General Henri Navarre to command the French Expeditionary Corps in May 1953 and charged him with one simple directive: to create the military conditions that would lead to an "honorable political solution."[9]

Navarre inherited a situation that, in mid-1953, could best be characterized as a stalemate both politically and militarily.[10] He quickly developed a strategy, known as the Navarre Plan, intended to accomplish two key objectives: the destruction of the enemy's main battle force and the elimination of the growing guerrilla threat behind French lines.[11]

To implement this strategy Navarre and his planners settled on the *base aero-terrestre* operational concept.[12] Under this model French forces established a fortified airland base, capable of both supply and defense by air, near key Viet Minh logistical lines. From these bases mobile French forces could either interdict vital enemy supply routes in the adjacent region or similarly force a massed assault on the outpost that would first fix, then decimate Giap's forces under the combined weight of superior French air and artillery. The airhead at Na San had validated this concept the previous December when French forces drove back Giap's army, which employed "human wave" tactics borrowed from their Chinese advisors, inflicting heavy losses.[13] The

French subsequently abandoned Na San, but the successful airlift retrograde of 12,000 troops further convinced Navarre of the fortified airhead model's utility.[14]

By November 1953 Navarre's staff had received intelligence indicating widespread Viet Minh activity near the Laotian border.[15] Sensing an opportunity, he subsequently chose to establish operations at the abandoned Japanese airstrip at Dien Bien Phu, from which French forces could disrupt the weapons and opium trade, conduct raids into Viet Minh territory, and potentially bait Giap into launching another large assault into well-prepared defenses.[16] Ignoring critical differences from the Na San model and against the advice of nearly every important subordinate commander, Navarre initiated Operation Castor in the late fall of 1953. The die was now cast for the epic Battle of Dien Bien Phu.[17]

The Air Mobility Campaign

On 20 November 1953, C-47 Dakotas carrying the 6th Battalion Colonial Parachutists along with two other battalions commenced the first of three days of troop and equipment drops at Dien Bien Phu.[18] The airborne troops surprised and scattered elements of the 148th Viet Minh Regiment and captured the small village anchoring the valley.[19] By the end of the third day French Air Force transports had delivered over 9,000 troops, along with heavy weapons and equipment to prepare the airstrip.[20]

The garrison, under the command of cavalry officer Colonel Christian de Castries, immediately began construction of the base camp. The central portion of the base, including the primary airstrip, anchored seven satellite positions bearing feminine names such as Beatrice, Claudine, Dominique, and Gabrielle. Engineers also built a second airstrip near the southern artillery battery at Isabelle. Even at this early stage, the battalions' basic daily supply requirements stretched the French airlift, which could not offer any spare capacity for the tons of sandbags, cement, steel, and additional heavy construction equipment requisite for a strong defensive position.[21] The decision to allocate valuable airlift priority to light tanks supporting mobile forays into the countryside, of which only two were conducted in December, further hampered defensive preparations.[22]

The Viet Minh under Giap, meanwhile, were rapidly surrounding Dien Bien Phu. French intelligence anticipated only one Vietnamese division in the valley when, in reality, Giap marshaled four despite persistent French air interdiction efforts.[23] His nearly four-to-one manpower advantage similarly extended to artillery and antiaircraft weapons, including an estimated 48 heavy American 105 mm howitzers captured in Korea.[24] Giap completed Dien Bien Phu's encirclement in late January and the French garrison came under near continuous fire from more than 200 artillery pieces beginning on 31 January.[25]

From the beginning of February until March, French transports operating in the air and on the ground near Dien Bien Phu found themselves under increasingly accurate communist antiaircraft from the 1,800-foot hills surrounding the airfield. The destructive fire wasn't limited entirely to the valley. On the nights of 6 and 7 March, Viet Minh guerrillas infiltrated two major French airbases at Gia Lam and Cat Bi and, ignoring nearby combat aircraft, destroyed 78 unguarded transports on the ramp.[26] This loss aggravated the already feeble French transport fleet, comprised mainly of antiquated C-47 Dakotas, while demonstrating that no bases, even the main cargo hubs located almost two flying hours away at Hanoi, were safe from attack.

By mid-March the large Viet Minh force had begun to tighten its grip around the French stronghold at Dien Bien Phu. Two outer defensive posts, Beatrice and Gabrielle, fell in quick succession while accurate antiaircraft fire downed 12 French aircraft in just four days.[27] Even more significantly, Vietnamese artillery, acting on Giap's explicit direction, cratered the main runway on 14 March and rendered it virtually unusable.[28] The last flight into Dien Bien Phu occurred two weeks later on 28 March when the besiegers destroyed a C-47 while it attempted to depart on a desperate medical evacuation mission.[29]

Throughout savage fighting in April the perimeter of the French garrison continued to recede. Giap's armies had abandoned their costly human wave tactics and instead inched forward through a series of trenches reminiscent of the First World War.[30] As a result of these trench lines, coupled with the airfield closure, the French soldiers depended on airdrop as the sole resupply means. Colonel Jean-Louis Nicot, the head of the French Air Force Air Transport Command, described the struggles associated with sorties to the increasingly smaller and constrained drop zones:

> My pilots experienced difficulties in finding the DZ [drop zone] and in seeing its markers. . . . It is difficult to maintain a split-second course and to fly at night at only 300 meters above the bottom of the valley. The pilots are subject to automatic weapons fire coming from all directions, and bursts of tracer bullets converge on the pilots who are also blinded by Viet Minh illuminating shells, searchlights and Bangalore torpedoes. The planes are also severely buffeted by the shock waves of the exploding enemy shells and by the friendly shells that are being fired. That type of acrobatic mission has become par for the course.[31]

In later missions the transports flew at progressively higher altitudes to avoid flak curtains comparable to, in several veterans' accounts, the dense barrages surrounding key German industrial centers during World War II.[32] Parachuting supplies is wasteful even under ideal conditions, asserts author Julian Thompson, but its inefficiencies compound as the airdrop height increases.[33] This maxim bore truth at Dien Bien Phu. As French planes climbed from initial drop altitudes of 1,000 feet or less to the headquarters-mandated 6,000 feet and higher in the later airlift stages, the cargo dispersion patterns inevitably swelled across Vietnamese lines.[34] In fact the French dropped an average of 120 tons of supplies per day during the siege, but the defenders usually recovered no more than 100 relief tons.[35] More significantly, this number was only half of the 200 ton-per-day requirement logistical experts assessed as the minimum amount necessary to sustain the garrison's combat effectiveness.[36]

April's dwindling resupply numbers corresponded with the shrinking footprint of Dien Bien Phu and its available drop zones. The resource-constrained French outpost could no longer mount even limited counteroffensives within the valley, and the retrieval of errant supply drops proved nearly impossible. Portions of the additional satellite outposts—Dominique, Elaine, Huguette—fell to Viet Minh forces during bitter fighting over the last two weeks of the month, and on 7 May Giap massed the bulk of his now 25,000-strong force for one final assault against the remaining defenders whose ranks had been decimated from a peak of over 10,000 soldiers.[37] Giap's offensive succeeded, and the final radio report from de Castries's command post simply stated: "We're blowing everything up. *Adieu*."[38] The Battle of Dien Bien Phu was over—and with it French colonial rule in Vietnam.

Analysis of Key Air Mobility Principles: Freedom of Movement

Air Superiority

The lack of air superiority was a critical factor in the air mobility forces' inability to effectively resupply the encircled outpost at Dien Bien Phu. The fault for this lay primarily in the French High Command's flawed strategic assessment of Vietnamese capabilities. By overlaying their own conventional logistical models on the enemy, the French underestimated the Viet Minh's ability to amass heavy artillery in the high ground overlooking Dien Bien Phu. By cleverly disassembling, transporting, then reassembling the larger pieces, Giap's forces expertly employed the jungle cover and hidden trails to successfully negate French interdiction efforts targeting the main highways.[39] Once emplaced in the mountains, Giap's artillerists utilized a network of tunnels to continually shift firing positions and further mitigate the effectiveness of French counterbattery fire.

Along with underestimating Vietnamese resourcefulness, the French (and American) airpower theorists misunderstood the evolving threat that antiaircraft weapons posed to modern aircraft. As journalist Bernard Fall explains,

> Since the Korean War had ended only a few months before the Battle for Dien Bien Phu, it probably was impossible by then to fully evaluate the deadly effectiveness of flak there, which finally accounted for 816 "kills" as against 147 Allied planes lost in air-to-air combat. Yet the myth that conventional light flak and even a "fire curtain" of massed small arms could not seriously hurt high-performance aircraft was so strongly anchored in the minds of American air-power strategists that they strongly affirmed "jungle rebels are not equipped with ack-ack or interception capability so that air superiority is practically assured." The French fully believed their American teachers. They paid for that error with a total of 48 aircraft shot down over the valley, another 14 destroyed on the ground at Dien Bien Phu, and 167 damaged over the valley by enemy flak.[40]

Fall goes on to further note that, since the Viet Minh imposed these losses on a fleet that never surpassed more than 100 supply or 75 combat aircraft, the costs suffered in less than five months were heavy indeed.[41] The erroneous operational lessons passed from the US to the French are even more perplexing when considered within the context of the US Air Force's Operation Swarmer where, in the opening days of the 1950 exercise, the opposing red force "destroyed" 37 aircraft by using well-placed artillery in the hills surrounding the primary airfield.[42] At nearly 10 miles long and 4 miles wide, with elevation ranging from 1,400 to 1,800 feet, the Dien Bien Phu valley was roughly analogous to Swarmer's operational environment in North Carolina.[43] The French Air Force finally learned at Dien Bien Phu that ground fire could be an equal if not greater threat than air assets.

Access

Much like the Germans at Stalingrad, the French at Dien Bien Phu suffered from a lack of suitable airfields both in the encircled area as well as in the broader supporting theater infrastructure. Within the valley, the poor layout of the seven defensive positions precluded effective mutual support so that Giap's forces could isolate and reduce each bastion in turn. While their artillery threatened the primary airfield throughout the entire 56-day siege, the loss of the Beatrice and Gabrielle redoubts in mid-March ensured an uninterrupted targeting picture for Vietnamese gunners and effectively closed the airfield to airland operations, thus driving the shift to the less effective airdrop methods.[44] The French never used the auxiliary airfield, located near the southern position at Isabelle, despite its ability to accept both C-47 and C-119 aircraft.[45] Viet Minh artillery also closed this strip notwithstanding Isabelle's large garrison—nearly one-third of the French troops—and its role as the primary artillery and counterbattery position.[46]

Outside of the immediate Dien Bien Phu area, the French also suffered significantly from a lack of suitable support airfields. General Charles Lauzin, commander of the French Far Eastern Air Force, recognized the problem early in the campaign and, six months prior to the battle, requested a modest $18.4 million appropriation for theater airfield construction and repair.[47] The French Parliament denied his appeal.

The French concentrated the majority of their air bases in the Hanoi area, located on average more than 200 air miles from Dien Bien Phu.[48] This subsequently limited the time-on-station and corresponding effectiveness of interdiction aircraft and contributed to the intense threat environment the transports operated within. Equally important, the far proximity of the bases added to the cargo aircraft's critical distance (from supply point to delivery point) and restricted the daily number of missions possible in support of the firebase. Throughout the rest of Northern Vietnam, low-lying areas normally suitable for runway construction required massive investments in crushed rock and other materials to counteract the poor soil foundations exacerbated by the monsoon season.[49] French engineers ultimately lacked both the resources and time to construct new airfields to enhance French operational flexibility. In sharp contrast, a little more than a decade later US engineer forces ensured that "nearly everywhere in Vietnam was within 25 miles of a C-130 capable strip."[50]

Command and Control

In his widely acclaimed account of Dien Bien Phu, Bernard Fall notes that the French High Command committed "two capital errors" in its command and control of airpower: first, it always requested aircraft on a piecemeal basis, with the result that every ground commander operated with his own personal air force; and second, neither the air force nor navy ever participated in the actual planning of the war effort itself.[51] These omissions manifested themselves in different yet critical ways.

In the first instance, the basic organization of the air effort matched the ground forces' geographical orientation and resulted in three separate air commands: North, Center, and South.[52] Each regional ground commander had competing air support requirements that were not well coordinated through a single theater air component charged with prioritizing the limited air assets. As a result, large-scale efforts such as Navarre's 30,000-strong Operation Atlante in southern Vietnam coincided with Dien Bien Phu's heavy combat requirements. Combined the two operations exceeded the capabilities of the available air resources. In the second error the senior air force officers in the French Northern Command, once apprised of Operation Castor in late October of 1953, vehemently protested their ability to resupply the distant garrison, citing lack of transports, poor weather, and enemy activity.[53] Navarre readily dismissed their concerns and proceeded with the operation as planned through his army staff. Additional C2 issues, discussed in greater detail below, added to these overarching failures.

C2 Operational Responsibility

In the operational command-and-control element, the French never successfully generated enough aircraft and aircrews to meet the required airlift taskings in support of the besieged garrison. Although the aircraft shortfalls are well documented, with no more than 100 transport aircraft ever available in theater, the lack of qualified aircrew proved equally problematic. As author Robert Bearden points out, "Ideally, the air transport group commander for Indochina, Col Jean-Louis Nicot, would have had more than one aircrew for every aircraft available. Such a ratio would have made aircraft almost continuously available except when they were restricted by maintenance functions. As it was, crew limitations were significant enough that Colonel Nicot had to fly one of the aircraft on the opening day of Operation Castor, and he and his staff regularly filled cockpits for operational missions during the French tenure at Dien Bien Phu."[54]

Although the numbers vary, analysis suggests the French Air Force was anywhere from 18 to 22 aircrew short of achieving even a basic one-to-one crew-to-plane ratio.[55] Assistance from the US, in the form of 15 additional covert Central Intelligence Agency (CIA) crews, mitigated the problem slightly although these pilots carried supplementary restrictions limiting their full employment. Ultimately Nicot authorized the operation of C-47s with only one pilot (vice the standard two crewmember complement) in a desperate attempt to stretch his limited crew force and improve the ratio metrics.[56]

Maintenance concerns also added to the problems plaguing the French Air Force. The operational aircraft reliability rate never exceeded 75 percent as manpower and supply shortages consistently hampered repair efforts.[57] As early as 1950 the American Military Assistance Advisory Group (MAAG) had complained of poor French maintenance practices, noting a "lack of appreciation of safety precautions, lack of respect for preventative maintenance . . . the standard French procedure of drinking while working . . . insufficient maintenance was draining spare parts . . . . Under these conditions no amount of logistical support supplied . . . will greatly reduce the difficulties now being experienced by the French Air Force in maintaining sufficient aircraft at the operational level."[58]

American doctrine dating to the mid-1940s had admonished commanders "to bring lots of airlift into counterinsurgency operations,"[59] but the limits on manpower and maintenance in Vietnam doomed the French to violate this axiom.

C2 Support Responsibility

The French in Indochina experienced several failures within the command-and-control support functions that likewise contributed to Dien Bien Phu's loss. First and foremost, the lack of proper intelligence—indeed the complete miscalculation of Vietnamese intent and capabilities—underpins the entire French disaster at both Dien Bien Phu and within Indochina itself. This strategic error led to a cascading series of additional, related missteps that included poor tactical efforts to mitigate the threat and the overarching inability to provide adequate airfield security, among others. In this latter respect, even after allowing for Dien Bien Phu's dynamic combat situation, the security lapses that permitted the Viet Minh sapper attacks at Gia Lam and Cat Bi near Hanoi were both devastating and inexcusable in effect. Furthermore, the French inability to secure adequate drop zones also severely limited the efficacy of the logistics chain once the airfields proved unsuitable for continued use.

The French also struggled with deficiencies in weather forecasting as well as navigational capability, which, when considered together, greatly impacted operations.[60] Low ceilings and poor visibility dominated Northern Vietnam during the winter months with debilitating fog banks often obscuring the airfield for large windows of time. The French attempted to address these effects by attaching weather balloons to the drop zones to aid identification but earned few positive results for their efforts.[61] The inadequate forecasts may have been partially mitigated with sufficient navigational aids; however, the French ultimately relied on a single radio homing beacon and very high frequency (VHF) direction finder whose wide tolerances proved impractical for locating the increasingly smaller drop zones at night or in overcast conditions.[62] Additional airfield and drop zone lights intended to assist with identification instead appeared as blinking gunfire to aircrew and did not enhance the efforts.[63] While each of these shortfalls was not definitive in its own respect, each added another complication to the monumental task of resupplying Dien Bien Phu.

Integrated Logistics

The French High Command never fully implemented the necessary steps to integrate the logistics chain despite the protracted and mobility-intensive aspects of the military campaign against the Viet Minh. To begin with, French leaders relied heavily upon the United States for material assistance, at one point receiving nearly 80 percent of their wartime resources from the Eisenhower administration.[64] This aid reinforced the French inclination against indigenous manufacturing investments that likely would have produced cheaper goods more readily available and better suited to the operational environment.[65] In this sense, from the very outset the French lacked any true sense of ownership for the critical supply chain components and further demonstrated a general unwillingness to devote "extensive attention to quartermaster problems" that dated back more than a decade.[66]

Once in theater, the French failed to optimize distribution processes for efficient operations. In comparing French Air Force logistical methods to its maintenance practices, Julian Thompson notes, "the French logistic system was similarly chaotic. For example, they had no stock control system and did not know what they had received or dispatched forward."[67] They also lacked a well-defined priority system to drive the planning and loading of the limited air assets. Although persistent rumors that French aircraft dropped ice and champagne into Dien Bien Phu are likely exaggerations of a one-time event (de Castries's promotion to flag officer), there is little doubt that, at times, less-critical stocks displaced certain higher-demand supplies such as food and ammunition.[68]

On the ground at Dien Bien Phu, the lack of dedicated cargo-handling personnel and equipment combined with the smaller side-loading door design of the C-47 added critical delays to loading and unloading processes.[69] In a threat environment, notes air mobility expert Keith Chapman, these turnaround times at the reception airfield should be as brief as possible to limit overall exposure to key air and ground personnel alike.[70] The French suffered for this deficit, particularly in the last two weeks of March when immediate Viet Minh artillery seriously threatened but did not completely close the airfield.

Personnel and process problems extended to the airdrop mission as well. Over the course of the battle, the French dropped 82,926 parachutes, including 3,763 huge cargo chutes, into the valley.[71] The sheer volume of chutes underscores their exceptional importance; however, even late into the battle only the French Airborne Supply Center in Hanoi was capable of preparing and folding the parachutes for use.[72] In practice this translated into the following process: the chutes arrived from American warehouses in Japan to the harbor at Haiphong; the parachutes were unloaded and transported to Hanoi for processing (preparing and folding) by the sole qualified members; the chutes were then finally shipped back to Haiphong for attachment to cargo loads that had also arrived at the same harbor—likely on the same ships the parachutes had originally arrived on.[73] Clearly this process added critical delays to the cargo-handling timeline that impacted the situation at Dien Bien Phu.

In the final challenge to the integrated logistics chain, the workhorse C-47 aircraft proved ill suited for the demanding resupply missions over the shrinking drop zones in the siege's latter stages. To be fair, it is difficult to ascertain whether *any* aircraft at the time could have successfully met the drop requirements; however, the C-47's side door engineering limited its airdrop off-load capacity significantly. In the last weeks of the siege, notes author Ryan Farrell, slow-flying C-47s crossed the smaller drop zones in approximately two seconds, which was not nearly enough time to manually push the supplies out the small side door.[74] A fully loaded C-47 actually required 20 passes—all within the accurate range of Viet Minh gunners—to air deliver the requisite supplies.

Technology

The French, still recovering from the devastating effects of the Second World War, possessed a technologically inferior air force consisting primarily of dated C-47s and converted Junkers Ju 52s (renamed the Amiot AAC 1 Toucan for French use).[75] Both aircraft have been discussed in previous chapters, and, while the C-47 played a pivotal role at Dien Bien Phu, the French did not use the Toucan for aerial resupply operations in the valley.

The truly innovative addition to Indochina was the Fairchild C-119 Flying Boxcar, an improved version of the C-82 Packet that saw service during the Berlin Airlift. The French employed over two dozen C-119 aircraft in Vietnam, piloted primarily by CIA personnel under French markings.[76] In accordance with the entire French air campaign in Vietnam, more Boxcars would have certainly made a difference at Dien Bien Phu—the C-119 boasted more powerful engines, increased cargo capacity, and a centerline internal monorail system that salvoed supply bundles rapidly and smoothly during supply drops.[77] C-119s from the 314th Troop Carrier Command had airdropped an entire bridge near Koto-Ri, Korea, to aid Marines in the fighting retreat from the Chosin Reservoir three years earlier.[78]

At Dien Bien Phu, Flying Boxcars dropped loads ranging from paratrooper sticks to large howitzers up until the battle's very last day in May. The heavy equipment was perhaps the most important, despite the noted structural weaknesses of the C-119, as the outgunned French desperately sought to counter the Vietnamese advantage. Although the French were ultimately unsuccessful in this particular endeavor, the C-119 represented a significant advance in airlift capabilities, one that married troop and large equipment deliveries together and ushered in new possibilities for the airdrop mission moving forward.

Significantly, there were no discernable technological advances in any of the support, cargo-handling and processing, or command-and-control elements. Future innovations such as precision-guided supply bundles would have assisted with drops to the dwindling DZs, but their cost, limited availability, and difficulties with retrieval and reuse would have weighed heavily against an employment decision.

Training

Although the French had been conducting mobile operations in Indochina for almost a decade prior to Dien Bien Phu, the battle exposed several key training shortfalls. Despite programs sponsored by advisors in the American MAAG, the French struggled (or more correctly refused) to adapt key maintenance and logistical processes to improve combat readiness. As Fall reports, "A French mission from Indochina went to visit supply operations at the 8081st Quartermaster Airborne Supply and Packaging Company of the U.S. Army at Ashiya Air Base in Japan and had returned amazed not so much at the efficiency of the American supply operation (which represented nothing out of the ordinary) but at the marvelous layout of the entire base. Less national pride and more willingness to learn from an ally would have helped the French a great deal."[79]

The state of aircrew readiness was also a concern. In addition to the previously discussed theater aircrew shortages, the French national pipeline was also perilously low with only 40 pilots in strategic reserve in late 1953.[80] This led to a necessary reliance on contract aircrew, namely the CIA pilots qualified to fill the extra C-119 cockpits that the French could not either through military or civilian means. An unintended consequence of these actions was the small but not insignificant language barrier between aircrew and ground components that resulted in misunderstandings and delays.[81] Enhanced cultural training and language capabilities may have reduced this impediment to operations.

Finally, the French suffered from a lack of training or experience in joint planning and command and control, a central element to effective counterinsurgency warfare identified in the 2007 *U.S. Army–Marine Corps Counterinsurgency Field Manual*. The manual notes that "air . . . planners require visibility of actions planned at all echelons to provide the most effective air . . . support" and that its fluid nature benefits from "informal and formal coordination and integration . . . for [maximum] efficiency."[82] One analyst attributes the French deficit in this area to the lingering effects of the Second World War by noting this was "the price the French now had to pay for their own defeat in World War II. . . . There were very few French senior officers who had sufficient command experience to make intelligent use of the available air power."[83] Enhanced training in modern C2 processes and planning functions may have successfully mitigated this weakness.

Final Analysis

Two distinct phases define the examination of the Dien Bien Phu case study with Phase One as the time frame from November 1953 to March 1954 and Phase Two from March until May 1954. At first glance French air mobility forces appear to have achieved the logistical tenets of attainability and sustainability during the first time period as reflected in figure 5.1.

In truth, however, as previously touched upon, the airlift assets were only able to provide the basic daily ration and sustainment requirements for the garrison at the expense of the defensive materials necessary to enable Navarre's hedgehog operational concept. The lack of additional resources, measured in tonnages of concrete, barbed wire, and sandbags, masked the shortcomings in command and control, training, and integrated logistics that further manifested themselves during the actual siege. Although senior French leadership disagreements concerning the actual mission of Dien Bien Phu—characterized alternately between a lightly defended offensive base for interdiction raids and a defensive stronghold that the Viet Minh would smash themselves against—contributed to the weaknesses of the Phase One air mobility campaign, the warning signs were unmistakable yet largely ignored by those outside of the air community.

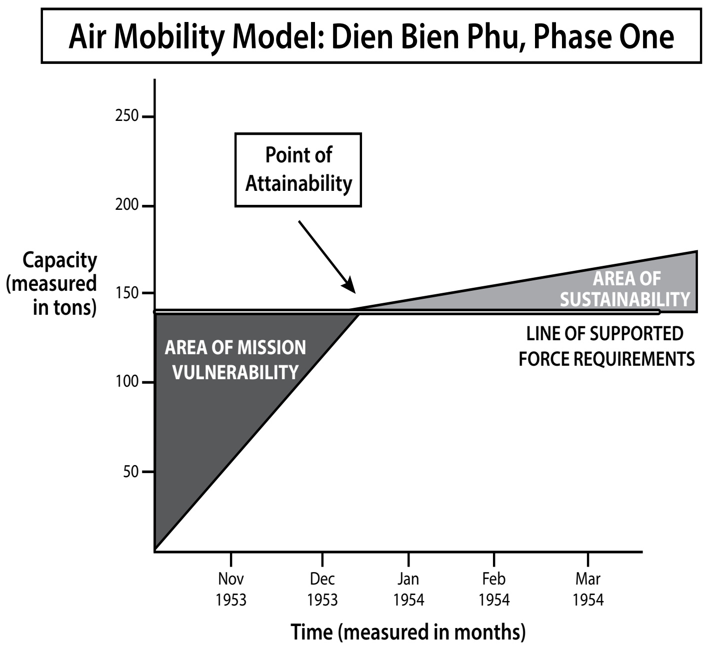

Figure 5.1. Air Mobility Utility Model: Dien Bien Phu, Phase One

The lack of freedom of movement dominates the failure of Phase Two. Once the French lost access to the primary airfield in mid-March with the loss of Beatrice and Gabrielle, their resupply difficulties intensified significantly and could not be entirely offset by airdrop sorties. In this phase, too, the miscalculations in command and control, integrated logistics, technology, and training compounded the difficult situation. Similar to Stalingrad, the debilitating effects of enemy fire may have been moderated with enhanced attention to the interrelationships between the five air mobility factors. For example, better trained and equipped ground-handling personnel working in concert with a technologically improved aircraft loading/unloading system on the C-47 (or other transport) may have reduced ground times in the threat zone and allowed more of the efficient airland missions into Dien Bien Phu. Similarly, improved command and control may have increased sortie generation rates involving the technologically superior C-119 in both the airland and airdrop mission sets with a corresponding rise in cargo delivered.

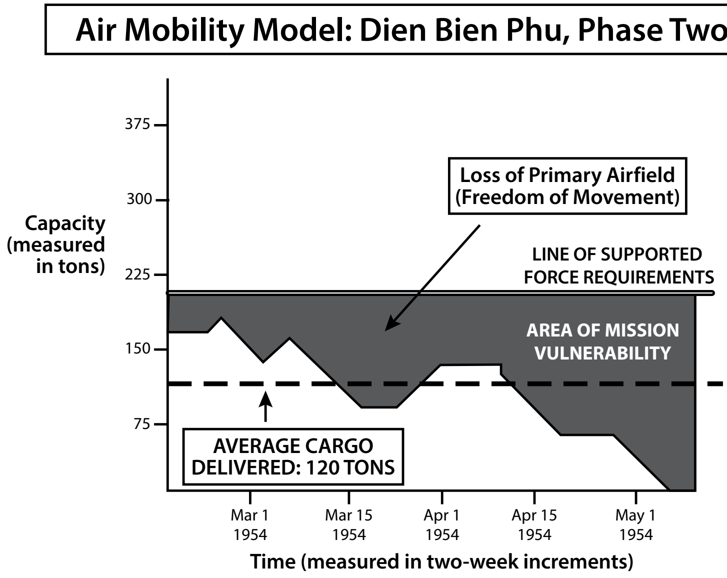

Figure 5.2. Air Mobility Utility Model: Dien Bien Phu, Phase Two with the key factor of loss of freedom of movement

In conclusion, some analysts argue that, due to the protracted nature of insurgencies, airpower is robbed of its psychological impact and is consequently ill suited to meet the demands of guerrilla warfare.[84] There is certainly an element of truth to this belief, although air mobility may be the possible exception to the rule. If planners give proper considerations to the air mobility factors for success, the psychological impacts of mass, maneuver, and flexibility that air mobility forces bring to bear in a counterinsurgency may prove the difference between ultimate mission success or resounding failure.

Notes

1. Owen and Mueller, *Airlift Capabilities*, vii.
2. Windrow, *The Last Valley*, 1.
3. Lacey and Murray, *Moment of Battle*, 389.
4. Logevall, *Embers of War*, 231–33.
5. Olson and Roberts, *Where the Domino Fell*, 34.
6. Duiker, *Ho Chi Minh*, 448.
7. Duiker, 447.
8. Morgan, *Valley of Death*, 133.
9. Davidson, *Vietnam at War*, 165.
10. Purcell, "Description and Analysis of the Sieges of Dien Bien Phu and Khe Sanh," 13.
11. Purcell, 14.
12. Plating, "Failure in the Margins," 9.
13. Duiker, *Ho Chi Minh*, 442.
14. Thompson, *Lifeblood of War*, 165.
15. Duiker, *Ho Chi Minh*, 452.
16. Shull, "The Battle of Dien Bien Phu," 14.
17. Karnow, *Vietnam: A History*, 190.
18. Thompson, *Lifeblood of War*, 166.
19. Morgan, *Valley of Death*, 195.
20. Davidson, *Vietnam at War*, 194.
21. Ireland, "Why Not Airdrop?," 20.
22. Thompson, *Lifeblood of War*, 169.
23. Olson and Roberts, *Where the Domino Fell*, 41.
24. Morgan, *Valley of Death*, 253.
25. Fall, *Hell in a Very Small Place*, 78.
26. Thompson, *Lifeblood of War*, 176.
27. Purcell, "Description and Analysis of the Sieges of Dien Bien Phu and Khe Sanh," 19.
28. Duiker, *Ho Chi Minh*, 453.
29. Bearden, *Risky Business*, 16.
30. Morgan, *Valley of Death*, 255–56.
31. Fall, *Hell in a Very Small Place*, 359.
32. Fall, 265.
33. Thompson, *Lifeblood of War*, 176.
34. Thompson, 176.
35. Thompson, 176.
36. Thompson, 176.
37. Morgan, *Valley of Death*, 559.
38. Fall, *Hell in a Very Small Place*, 408.
39. Morgan, *Valley of Death*, 238.
40. Fall, *Hell in a Very Small Place*, 454–55.
41. Fall, 455.
42. Miller, *Airlift Doctrine*, 190.
43. Farrell, "Airlift's Role at Dien Bien Phu and Khe Sanh."
44. Thompson, *Lifeblood of War*, 181.
45. Thompson, 177.
46. Karnow, *Vietnam: A History*, 194.
47. Fall, *Hell in a Very Small Place*, 457.
48. Thompson, *Lifeblood of War*, 165.

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50. Thompson, 199.
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52. Croizat, "Translation from the French: Lessons of the War in Indochina," 56.
53. Morgan, *Valley of Death*, 189.
54. Bearden, *Risky Business*, 13.
55. Bearden, 13.
56. Simonson, "The Ability to Reach," 17.
57. Ireland, "Why Not Airdrop?," 19.
58. Thompson, *Lifeblood of War*, 153.
59. Owen, *Air Mobility*, 280.
60. Croizat, "Translation from the French: Lessons of the War in Indochina," 332.
61. Bearden, *Risky Business*, 13.
62. Farrell, "Airlift's Role at Dien Bien Phu and Khe Sanh," 8.
63. Farrell, 8.
64. Khong, *Analogies at War*, 74.
65. Thompson, *Lifeblood of War*, 154.
66. Fall, *Hell in a Very Small Place*, 249.
67. Thompson, *Lifeblood of War*, 153.
68. Plating, "Failure in the Margins," 114.
69. Ireland, "Why Not Airdrop?," 21.
70. Chapman, *Military Air Transport Operations*, 114.
71. Fall, *Hell in a Very Small Place*, 411.
72. Fall, 249.
73. Fall, 249.
74. Farrell, "Airlift's Role at Dien Bien Phu and Khe Sanh," 8.
75. Simonson, "The Ability to Reach," 17.
76. Plating, "Failure in the Margins," 83.
77. Miller, *Airlift Doctrine*, 192.
78. "Amazingly Versatile Fairchild C-119 'Flying Boxcar,' " 12.
79. Fall, *Hell in a Very Small Place*, 249.
80. Fall, 304.
81. Farrell, "Airlift's Role at Dien Bien Phu and Khe Sanh," 8.
82. Petraeus and Amos, *The US Army–Marine Corps Counterinsurgency Field Manual*, 370.
83. Fall, *Hell in a Very Small Place*, 458.
84. Meilinger, *10 Propositions Regarding Airpower*, 33.

Photo Gallery

The first sustained test of air refueling occurred in 1929 when the flight of the *Question Mark* stayed airborne for more than 150 hours across 43 in-flight refuelings. Note the hose being held by an occupant of the receiving aircraft, possibly Maj. Carl Spatz (the spelling later changed to Spaatz).

Maj Ruben H. Fleet stands beside one of six JN-4 "Jennies" used in the first Air Service mail route from Washington, DC, to New York City in 1918. The service would need to relearn critical lessons regarding training, technology, and operational support when it resumed mail operations in the 1930s.

German soldiers using rudimentary sleds struggle to unload critical supplies from a Ju-52 near Stalingrad. The extended ground times required to unload the aircraft reduced the amount of daily resupply trips possible while increasing the aircraft's exposure to hostile Russian fire.

Early Allied campaigns against Japanese forces within Burma were hampered by the lack of suitable roads and dense jungle terrain until airdrop as a resupply method was firmly established.

"Kickers"—C-47 aircrew who would literally kick out resupply bundles over waiting troops and drop zones—proved a critical piece of the integrated logistics chain.

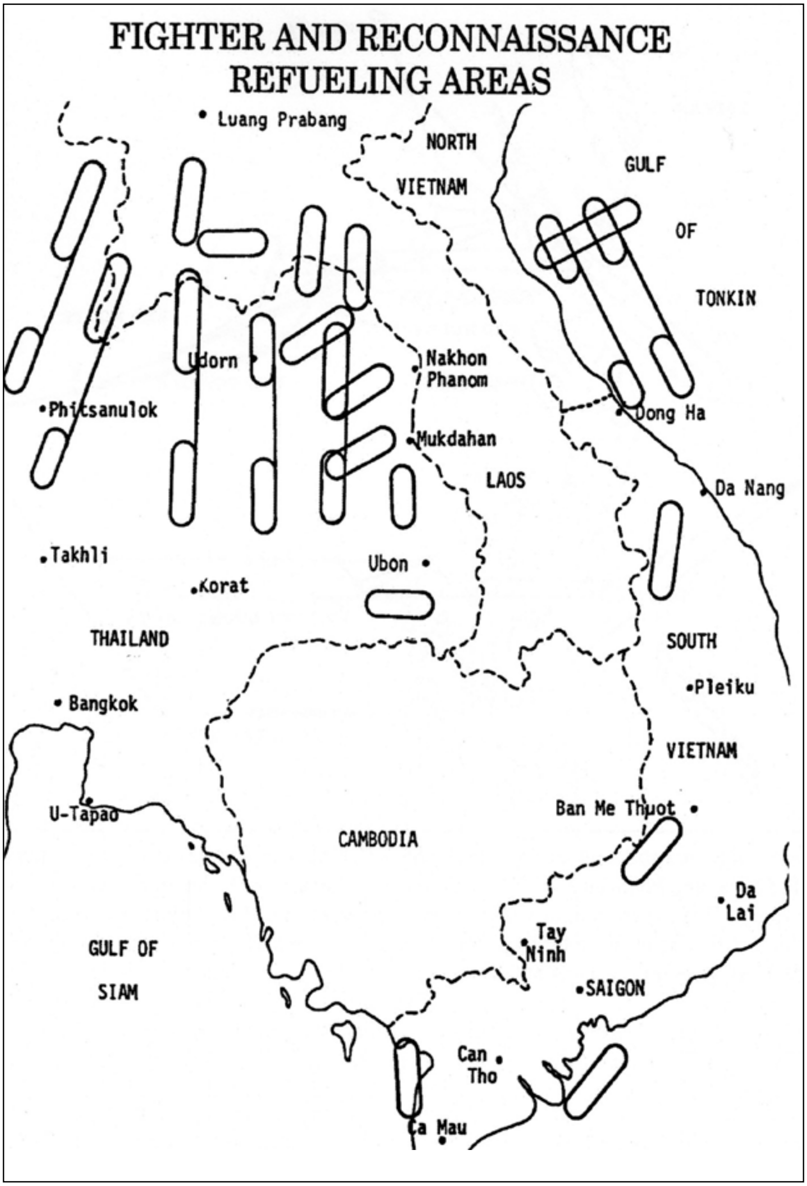
Iconic photo of a US Air Force C-54 landing at Berlin's Tempelhof Airport as part of Operation Vittles—better known as the Berlin Airlift and one of the most significant events in the Cold War. As the airlift progressed, aircrew trained in Great Falls, Montana, at an airfield specifically designed to simulate the challenging approach conditions Tempelhof was known for.

A renewed focus on integrated logistics helped to steadily lower average loading times from multiple hours at the beginning of the Berlin Airlift to less than an hour by the operation's end.


Dien Bien Phu was designed and built under the French base *aero-terrestre* operational concept where the fortified airland base would rely on airpower for both its supply and defense.

As the battle of Dien Bien Phu continued, the accurate Vietminh antiaircraft fire—from extensive positions ringing the surrounding hills—made aerial evacuation of casualties extremely hazardous.

A Young Tiger KC-135 refuels an F-105 en route to strikes over Northern Vietnam. “Without tankers, the whole character of the war would have changed,” noted Lt Col Stanley J. Dougherty (as quoted in David M. Cohen, *The Vital Link* [Maxwell AFB, AL: Air University Press, 2001], 5).



Established freedom of movement as well as clear command and control underpinned the numerous air refueling "tracks" that supported more than 30,000 sorties in 1968 and over 1.4 billion pounds of fuel offloaded in 1969.

A technological marvel and one of the world's largest aircraft, the C-5 was specifically designed to carry outsized military equipment. During Operation Nickel Grass C-5s delivered 48 percent of the operation's total cargo while flying only 25 percent of its missions.

An M60 tank is unloaded from a C-5 Galaxy during Operation Nickel Grass. The strong command-and-control system, as well as the fine-tuned integrated logistics network, expedited loading operations and kept critical supplies moving quickly from the United States.

With little more than a card table and a radio, US Air force combat controllers rapidly restored air traffic control services into Haiti's Toussaint L'Ouverture International Airport. Combined with specially trained Contingency Response Group personnel who managed airfield operations, ultimately more than 18,000 tons of aid was delivered by nearly 4,000 sorties.

A US Air Force C-17 Globemaster III readies for departure with nearly 200 Haitian refugees on board. A large portion of air mobility forces resides in the Air Force Reserve and Air National Guard components, in turn highlighting the criticality of sustained training opportunities to ensure readiness across all mission sets.

The hi-tech Combined Air Operations Center at Al Udeid Air Base, Qatar, directed the air war against ISIS. After Russian entry into the theater in September 2015, the CAOC played a pivotal role ensuring deconfliction across the increasingly crowded airspace.

US forces enjoyed access to modern airfields with enhanced, integrated logistics systems to support sustained (and often intense) flying operation. Here a ground crew pumps a portion of the more than 500,000 gallons of aviation fuel processed daily at the fuel bladder farm at Al Dhafra Air Base, United Arab Emirates.

A US Navy F-18 refuels from a KC-135 during a strike mission against ISIS forces in 2014. Note the “basket” signifying the probe and drogue refueling system used by naval and allied aircraft. The KC-135 must be configured on the ground for either boom or drogue missions, thus limiting its flexibility once airborne.

Chapter 6

Young Tigers

The long haul is now over, the Young Tiger must withdraw,
But they stand ever ready, to extend their mighty paw.
Ask any fighter jock, as he was very well aware—
That when he hollered "Bingo" a Tiger was always there.

—"Ode to the Young Tigers"

In the first week of January 1929, airpower pioneers headlined by future icons Carl Spaatz, Ira Eaker, and Elwood Quesada ushered in a new era of flight when their venerable Atlantic Fokker C-2A *Question Mark* aircraft stayed airborne for more than 150 hours.[1] The endurance record alone, however, was not the flight's most consequential aspect but rather the unprecedented 37 air-to-air refuelings that permitted the record-setting attempt.[2] Thirty-five years later, in a distant Southeast Asia war, another air refueling team similarly added a momentous chapter to the annals of flight. Just as the *Question Mark* Airmen established new possibilities for the concept of air refueling, the Young Tigers of the KC-135 Tanker Task Force in Vietnam demonstrated new potential for its combat employment. As the later chapter on Islamic State of Iraq and Syria (ISIS) illuminates, air refueling remains a strategic, force-extending capability vital to the American way of war. Here, in its relatively modern infancy, a deeper examination of its principles through the lens of Vietnam's tanker force yields invaluable insights.

Campaign Background

The United States's involvement in Vietnam largely began with its 1950 advisory mission to the French forces battling the growing Viet Minh threat.[3] After the catastrophic defeat at Dien Bien Phu and France's subsequent withdrawal from Indochina, the US maintained a small group of nearly 900 advisors within South Vietnam to support the fledgling Ngo Dinh Diem regime and his Army of the Republic of Vietnam (ARVN).[4] The number of combat advisors rapidly escalated to more than 16,000 soldiers by 1963 as Pres. John F. Kennedy's administration, facing communist threats in Berlin, Cuba, Laos, and space, sought to halt its spread into Asia while bolstering America's international credibility and prestige.[5]

After the November 1963 assassinations of both Diem and Kennedy, new US president Lyndon B. Johnson focused on the growing threat in Vietnam and pledged to answer the communist aggression with strength and resolve.[6] A turning point occurred in August 1964 when North Vietnamese torpedo boats allegedly attacked two US Navy destroyers over several days in the Gulf of Tonkin. This act led to the congressional Gulf of Tonkin resolution giving Johnson broad powers to conduct military operations within Southeast Asia without a formal declaration of war.[7]

Johnson's administration first retaliated with a series of gradual bombing campaigns—codenamed Operations Flaming Dart, Rolling Thunder, and Arc Light—which lasted three years (1965–68) and were intended to dissuade North Vietnamese support for the Vietcong guerrillas operating within South Vietnam. The target sets, although slightly different within each separate operation, generally centered on the North Vietnamese air defenses, transportation networks, and industrial base along with infiltration routes and supply depots used by the Vietcong.[8] Although a series of bombing pauses and politically based restrictions marked the air campaigns, the escalation in US ground forces continued unabated, reaching a peak of more than 500,000 troops in 1968.[9]

The large-scale Vietcong offensive over the 1968 Chinese lunar holiday of Tet shattered any optimistic illusions concerning the war's progress. Although a tactical defeat, the Vietcong gains reverberated most effectively in the United States as Johnson decided against a reelection bid and Richard M. Nixon replaced him in the White House in 1968.[10] Nixon pledged a policy of "Vietnamization," where ARVN personnel would bear greater responsibility for South Vietnam's defense while US troops began to withdraw in 1969.[11] As the war spread into neighboring Laos and Cambodia, war protests within the US intensified amid continuing battlefield reverses on the part of the South Vietnamese, in turn adding greater pressure on the Nixon administration to bring US involvement to a close.[12]

In the spring of 1972 the conflict shifted again as the North Vietnamese regular army, taking advantage of the now widely diminished US ground troop presence, launched a full-scale conventional invasion of South Vietnam—the Easter Offensive.[13] Only US airpower intervention, primarily in the form of Operation Linebacker's heavy

B-52 strikes, staved off defeat, although the offensive painfully exposed the inherent weakness of the Vietnamization policy.[14] Throughout much of 1972 Secretary of State Henry Kissinger secretly negotiated a peace treaty with North Vietnamese representatives before finally producing an agreement in October against the backdrop of continued US ground force reductions.[15]

When both the North and South Vietnamese governments failed to ratify the agreed-upon peace accord, Nixon ordered Operation Linebacker II, the massive bombing of Hanoi and Haiphong harbor, in an attempt to break the diplomatic deadlock.[16] The 11-day bombing campaign spanning the last week of December 1972 achieved its intended effect, and all parties signed the Paris Peace Accords at the end of January 1973, essentially ending the US involvement in Vietnam.[17] In April 1975 a South Vietnam lacking US military assistance (specifically airpower) fell under the assault of North Vietnamese conventional forces and, in July 1976, the communists formally unified the country as the Socialist Republic of Vietnam.[18]

The Air Mobility Campaign

The Vietnam War marked the first contemporary example of a "Tanker War." As author Keith Hutcheson asserts, after nearly 178,000 sorties and 8.2 billion pounds of fuel off-loaded over nine years, many analysts believe KC-135 Stratotankers "were the key to all successful air operations . . . and the associated ground operations."[19] Indeed the capability and versatility of the tanker fleet, translated into increased weapons loads and greater endurance for its associated receiver units, dramatically changed the nature of air warfare—and Vietnam was its proving ground.[20]

This profound paradigm shift in air warfare induced by the KC-135 did not occur all at once. To begin with, Strategic Air Command (SAC) planners, who retained strict control over the KC-135 inventory under the single manager construct, established initial, modest goals for the fleet: support day-to-day operations in Southeast Asia, enhance Pacific Air Force (PACAF) air refueling training, and prepare for the anticipated use of B-52s later in the war.[21] Within these broad priorities, intended to preserve the KC-135 for its primary mission supporting the nuclear Single Integrated Operational Plan, the first theater air refueling occurred on 9 June 1964 as four tankers (known as the Yankee Team Tanker Task Force) provided prestrike refueling to eight Laos-bound F-100s.[22] After the Gulf of Tonkin incident two months later, however, air operations grew dramatically.

The expanded operations primarily took the form of the Flaming Dart, Rolling Thunder, and Arc Light campaigns of early 1965. To meet these demands the 45 in-theater tankers based at Kadena Air Base, Okinawa, were allocated between the two larger operations, with 30 assigned to Arc Light B-52 sorties and 15 matched to the tactical missions that earned the Young Tigers their name.[23] In actuality, only 35 percent of missions supported Arc Light while the remaining 65 percent were Rolling Thunder tactical sorties, causing leaders at the 3rd Air Division (AD) to remove any mission distinction between the crews and aircraft except for minor administrative purposes.[24]

The Report of the Office of the Secretary of Defense Vietnam Task Force officially described the three-year Rolling Thunder air campaign as "a program of measured and limited air action . . . against selected targets in the Democratic Republic of Vietnam" intended to dissuade the North's logistical support of guerrilla forces in the South and to force Hanoi to the peace table.[25] Arc Light's goals were similar and pursued under the intimidating carpet bombing tactics of the heavy B-52s. The associated tanker bill for both operations was large as Arc Light missions swelled to nearly 850 missions a month and tankers supporting Rolling Thunder F-105s and F-4s logged over 32,000 sorties in 1968 alone.[26] The next year witnessed only a slight decrease to 28,000 total tanker missions with 1.4 billion pounds of fuel off-loaded.[27]

The typical tanker mission profile consisted of takeoff and cruise to an established air refueling area (designated either a track or anchor area on the basis of available size) where the strike package of attack, bomber, or reconnaissance aircraft rendezvoused for prestrike top-offs, typically equaling 10,000 pounds per fighter and 80,000 pounds per bomber or large aircraft.[28] Afterward the tanker crew loitered in the refueling area to conduct poststrike refuelings before returning to base. One of the most rewarding aspects of the Vietnam tanker mission set was the "save," where pilots of battle-damaged aircraft experiencing fuel loss linked up with a tanker, often over hostile territory, to receive the fuel that enabled a safe return to base. Tankers recorded more than 500 saves, although more likely occurred, and almost all involved significant risk and skill on the part of both tanker and receiver aircraft.[29]

The heavy volume of tactical sorties eventually influenced the decision to base more KC-135s closer to receiver units within Southeast Asia to increase operational efficiencies. Studies demonstrated Thailand-based tankers could supply two to three times more fuel than the Kadena-based tankers and a complement of 10 mainland tankers could match the off-load capability of 22 from Okinawa.[30] Construction of the new main operating base at U-Tapao Air Base (AB), approximately 90 miles southeast of Bangkok, supplemented forward operating bases at Don Muang and Takhli.[31] Additional airfields throughout the theater, most notably Ching Chuan Kang (CCK) Air Base on Taiwan, serviced other refueling requirements for strike and reconnaissance aircraft, such as the ongoing, high-demand SR-71 Blackbird sorties.[32]

To provide enhanced operational command and control, SAC established the 4252nd Strategic Wing at Kadena and later the 4258th Strategic Wing at U-Tapao, with both wings reporting to SAC's 3 AD at Andersen Air Base, Guam.[33] On several occasions higher headquarters reorganization plans called for placing tanker management responsibilities under the 2 AD, the tactical arm of PACAF that later became 7th Air Force.[34] SAC, and even elements of PACAF itself, resisted these initiatives while citing the effectiveness of the SAC liaison function to the 2 AD in meeting the air refueling requirements. SAC ultimately rejected the reorganization plans, although ensuring tanker responsiveness to dynamic tactical refueling taskings remained an ongoing organizational focus.[35]

The pivotal year of 1972 proved to be a record-setting one for the Young Tiger tanker force. Extra Stratotankers added to both Kadena and Clark AB in the Philippines accounted for 90 total tanker support missions per day while 62 Thailand-based aircraft accounted for another 80 daily sorties during the Easter offensive.[36] Throughout the year additional KC-135s augmented each base before achieving a wartime high-water mark of 170 total aircraft supporting the Vietnam air campaign directly.[37] September 1972 proved the busiest month of the war with 3,902 refueling missions divided between 2,661 Young Tiger and 1,241 Arc Light sorties.[38] Moreover 12,000 individual receivers took on 159 million pounds of fuel over the course of the month.[39] Refueling operations spiked again during the intensive Christmas offensive of Linebacker II, with KC-135s flying 1,312 sorties and providing 4,593 refuelings to mark one of the last acts of the Vietnam drama.[40]

Tanker missions continued to dwindle over the next two years, accelerated by the departure of combat forces from the Pacific in response to the October 1973 crisis in the Middle East. By May 1974, tanker operations had returned to normal PACAF peacetime levels and the US fundamentally closed its air commitment to Vietnam.

Analysis of Key Air Mobility Principles: Freedom of Movement

Air Superiority

The establishment of air superiority in the Vietnam War was a critical factor in the success of the US tanker fleet. Importantly, in many ways the tanker fleet played a key part in preserving the freedom of movement they enjoyed throughout the campaign. By increasing both the endurance and ordnance-carrying capability of the fighter aircraft that maintained the requisite air superiority, the KC-135s were able to assist in ensuring the viability of their own critical enabling role.

The potential threat and attendant risk, however, was never far from senior leader consideration. Historian Charles Hopkins notes how SAC leadership, charged with overall responsibility for executing the national nuclear response mission, may have reasonably demurred with risking strategic KC-135 assets in what was ultimately a limited war.[41] Instead the leaders chose to manage the risk to an acceptable level by basing tactics on solid intelligence and placing restrictions on where tankers could safely operate.[42] While tanker crews were thus limited by regulation to operations below the nineteenth latitude, dedicated tanker crews in many instances accepted the potential risk to "save" stricken aircraft both north of the twentieth latitude and within other threat areas.[43]

Gen Charles Horner, the future Desert Storm air commander and a Vietnam-era F-105 pilot, remembers "in Vietnam being over Hainan Island, almost out of gas. And here comes a KC-135, way up north of where he ought to be because of the enemy threat. And [me] turning around to get in behind, getting enough fuel to get home."[44] Ultimately the Air Force lost only four KC-135 aircraft in Southeast

Asia and none to enemy action while saving countless friendly assets with timely air refueling.[45]

Future adversaries, however, recognize the critical importance of tankers dating from America's Vietnam experience and similar operations and will likely target the assets in an effort to degrade and disrupt a critical enabler in US air campaigns. Future mobility leaders, analogous to their SAC predecessors, will need to balance the potential risk-versus-reward calculus in managing the strategic tanker fleet during combat operations.

Access

Access remains another dominant factor in the success of general air mobility operations and specifically air refueling campaigns. Author John Payne identifies how tanker locations in Southeast Asia would "ebb and flow based on political constraints, weather, operations tempo, and infrastructure limitations."[46] The operations tempo element is important because, similar to airlift operations, the management of critical distance is paramount. In essence the basic concept acknowledges that the greater the fuel amounts required by tankers to transit to an air refueling area, the correspondingly less fuel available for receiver off-load or to loiter to meet additional mission requirements. Additionally, the greater fuel transfers provided per single tanker reduces the overall number of tankers required—that is, one aircraft can accomplish the task instead of two or three, in turn better preserving the fleet's viability over the long term. During the opening years of the Vietnam conflict, the advantage of Thailand-based tankers was not as readily apparent given the large B-52 strategic requirements generated from Guam and the Philippines and serviced by Kadena tankers. As the tactical sorties increased in later years, however, the nearly tripled off-load capacity of the Thailand force, enabled by the shorter critical distance, made a tremendous difference.

Political constraints also heavily impacted basing access in Thailand. Initially KC-135s operated out of Don Muang International Airport in Bangkok, where its modern facilities expedited the smooth flow of tanker operations. Ultimately the highly visible nature of the KC-135s influenced host-nation sensitivities perhaps to a greater degree than a basic airlift aircraft presence would have—tankers, in practice, have a clearer connection to direct combat support operations in comparison to other mobility platforms.[47] This restriction led the US to develop U-Tapao AB by 1966, and the base quickly evolved into the primary operating location for the Southeast Asia tankers.

One final access consideration focused on infrastructure limitations. Permanent bases in Okinawa, Guam, and the Philippines were constructed to rigorous US engineering standards and were well suited for hosting tanker units. Other bases, however, suffered under the exigencies of rapid expansion. Taiwan's CCK AB repeatedly experienced airfield issues ranging from navigation and radar approach control outages to petroleum and oil shortages.[48] Ramp and support facility constraints also significantly hampered Takhli AB in Thailand.[49]

In retrospect the US Air Force in Southeast Asia ultimately benefited in many respects from relative "quantity over quality" in achieving operational flexibility through its basing options. In view of the many basing factors for consideration, John Payne was correct in noting that the "need for prior coordination to strategically locate the tanker aircraft continued to be a fundamental concern when employing the tanker."[50]

A corollary but important point regarding the freedom of movement factor involves the necessary airspace to conduct air refueling operations. Such access was not an issue over Thailand, given its proximity to hostile North Vietnam airspace and the fact that most refueling occurred at 15,000 feet, well below altitudes civilian aircraft normally utilized. Around the Philippines, however, the restrictions were considerable. "Arc Light refueling areas had to compete with commercial airline routes for the duration of the Southeast Asia hostilities," writes Charles Hopkins, "and Manila Air Traffic authorities naturally tended to give preference to the profitable commercial business."[51] Over the nearly decade-long engagement, however, military and civilian agencies around the region eventually reached compromises that facilitated safe and effective flight operations for all concerned parties.

Command and Control

The Tanker Task Force in Southeast Asia remained under the command and control of SAC leadership for the duration of the air war. This arrangement, referred to as the single manager concept, ensured standardization and effective utilization of tanker assets not just in the western Pacific but also across additional competing global interests. As previously mentioned the 3 AD controlled Vietnam-tasked tankers, which comprised 13 percent of the entire Air Force inventory, with a liaison detailed to the tactical air division (2 AD) to both validate the daily taskings and simultaneously educate the tactical force on tanker capabilities and employment.[52] The system generally proved effective, and Airmen rejected attempts to subsume the tankers under Lt Gen William Momyer's Seventh Air Force.[53]

C2 Operational Responsibility

The Air Force carefully implemented and executed the operational command-and-control element during the Vietnam War. While faced with many uncertainties at the war's outset, the operational C2 function steadily improved over the conflict's duration. The decision to form one aircraft pool for tanker taskings, for example, and subsequently remove the distinction between designated Arc Light and Rolling Thunder mission taskings is a case in point. This consequently introduced greater flexibility and responsiveness into the C2 process. Additionally the SAC liaison officer worked to streamline the higher headquarters tasking process by removing classified but nonessential information from the daily mission tasking order, thereby ensuring the wing planning sections received the key information earlier and could generate aircraft accordingly.[54]

The scheduling and distribution of tankers provided the most tangible operational benefit. SAC planners determined the tanker task force could supply 1.8 million pounds of fuel daily by spacing refuelings at 40 percent in the morning, 40 percent in the afternoon, and 20 percent at night.[55] PACAF planners, however, preferred mass strike packages that lowered the daily fuel allowance to 1 million pounds.[56] They also preferred tying specific tankers to specific receivers whereas SAC favored simply calculating the planned off-load in pounds and generating sorties to meet this total.[57] The difference was subtle, but the latter construct offered increased flexibility, and all parties conducting air operations within Vietnam generally adopted that model. In particular, SAC's approach proved the most efficient as refueling requirements fluctuated in the war's later stages. The philosophy also formed the basis for air refueling planning in the decades after Vietnam, although it took until the late 1990s for the methodology to be firmly cemented, when its operational tenets were proven once again during Operation Allied Force.

C2 Support Responsibility

In general, the support command-and-control responsibilities enhanced operations and, in only a few isolated instances, detracted from operational capability. With a robust network of established theater bases, the intelligence, tactics, weather, security, communications, and airfield components strengthened the intensive air operations. Intelligence, for example, identified a potential surface-to-air missile site near the North Vietnamese border and adjusted the air refueling tracks and fighter coverage accordingly.[58] Weather also proved challenging given the region's intense monsoon seasons that affected not only the bases but the numerous refueling areas as well. The introduction of satellite imagery, a new technology at the time, greatly aided the forecasting services.[59] The security situation precluded basing tankers within South Vietnam, but neither ground fire nor sapper infiltration damaged any KC-135s throughout the conflict.

The Air Force invested the majority of its C2 support effort in either establishing or refurbishing the airfields at Takhli, U-Tapao, and CCK AB. These airports, records Hopkins, employed practices "that would have been anathema at continental CONUS bases. . . . The bases were frequently under major construction, their taxiways narrow, their lighting inadequate to nonexistent."[60] Theater leadership worked diligently to rectify the airfield and support facility deficiencies and to bring the bases up to US Air Force heavy jet aircraft standards. This entailed, for example, providing operating runways nearly 13,000 feet long for fully loaded yet underpowered KC-135A aircraft.[61] The efforts persisted throughout the nine-year engagement, but aircrew and practitioners generally regarded them in positive terms.

Integrated Logistics

In stark contrast to the airlift mission, which may involve a multitude of different cargo types requiring shipment, an air refueling operation's primary logistical concern is fuel availability. As evidenced by the numbers already documented in this chapter, this may be a daunting task given quantities that range annually in the millions of gallons. In large part the integrated logistics chain in the Pacific was able to satisfy the air fleet's requirement. Ships and pipelines transported much of the required fuel to base fuel facilities where trucks or refueling nozzles located in the ground transferred it to KC-135s.

But at Takhli and CCK AB the lack of fuel capability noticeably impacted operations. Fuel was so limited at Takhli, for example, that contracted trucks labeled the "Red Ball Express" drove replenishment stores from Bangkok every night.[62] The situation at CCK was even more frustrating. While the remainder of the base boasted exceptional support facilities built to modern airfield standards, the fuel capacity and transfer system repeatedly proved problematic. "The Air Force experimented with a variety of processes to supply the fuel," notes John Payne, "to include pumping it directly from oiler ships just off the coast, but despite these efforts the limitations would continue to bother operations at CCK throughout its history."[63] The difficulties forced tanker planners to continually revisit and rearrange unit and aircraft basing plans because of the fuel shortages at these two locations. It was a problem only partially mitigated by the war's end.

Technology

The Boeing KC-135 Stratotanker formed the technological centerpiece of the Young Tigers campaign. In operational service less than a decade by 1964, the KC-135 answered the Air Force's need for a high-performance, dedicated tanker to match the greater speeds and altitudes of the new generation fighters and bombers, specifically the B-52.[64] Although underpowered with four JP-57 engines offering only 11,000 pounds of thrust each, the KC-135 could carry fuel loads of 200,000 pounds at a range of 9,900 miles.[65] By 1962 the Stratotanker's inherent advantages over the piston-driven KB-97 and KB-50 tankers ensured KC-135s fulfilled all overseas SAC rotations.[66]

One crucial limiting factor was the KC-135's refueling system. The Stratotanker employed an innovative flying boom design that mated with the receiver's air refueling receptacle when steered in place by the enlisted boom operator.[67] For Air Force receivers, the system enhanced safe and efficient operations. Navy aircraft, however, utilized the probe-and-drogue system that included a soft basket trailing from the tanker that the receiver aircraft rendezvoused with and refueled by employing a probe on its aircraft. Ultimately Air Force KC-135s could only be configured with one boom system type on the ground (either boom or basket) and could not switch between systems in the air based upon the receiver type. This design constraint limited the tanker force's operational flexibility during the execution phase.

Air refueling rendezvous procedures benefited substantially from technological advancements. As the war continued, tanker and receiver developments in airborne identification equipment effected increasingly smoother airborne linkups under combat conditions.[68] Primitive direction-finding navigation aids consisting of a single arrow pointing in the receiver's general direction progressed to air-to-air navigation systems with specific direction and distance information that mirrored ground-based aids. Aircraft also incorporated beacons identifying exact aircraft types, in turn easing precise receiver validation in congested airspace. Radio served as a sound alternative in the event other rendezvous methods failed, but planners reserved the frequencies for ground control intercept (GCI) crews who vectored tankers and thirsty receivers together. "Dependence on GCI," notes Hopkins, "amounted to a major innovation in air refueling procedures."[69]

As previously noted, the support elements also benefited from enhanced technology in the form of the new satellite imagery for improved weather forecasting, upgraded secure communications linking the bases to higher headquarters and each other, and valuable airfield support equipment reflecting key advancements in navigation and heavy jet airport design and repair.

Training

Training in Southeast Asia profited from SAC's role as the single manager of the KC-135 fleet. During this period, training remained the primary focus for strategic aircrew outside of Southeast Asia, and, fortunately, air refueling skills transferred easily between the nuclear mission and the theater sorties. SAC's policy of crew integrity, where the pilot and boom operator team stayed together for the duration of their deployment, also reinforced the culture of standardization that eased additional training requirements.[70] Tankers also provided supplementary air refueling training to PACAF aircraft when the operations tempo permitted, although this was not generally possible from 1965 onward.[71]

Final Analysis

In the air mobility utility model reflected below in figure 6.1, the Young Tigers successfully achieved the logistical tenets of attainability and sustainability even as the supported users' requirements grew exponentially throughout the air campaign. That is perhaps the most significant difference of this model in comparison to the other air mobility utility models examined: over the course of nine years the supported force requirements did not remain constant but fluctuated given the specific phase of the conflict. The responsiveness of the command-and-control element to aircrew and aircraft management, as well as to the opening and sustaining of new operating locations, ensured the flexibility necessary to adjust to the rising demand and was the primary factor in the Young Tigers' success.

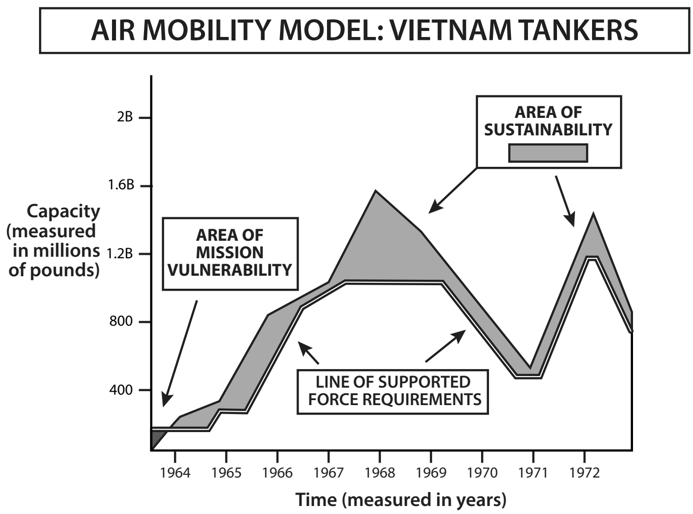


Figure 6.1. The Air Mobility Utility Model: Young Tigers in Southeast Asia

The well-trained, disciplined crew force, equipped with a modern designed-to-mission aircraft and exercising freedom of movement, also proved to be important elements. If host nations denied tankers basing access or if the available basing solutions were located prohibitively far from the user requirements, the air operations would have been necessarily and dramatically different. In the same vein if air superiority had not been established, the tanker's key enabling role would have been greatly diminished.

Although the conflict ultimately ended in bitter defeat for the United States, the conflict validated the critical importance of the KC-135 and its crews and their contributions cannot be overemphasized. As Walter Boyne concludes, "Without tankers, the whole character of the war would have changed. The politically sensitive B-52s would have required much closer basing to Vietnam . . . . Tactical fighter missions would have been less effective and far more complicated and hazardous. More ground troops would have been necessary to protect additional bases in South Vietnam. Additionally, it is difficult to conceive of any operation on the scale of Linebacker II without air refueling."[72] In essence, the entire Southeast Asia air war would have been dramatically different—and likely prohibitively less effective—without the key role of the US Air Force Young Tigers fleet.

Notes

1. Nalty, *Winged Shield, Winged Sword,* vol. I, 115.
2. "Aeronautics: Question Mark."
3. Nagl, *Learning to Eat Soup with A Knife*, 118.
4. Nagl, 120.
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Chapter 7

Operation Nickel Grass

For generations to come, all will be told of the miracle of the immense planes from the United States bringing in the material that meant life to our people.

—Israeli Prime Minister Golda Meir

For nearly five decades spanning the height of Cold War tensions, airpower embodied the nation's primary deterrence force. From the iconic images of a cigar-chomping Curtis LeMay to the poised bomber and missile fleets on minutes' alert, the Air Force in general and Strategic Air Command in particular led the United States's strategy to prevent full-scale nuclear holocaust. Air mobility's pivotal role in the deterrence mission, however, has garnered considerably less attention than these high-profile strategic forces. Yet the rapid transport of troops and equipment to developing combat situations may help decisively shape an unfolding conflict before escalatory actions exceed acceptable political thresholds—for either conventional or nuclear war. The 1973 strategic airlift known as Operation Nickel Grass typifies this powerful relationship between deterrence and air mobility capability.

Campaign Background

On 6 October 1973, forward elements of the Egyptian Eighteenth Division blasted through the formidable Israeli defensive posts of the Bar-Lev Line overlooking the Suez Canal.[1] The division, one of five comprising an assault force totaling more than 100,000 soldiers and 1,500 tanks, followed its surprise success with the prompt deployment of pontoon bridges across the canal.[2] Soon thereafter a mass of Egyptian units, under the cover of more than 200 MiG and Sukhoi fighters, poured into hastily established bridgeheads on the Sinai Peninsula.[3]

At nearly the same time more than one hundred Syrian air force attack planes bombed and strafed Israeli positions in the Golan Heights in Israel's far northeast corner.[4] The aerial bombardment targeted key communication centers and antiaircraft batteries and preceded a coordinated armor and infantry attack by five Syrian divisions comprising more than 500 tanks and over 9,000 supporting artillery pieces.[5] The Syrian armies, after splitting the Israeli defensive forces, planned to regroup and drive southwestward to the Sea of Galilee.[6]

The Arab forces timed their surprise offensive perfectly. After masking preparations in the preceding months with numerous large-scale border exercises, the Egyptians and Syrians chose Yom Kippur—the Day of Atonement and the holiest day in the Jewish year—to launch their attacks.[7] In what would soon become known as the 1973 Arab-Israeli War but was widely regarded as the Yom Kippur or October War, the Arab armies battled fiercely to reclaim the Sinai Peninsula and the Golan Heights, two territories captured by Israel in the 1967 Six Day War.[8]

As the initial shock wore off, the Israel Defense Forces (IDF) responded rapidly to the emergent threat. After mobilizing its remaining reserve forces, the IDF strategy called for defeating the Syrian advance first while holding along the western front where the Sinai Desert's vast spaces afforded the tactical luxury of trading space for time.[9] The Israeli forces soon realized that the Arab militaries in 1973 were qualitatively superior to those encountered just six years earlier—particularly the Egyptian armies.[10]

Under withering antitank and antiaircraft fire, Israeli casualties quickly mounted. The IDF suffered 49 downed warplanes and more than 500 tanks destroyed in the first four days alone.[11] Equally troubling were the massive ammunition expenditures that rapidly depleted Israeli reserve stocks. Faced with the unexpectedly high losses, Israeli Defense Minister Moshe Dayan broached the idea of employing Israel's unacknowledged but potent nuclear stockpile.[12] After intense discussions Prime Minister Golda Meir assented to initial planning steps and further authorized the preparation of 13 tactical nuclear rockets for use in the case of impending defeat.[13]

Upon discovering Israel's nuclear mobilization through intelligence channels and fearing the potential repercussions given Soviet support of its Arab client states in Egypt and Syria, Secretary of State Henry Kissinger persuaded Pres. Richard Nixon to approve an airlift to replace Israel's conventional material losses.[14] The president approved the request on 9 October 1973, and Operation Nickel Grass was underway.

The Air Mobility Campaign

The first few days of the airlift progressed slowly as the US military and National Command Authority debated the best airlift course of action. The policy makers weighed various options, including collecting supplies at key East Coast hubs or Lajes Air Base (AB) in the Azores for transshipment by El Al Airlines (Israel's national carrier) to Israel, the exclusive use of American commercial carriers, using sea carriers for shipment (although they discarded this option early in the planning stages as too slow), or the employment of Military Airlift Command (MAC) aircraft for flights either to Lajes for transshipment to other aircraft or directly into Israel proper.[15] The first two options sought to deliver the necessary support while simultaneously limiting US diplomatic exposure to its angry Arab partners, most notably Saudi Arabia, who along with other Organization of Arab Petroleum Exporting Countries (OAPEC) members instituted an oil embargo effectively quadrupling global fuel prices overnight.[16]

After three days of deliberations, whose delay provoked another urgent appeal from Prime Minister Meir, President Nixon on 12 October angrily demanded the US initiate the airlift utilizing MAC aircraft. "Goddamn it," Nixon fumed to his staff, "use every one [i.e., C-5] we have. Tell them to send everything that can fly."[17] MAC commander Gen Paul K. Carlton, anticipating the order after witnessing the small tonnage amounts El Al airliners proved capable of transporting, quickly sprang into action.

During this decisional period Carlton and his MAC staff had aggressively postured the logistics chain for action. Their efforts, along with those of Air Force Chief of Staff Gen George Brown, paid off when they finally received the execution order.[18] In the previous three days, they had assembled vital munitions and advanced missiles at 29 standard MAC shipping points, principally military bases, where logisticians rapidly inventoried the materiel and loaded it onto waiting cargo aircraft.[19]

The fully loaded aircraft—Lockheed C-141 Starlifters and C-5 Galaxys—then departed the continental United States for the six-hour flight to Lajes. Carlton and his MAC planners had negotiated the use of the Azores base with NATO partner Portugal, a critical move especially after many European countries subsequently denied overflight and landing clearances in response to the OAPEC reprisal embargo.[20] Without Lajes, Operation Nickel Grass would have clearly struggled to meet the delivery requirements and timelines. While in theory the mammoth C-5s could fly nonstop to Israel from their East Coast hubs, the large fuel requirement would have dictated smaller cargo loads almost negligible toward meeting the IDF's demanding combat requirements.

To maintain velocity throughout the growing "air bridge" linking the US to Israel, Lajes AB became a staging location where transiting aircraft delayed only long enough to refuel and change crews if necessary; C-5 crews often carried augmented crews and completed the entire US–Israel–US circuit in 28 continuous hours.[21] Planners established a similar organization at the primary debarkation base of Lod International Airport outside Tel Aviv. This unit, designated the airlift control element (ALCE), provided command-and-control services, maintenance, and limited cargo handling capability.[22] The ALCE commander, Col Donald Strobaugh, described the unique processes underway at Lod once an aircraft arrived:

> We had no support facilities at Lod Airport and only a small number of US support personnel were present in Israel to assist with the aircraft. To unload the planes, the IDF employed a mixture of reserve personnel and civilian teenagers enlisted as laborers from the surrounding area. Israeli teams of five to 10 men emptied the airplanes either by hand or with materials handling equipment flown in on earlier chalks. Source reports that crews averaged 30 minutes to unload the aircraft and [with IDF truck delivery] could reach their destination around 3.5 hours [from touchdown].[23]

Once establishing these key logistical components between the US, Lajes, and Israel, Operation Nickel Grass began to flow smoothly and, although only 32 days in duration, its effects were significant both psychologically and materially. To the IDF the concept of a secure, established logistical lifeline sustained bold tactical maneuvers that reversed the battlefield dynamic while further demoralizing the Arab armies. With US support through Operation Nickel Grass, the IDF turned the tide from the initial reverses of early October and the United Nations successfully brokered a ceasefire on 25 October 1973.[24]

The final airlift numbers were substantial. The United States delivered 22,315 tons across 422 C-141 sorties and 145 C-5 missions.[25] The Soviet Airlift to Egypt and Syria, by comparison, lagged: "Best estimates of the Soviet effort were that their 935 missions, over a distance of 1,700 miles, moved in about 15,000 tons during a 40-day period. In short, MAC airlifted one-fourth more cargo with a little more than one-half the missions over a route that was three times greater."[26]

More importantly, in the end the airlift helped to usher in several lasting and momentous strategic events: the narrow prevention of nuclear weapons employment for the first time in the post-World War II era, the opening for Egypt's eventual and historic recognition of Israel as a nation-state, and the decreased Soviet influence in the geopolitically strategic Middle East following the war's outcome.[27]

Analysis of Key Air Mobility Principles: Freedom of Movement

Air Superiority

Despite operating within a constrained battle space comprised of active enemy air forces, the US maintained the necessary air superiority to permit the airlift to occur. The US partially owed this freedom of movement to the reluctance of the Arab air forces to target a US-flagged air transport, the strategic consequences of which far outweighed any transitory tactical advantage. The United States still took certain precautions. Two carrier task groups of the US Sixth Fleet, the USS *Independence* and the USS *Franklin Delano Roosevelt*, provided nearly 100 aircraft for air support over the Mediterranean Sea routes.[28] For the last 200 miles into Lod International, Israeli Air Force (IAF) Mirages and F-4 fighter aircraft flew armed escort.[29] Although no attacks materialized, historian Walter Boyne notes, "the MAC transports were shadowed on several occasions by unidentified fighters and often experienced very strong radar jamming, . . . [and] on one occasion a death threat was radioed."[30]

Access

Access proved absolutely essential to the success of Operation Nickel Grass. As previously noted, the OAPEC oil embargo threats had their desired effect, and key European countries such as Spain, Italy, and Germany refused basing rights due to the economic repercussions.[31] Other countries, including Greece and Turkey, denied diplomatic overflight clearances, forcing MAC aircraft to fly a longer route to avoid the air traffic control sectors of both the usually friendly Mediterranean nations as well as the more hostile North African

Arab countries.[32] Energy had arrived as a form of warfare—and the OAPEC nations wielded it effectively.

Only Portugal allowed the use of Lajes Air Base in the distant Azores (a small island group in the Atlantic Ocean), and the airfield proved a critical transit point for both east- and westbound aircraft.[33] The carrying capacity of the airlifters clearly demonstrated Lajes's value. C-5s with Lajes access averaged 73 tons (nearly 150,000 pounds) per mission while direct operations would have slashed that capacity to a mere 20 tons (40,000 pounds).[34] C-141s averaging 28 tons per airlift sortie would have had no appreciable cargo capacity at the 6,450-mile direct range without Lajes.[35]

In a final important point, the access issues experienced during Operation Nickel Grass underscore again the key symbiotic relationship between diplomacy and military operations, particularly regarding the air mobility mission. As with the Berlin Airlift, the entire nature of an airlift operation may change depending on basing and route restrictions, and careful diplomacy, both in the extended time frame before the operation as well as during the actual airlift itself, can play a crucial role in shaping both potential courses of action as well as the ultimate outcome.

Command and Control

The effective command-and-control system underpinning Operation Nickel Grass was the direct result of a nearly decade-long investment in organization, policy, and technology spurred by the Vietnam War. After a 1962 visit to Vietnam, Gen Curtis LeMay remarked "there is no effective airlift system" while citing two key problems: insufficient aerial port facilities and poor command, control, and communications.[36] As the US commitment to Southeast Asia expanded, air mobility senior leadership worked diligently to redress these fundamental issues and established the end goal of moving transport aircraft as rapidly as possible through a well-functioning airlift support system.[37]

Leaders scrutinized every aspect of the system to achieve this goal. Gen Howell Estes, the commander of Military Airlift Command from 1964 to 1969, was further "convinced that positive command control of the MAC airlift force is the key to achievement of the higher utilization rates and successful mission accomplishment,"[38] and this philosophy permeated all aspects of the developing airlift system. Airmen standardized procedures for en route stops to eliminate costly time delays during aircrew changes. Logisticians extensively reviewed and updated cargo-handling processes to maximize gains from new materials-handling equipment (forklifts and cargo loaders) and increased manpower billets. Leaders instituted the concept of the installation command post as the focal point between headquarters and the widely dispersed bases in tandem with enhanced communications equipment for increased connectivity and mission management. Operation Nickel Grass, occurring near the end of these sweeping reform initiatives, realized the benefits.[39]

C2 Operational Responsibility

The fact that MAC aircrew launched within nine short hours of the presidential execution order testifies to the strength of the operational command-and-control element in October 1973.[40] As Dr. Robert Owen writes in *Air Mobility*, "With only a few days' notice to plan and initiate the operation, MAC and its unstoppable commander [Gen P. K. Carlton] pulled together the aircraft, crews, plans, schedules, support structures, control facilities, cargoes, interagency and interservice coordination, and diplomatic agreements to start a flow of 750 to 1,000 tons of cargo per day down a 6,400-mile route that substantially did not exist the week before."[41] Such a timely and orderly response to the complex, rapidly developing crisis was not possible without the previously established command protocols necessary to implement the conveyer belt–like "air bridge" Lieutenant General Tunner had always envisaged.

The operational command-and-control node at Lajes highlights the effectiveness of MAC's preparations for an operation of Nickel Grass's scale. As the greatest potential chokepoint for operations, planners realized the imperative for smooth aircraft and aircrew management through the base. To best achieve this task, MAC established the previously mentioned stage operation at Lajes Field as well as at three additional stateside bases. During an air mobility stage, planners pre-position and manage aircrew and maintainers to ensure maximum utilization of the available aircraft. Planes transiting a stage delay only the minimum time required to refuel, complete minor maintenance, and replace the operating aircrew with fresh personnel who now reset the flight duty operating period. Maintainers repair aircraft requiring additional, more complicated maintenance, and schedulers subsequently match them with the next available aircrew (then sitting a modified ready alert until a plane becomes available) to boost aircraft utilization and sustain the operation's mission velocity.

The entire process is a complex symphony of aircrew and maintenance regulations, safety considerations, and technical order guidance demanding specialized management skill to maximize efficiency. This was particularly true given, at its peak, Lajes AB housed more than 1,300 personnel in World War II–era barracks and even former psychiatric wards.[42] As Charles Miller notes,

> It took careful planning to avoid total saturation [since] Lajes could handle only 25 C-141 and 5 C-5 aircraft on the ground at one time. . . . The airlift flow, based on a complex calculus, was limited to 36 C-141s and 6 C-5s eastbound daily; this meant enough people at Lajes to handle a combined flow of 72 C-141 and 12 C-5 east/west flights per day. The facilities in the Azores and at Lod [alone] could not handle this flow, so MAC established airlift control elements at both locations to control the aircraft and aerial port activities.[43]

Critically, this precise management allowed MAC to avoid the politically sensitive decision to mobilize either Reserve units or the Civil Reserve Air Fleet (CRAF), a collection of civilian air operators who execute peacetime contracts while remaining prepared to augment military logistics operations during times of crisis.[44] While the Reserves and CRAF invariably bring tremendous capability to any operations, their activation also signals a significant national commitment on the part of the US that key policy makers were happy to avoid. Additionally, the effective command and control of the strategic airlift fleet mitigated the impact of the European and Readiness Commands' recall of Europe-based C-130 tactical airlifters that had assisted with early airlift requirements.[45] The lack of comprehensive authority over all airlift assets, however, reopened the organizational debate over strategic and tactical mission C2 and remained an issue requiring resolution by MAC and Air Force leadership following the operation.

C2 Support Responsibility

A corollary and important part of the command-and-control support component was the previously mentioned airlift control element or ALCE. Walter Boyne expands upon the concept when he notes, "An ALCE is a compact organization that handles all the functions of a major airport terminal, including maintenance, aerial port functions [loading, unloading, and transshipping cargo and personnel], and command and control. It is able to operate on its own but fits, like a gear within a transmission, in the MAC organization."[46] MAC established an important ALCE at Lajes, where its members teamed with aircrew stage personnel to facilitate operational mission management; however, the ALCE unit at Tel Aviv's Lod Airport provided the greatest overall impact.

Here personnel under the command of Col Don Strobaugh ensured planners properly addressed all key air mobility support elements while operating within a dynamic environment at the closest point to the combat zone.[47] Major international airports such as Lod already have many well-established support facets, including security, weather reporting, airfield suitability, and communications (although the ALCE maintained its own direct link to higher headquarters as the local C2 node). Strobaugh's primary focus, then, turned to aircraft unloading and loading processes to help expedite quicker aircraft turnaround times and increased cargo delivery through the port of debarkation.

During Nickel Grass's roughly month-long duration Strobaugh never had more than 55 US personnel available and, at the beginning, only 12 cargo handlers to process aircraft with the nearly 75-ton loads.[48] He expertly utilized host-nation support as El Al Airlines maintainers serviced aircraft, stewardesses established a catered crew lounge stocked with goods from Tel Aviv merchants, and eager Israeli citizens assisted with demanding and at times backbreaking loading operations.[49] Though not covered in any Air Force regulatory guidance or "how to" manuals, the Lod ALCE was able to expertly leverage these varying pieces to ensure it had the necessary support to sustain a well-functioning airlift support system at the destination locale.

In the end, superior command-and-control practices helped establish the Nickel Grass operation as one of the brightest examples of the "air bridge" concept, particularly given its record length of more than 6,500 miles.[50] This acclaim, however, does not neglect certain C2 areas of concern that investigators later uncovered. The Government Accountability Office's after-action report, for example, noted deficiencies in command post personnel, weather dissemination, and communications that required improvement in future operations.[51] In spite of these concerns, Operation Nickel Grass clearly demonstrated that the painstaking work of the previous decade and the corresponding energy and resources poured into the airlift system's command-and-control aspects were a valuable investment in the continued development of air mobility's war-fighting tenets.

Integrated Logistics

In his book *October 1973: The Arab Israeli War* author Frank Aker credits Israel's battlefield rally to the US supply machine and its "deterrence through logistics" approach.[52] This is a fair assessment given that the supply chain connecting the continental United States to Israel ranks, along with the Berlin airlift, as one of the most compelling historical cases of integrated logistics in practice. Furthermore, this chain undoubtedly benefited from the foreign military sales (FMS) relationship between the two countries, a connection that eased the numerous linkages connecting the distant supply depots to the delivery port. These key linkages warrant further examination.

As previously mentioned and significant in effect, General Carlton coordinated with various defense logistics agencies to organize the supplies for the airlift in the days before he received the execution order.[53] The Air Force Logistics Command responded by establishing a logistics readiness center (LRC) to handle and prioritize the numerous war supply material requests.[54] Ultimately the LRC catalogued 365 different and complicated item categories for shipment to Israel while limiting the risk to US war reserve stockpiles to only 73 classifications.[55] Critically, the LRC located the necessary supplies in accordance with Israeli priorities, assembled them at one of the previously noted 29 mobility cargo hubs, then notified MAC planners regarding the cargo's availability for delivery.

At this point, scheduled C-141 and C-5 missions transited the key cargo centers and began their fully loaded, 6,000-mile journey to Israel. The aircraft loading required intricate coordination. Typical cargo manifests consisted of heavy ammunition pallets, M-60 battle tanks, and even complete A-4 Skyhawk fuselages to replenish the IAF's heavy losses.[56] Notably, many of these cargo loads could not be transported, in either quantity or quality, by El Al's civilian airliners as originally intended in the crisis's opening days. The advanced, drive-on/drive-off loading systems of the Starlifter and Galaxy aircraft—two of the first modern, dedicated airlift aircraft—greatly alleviated potential loading concerns, enhanced cargo-transport integration, and proved a critical element to the strength of the overall supply chain.

At the receiving end, the US employed a Vietnam-era lesson by noting how "experience showed that sophisticated aerial ports were not an absolute necessity. Even during high-volume, sustained resupply operations, the new MAC doctrine said, only minimal facilities would be needed for off-load in the forward area. *This, however, put a premium on effective interface with the airlift user*" [emphasis added].[57] Strobaugh's ALCE provided the effective interface that enabled host-nation forces largely familiar with FMS materials to augment and function exceptionally well with minimal support equipment available. Boyne characterizes how this relationship, spurred by innovative practices, often played out:

> The Israelis had improvised off-loading equipment, including a "rollerized" semitrailer that worked perfectly for off-loading crates of ammunition. A long consecutive series of rollers had been installed in the semitrailer bed, and the device worked as well as far more specialized equipment. A system quickly evolved in which the special U.S. K-loader would pull two pallets off the aircraft and deliver it to the rollerized trailer. There the Israeli crews broke down the pallets and loaded waiting trucks with the shells and equipment. When loaded, the trucks took off directly for the front lines. It was a streamlined process, not burdened by excessive paperwork on the Israeli side.[58]

Other anecdotes, including the unloading of 113,000 pounds of ammunition by Israeli hands in just over three hours, typify how the logistics chain was just as robust at the end as at the beginning.[59] The Soviets and their allies could not match these results with their disjointed logistics system that lost lower priority materials in warehouses and delivered non–battle ready tanks to Cairo ports. "[The Soviets] had transport aircraft," adds Owen, "but they clearly didn't know much about airlift."[60] In contrast the overall US logistical strength, one that resulted in a 7,000-ton surplus over its Soviet antagonist despite fewer sorties and longer distances, resonated within Israel and reinforced the overarching psychological effect the airlift had during a critical juncture in the young nation's history.

Technology

The Lockheed C-5 Galaxy was the single most important technological advance contributing to the success of the Nickel Grass airlift. Operational for only three years by 1973, the large aircraft garnered many critics during its development and test period. A *Washington Post* editorial in April characterized the transport as both a "death trap" and "flying coffin,"[61] and the plane's production run remained grossly overbudget and behind schedule, largely due to wing design and maintenance issues.[62]

But in October 1973 the C-5's performance silenced its critics while validating Lieutenant General Tunner's earlier faith in the value of large aircraft. The C-5 proved its ability to carry the requisite outsize loads, such as M-60 battle tanks and support equipment, in a cargo compartment longer in length than the Wright brothers' first flight at Kitty Hawk, North Carolina.[63] Additionally, with both forward- and aft-loading cargo doors permitting drive-on-drive-off loading, the C-5 enhanced rapid cargo-carrying and -handling operations in ways El Al and other contemporary civilian airliners simply could not replicate. In a true endorsement of its impact, Galaxys ultimately delivered 48 percent of the total Nickel Grass cargo on only 25 percent of the missions.[64]

The added value of increased cargo capacity was also realized by the Lockheed C-141 Starlifter, the other critical airlift platform during Nickel Grass. Throughout the remainder of the decade, MAC programmers implemented a modification plan that "stretched" the C-141 fuselage 23 feet and led to an overall 30 percent increase in cargo-carrying capability.[65] This move added the equivalent of 90 Starlifters to the inventory.[66] Additionally, in recognizing the threat posed by the lack of basing access, MAC planners also added aerial refueling capability to the C-141 fleet in order to increase its operational flexibility in future conflicts.

Training

Operation Nickel Grass greatly benefited from timing in the sense that US mobility aircrews in 1973 possessed high readiness levels earned from extensive flying during the ongoing Vietnam drawdown. This highlights again a unique aspect of the air mobility mission: even routine cargo sorties mirror air mobility wartime missions so crew members are, in effect, continually training and improving their ability to respond during times of crisis. As a consequence, for the operators the airlift quickly fell into the "usual routine of watching autopilots fly their planes, monitoring instruments, tracking courses and checking cargo restraints" as part of standard flying procedures. This flight discipline, while unexciting in its execution, represented the continuing fulfillment of Tunner's professional vision concerning the foundation of successful airlift operations. Arguably only the well-trained ALCE personnel at Lod experienced the airlift at higher emotional levels as the intensive aerial port environment continually employed and challenged their skill sets.

Despite these successes Nickel Grass did expose a shortfall in air refueling capability among US forces. Although the C-5 possessed the technical air refueling equipment, only 10 percent of Galaxy crews were trained or proficient in air-to-air refueling procedures during the airlift. As with the later upgrades to the C-141 fleet, this capability would have mitigated the impact posed by lack of basing rights and offered greater options to the military planners. In response, MAC later included and enhanced air refueling training throughout the C-5 crew force and subsequent airlift platforms.

Final Analysis

As the model demonstrates below, Operation Nickel Grass achieved the logistical tenets of attainability and sustainability nearly from the outset. The reasons for this success are numerous but primarily include the well-developed command-and-control system as well as the integrated logistics chain. Both of these elements benefited from heavy investment over the preceding years as a direct result of the air mobility experience in Vietnam. Visionary leaders—General Estes and General Carlton and many subordinate leaders at different levels across the enterprise—deserve credit for their role in developing the airlift system that performed so admirably during the October crisis.

At the same time, it is important to recognize the effective air mobility foundation was only part of the formula for success. The key decisions made at the actual time of execution also proved critical. As discussed in the chap. 1 analysis of the air mobility model, the goal of air mobility practitioners is to reduce the area of mission vulnerability by moving the velocity line to the left as quickly as possible. Practitioners also seek to increase the area of sustainability by moving the velocity line upward above the supported force requirements. General Carlton's decision to energize the supply depots in the logistic chain prior to the execution order, as well as his timely posturing of aircrew and support forces, enabled a rapid start to the airlift that accomplished both of these key objectives. The effective force management in the following days and weeks at Lajes, Lod, and in the continental United States ensured increasing cargo sustainability levels that bolstered Israeli confidence and contributed to the IDF victory.

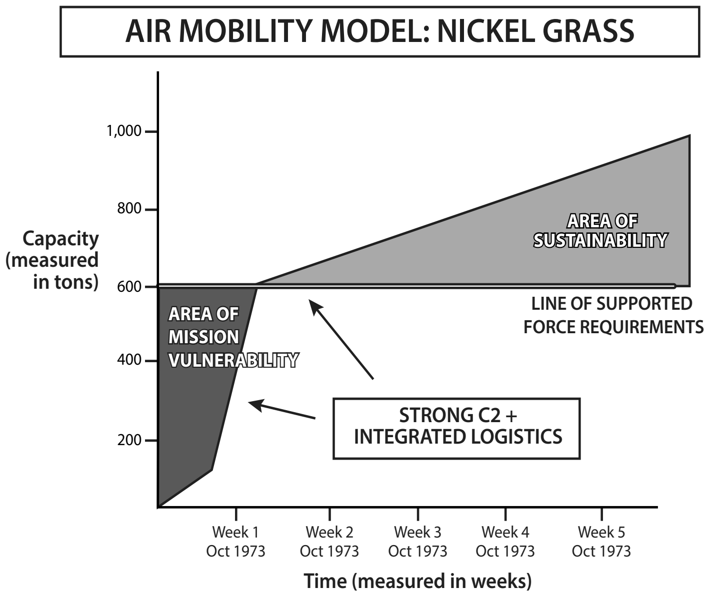

Figure 7.1. The Air Mobility Utility Model: Operation Nickel Grass

Critically, while Nickel Grass successfully addressed all five mobility factors, the issue of freedom of movement—and basing and overflight access specifically—ultimately posed the greatest threat to mission success. Without secure access to Lajes AB the entire nature of the operation would have been dramatically altered. Fortunately, effective diplomacy, coupled with efficient military operations, lessened the overall potential impact. Equally important, the air mobility community applied this important lesson by implementing the necessary air refueling technical upgrades and training policy changes to the force structure in the following years.

In the final analysis, Operation Nickel Grass was a strategic success on par with the more heralded Berlin airlift. Both airlifts embodied the proper application of the five key mobility factors, and both operations illustrated the key role of air mobility in preventing broader conflict. As author Chris Krisinger states, "Nickel Grass convinced many people that airlift is a vital component of our national strategy of deterrence. The demonstration of capability and determination doubtless will not be lost on friend or foe and should prove of great value in underscoring the deterrence that is the cornerstone of American strategy."[71]

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Chapter 8

Haiti

I lived as best I could, and then I died,
Be careful where you step: the grave is wide.

—Michael R. Burch
Epitaph for A Child of Haiti

Over the past two-and-a-half decades a growing phenomenon known simply as the "CNN Effect" has entered the lexicon of air mobility practitioners. This idea captures the well-founded belief that, as international crises unfold on the 24-hour news networks, mobility aircrew and support personnel receive near-simultaneous mobilization orders directing rapid disaster relief and humanitarian aid to the affected region. In the last half of the twentieth century such operations occurred an astounding 560 times.[1] With major efforts ranging from the devastated city blocks of New Orleans to Indonesia's tsunami-ravaged beaches, the opening of the new century has offered little respite from the blistering pace.[2] Despite five separate, major regional combat engagements over this same extended period, national decision makers have consistently pursued nonkinetic relief operations as an important extension of national security policy. Indeed, no air operation more clearly connects the diplomatic and military elements of power in the pursuit of national objectives than humanitarian airlift—a fact that the US response to the 2010 Haiti earthquake powerfully testifies to.

Campaign Background

Late on the afternoon of 12 January 2010, a 7.0-magnitude earthquake struck the island of Haiti approximately 15 miles southwest of the capital Port-au-Prince, leaving in its aftermath destruction of near-biblical proportions.[3] The numbers are astonishing even for a country long accustomed to suffering: 316,000 people killed with another 300,000 injured; over 100,000 structures collapsed with 200,000 additional buildings damaged; close to one million internally displaced persons with little to no access to food, shelter, medical care, or sanitary conditions.[4]

Nearly equal in effect, if not scale, was the virtual decapitation of the Haitian government. Already facing significant governance challenges before the earthquake, Haiti reeled further under the loss of 14 of 16 key ministers as well as numerous administration officials critical to recovery functions.[5] The surviving government representatives quickly appealed to the United States for help, a plea made even more urgent by the compounding loss of the United Nations Stabilization Mission in Haiti (MINUSTAH) commander and principal deputy.[6]

US Pres. Barack Obama immediately responded with a promise of assistance and appointed the US Agency for International Development (USAID) to lead the "whole-of-government" emergency response.[7] The Department of Defense, specifically the US Southern Command (USSOUTHCOM) as the regional combatant command responsible for Haiti, also provided major support. By coincidence the USSOUTHCOM Deputy Commander, Lt Gen P. K. Keen, was already in Haiti on a previously scheduled visit and survived the earthquake at the ambassador's residence.[8] In the immediate aftermath Keen, armed with only his Blackberry, surveyed the damage and began verbal coordination for personnel and resources that later formed Joint Task Force (JTF) Haiti.[9]

Additional organizational efforts followed over the next two days as discussions between US and United Nations leaders codified the duties of their respective missions. Under Keen's command, JTF Haiti focused on direct relief and humanitarian assistance while the remaining UN MINUSTAH forces provided operational security throughout the country.[10] What analysts later recognized as the largest international humanitarian response to a natural disaster in US history was rapidly underway.[11]

The Air Mobility Campaign

Even before the Chairman of the Joint Chiefs of Staff issued a formal notification order for the impending operation early on 13 January, air mobility forces and their surrogates initiated response actions. That same morning two MC-130 Combat Talons loaded with special tactics personnel landed at Toussaint L'Ouverture International Airport—the only serviceable airfield near the capital—and began organizing flight operations.[12] Along with unscrambling the congested ramp area then littered with more than 45 aircraft (when its design limit was 10), the combat controllers established basic air traffic services and landed their first relief aircraft only 28 minutes after arriving.[13]

Over 1,700 miles away near Belleville, Illinois, senior leadership at US Transportation Command continued important force-posturing efforts first started with the news reports from the previous evening. Acting through Air Mobility Command's (AMC) global command-and-control node—the 618th Air and Space Operations Center or AOC (better known as the Tanker Airlift Control Center or TACC)—senior leaders placed aircrews into required premission crew rest and alerted the aerial port opening specialists of McGuire Air Force Base's 818th Contingency Response Group (CRG) for short-notice deployment into Haiti.[14]

Critically, AMC leadership also began coordination with 12th Air Force headquarters at Davis-Monthan Air Force Base in Arizona. As the air component to USSOUTHCOM, the Air Mobility Division (AMD) within the 612 AOC would oversee the Haiti air operations. To augment the limited capability at the Arizona command center, AMC dispatched Brig Gen Robert K. Milliman Jr. to serve as the Director of Mobility Forces (DIRMOBFOR).[15] In this critical role Milliman linked the AMD with the considerably greater mobility resources at TACC in Illinois while also providing key operational advice informed by his leadership role in several recent disasters, including Hurricane Katrina response efforts.

At the same time AMC also appointed Col Warren Hurst as an additional DIRMOBFOR to the 601 AOC at Tyndall AFB, Florida.[16] As US Northern Command's (USNORTHCOM) air component, First Air Force had previously established a standing organization dedicated to coordinating aircraft flow schedules into disaster airfields. Known as the Regional Air Movement Control Center (RAMCC), this unit played a critical role in managing the demanding airlift timetables into Haiti's L'Ouverture Airport until the 612 AOC could assume this function.[17] Although these leadership moves took two days to complete, it later proved crucial that planners finalized the command, control, and coordination functions linking Illinois, Arizona, Florida, and Haiti in the early stages of the operation.

Meanwhile operations into Haiti itself intensified on 14 January. Phase I of USSOUTHCOM's five-phased plan focused exclusively on emergency response, and, concurrent with the execution order from the National Command Authority, the first AMC C-17 delivered the California Task Force 2 Urban Search and Rescue Team along with

82,000 pounds of lifesaving equipment that day.[18] Also on 14 January, the 818 CRG's 26 Airmen and 44 tons of specialized equipment landed and immediately commenced aerial port opening duties.[19]

The CRG's arrival marked a turning point in the newly minted Operation Unified Assistance as its members, armed with the proper equipment and expertise, began to bring a semblance of order to the frenetic airfield. In teaming with the special operators, for example, CRG personnel helped smooth inbound traffic flow procedures. While the combat controllers still provided basic air traffic control services, an aerial port member paired with tower personnel provided the latest ramp and cargo marshaling status.[20] In several instances, this partnership resulted in denied landing clearances when other aircraft saturated the parking and loading areas. As a result of the improved coordination, airfield personnel prevented process bottlenecks and maximized L'Ouverture's otherwise meager 10 wide-body-jet parking spots.[21]

The number of aircraft serviced and the corresponding relief supplies delivered gradually increased from 50 large aircraft on the second full day of operations to a peak of 165 at the end of the first week.[22] A violent aftershock registering 6.0 on the Richter scale on 20 January did little to slow operations as airfield personnel handled an average of 120 large aircraft per day over the inaugural two weeks.[23] This number excludes countless smaller aircraft and helicopters that also comprised the relief operation.

Although process improvements at the airfield level paid dividends, the uncoordinated influx of humanitarian aid from various entities, both governmental and private, threatened to undermine the precise flow necessary to maximize the cargo tonnage entering Haiti. These flights, while well intentioned, often disrupted the disciplined flight patterns and parking plans for excessive amounts of time. The solution lay in synchronized slot times, essentially a designated landing and takeoff window coordinated for each aircraft to limit ground congestion and corresponding delays.

Haitian Pres. Réne Préval perceived the value of the coordinated airflow and, on 15 January, directed his prime minister to sign a memorandum of understanding authorizing the US military to "prioritize and supervise the flow of fixed wing aircraft" into Haiti.[24] The responsibility for this action fell to a small cell established within the USNORTHCOM RAMCC. Designated the Haiti Flight Operations Control Center (HFOCC) to differentiate it from military operations and, hopefully, allay political fears of undue US control over flight operations, the small organization commenced approving slot time applications on 16 January.[25] Through a standardized notice-to-airmen entry detailing the request process and a detailed-yet-flexible approval algorithm designed to prioritize critical cargo, the HFOCC model increased L'Ouverture's capacity to 170 large aircraft arrivals per day.[26] As a point of reference the airfield had controlled roughly 25 flights per day until the earthquake.[27]

The air mobility assets supporting Operation Unified Assistance remained heavily engaged through Phase II of USSOUTHCOM's recovery plan, a period lasting approximately one month. Air operations diminished toward the end of February, coincident with the opening of the Port-au-Prince seaport and the transition to Phase III redeployment operations.[28] Over the course of its initial engagement, however, AMC cataloged a remarkable 2,677 military and commercial charter missions airlifting 14,135 tons of cargo both into and out of Haiti.[29] While precise end-of-mission numbers are not available, analysts at Twelfth Air Force conservatively place the final tally at 3,940 combined US and international sorties delivering more than 18,000 tons of aid.[30] Although the suffering the Haitian population endured unfortunately outstripped these impressive relief totals, the combined efforts of the US and international community directly translated into lives saved and a renewed sense of hope where none previously existed.

Analysis of Key Air Mobility Principles: Freedom of Movement

Air Superiority

Haiti's permissive operating environment is representative of many disaster and humanitarian relief efforts,[31] and there were no air or ground threats to US military aircraft.

Access

Haiti, like most impoverished nations, suffered from a significant lack of reliable infrastructure in the period preceding the 2010 earthquake. The natural disaster only exacerbated this deficit, although, to the benefit of all relief parties, Toussaint L'Ouverture International

Airport did not suffer extensive damage. The airfield remained a suitable point-of-debarkation hub, a critical factor given its proximity to Port-au-Prince, the earthquake's epicenter and the corresponding location of the preponderance of casualties.

AMC planners took immediate steps to mitigate the inherent risk of single-runway operations at L'Ouverture Airport. Col Gordon Bridger's joint assessment team (JAT), another element of the 621st Contingency Response Wing from New Jersey's McGuire AFB, diverted into Haiti on 14 January from previously scheduled training in Mississippi.[32] After establishing the viability of L'Ouverture, the team assessed two additional fields in the neighboring Dominican Republic. Although neither field proved essential to the operation's outcome, both San Isidro Air Base and Maria Montez International Airport supported additional Haiti-bound relief loads and, equally important, assured continued access to mitigate any potential loss with L'Ouverture's closure.[33] The JAT's overarching value in quickly identifying and assessing these alternates remains a noteworthy air mobility capability.

The value of the support airfields located outside of Haiti also merits consideration. Critically, the network of established cargo hubs on the United States's East Coast allowed planners a wider degree of flexibility in deconflicting routes and marshaling yards for the airlift's execution. Charleston AFB, South Carolina, played a key role throughout the operation as its capable, well-established aerial port assumed increasing cargo amounts.[34] US government entities, including USAID and the Department of State, originally manifested shipments for the less robust aerial port at Homestead Air Reserve Base in Florida. Planners instead diverted these loads to Charleston where logisticians quickly processed and matched them to Haiti-bound flights, shaving valuable days off the transit time.[35] In North Carolina, Pope AFB's fleet of C-130s and its close professional relationship with the 82nd Airborne Division also proved vital to the division's rapid deployment to assist with stabilization efforts near the capital.

Finally, access in an air mobility operation is not limited to airports. While less efficient than airland delivery, relief efforts briefly employed airdrop methods in Haiti, although their true value lay in the added flexibility of another potential distribution method. As author Jonathan Katz describes, the "spiraling tails of food and water packets sprouting olive-green parachutes looked great on TV, but the drops solved a problem that didn't exist. Eventually, SOUTHCOM rejected the airdrops as 'not . . . effective or safe.' "[36]

Command and Control

The incredibly high operations tempo impacting the mobility forces at the time of the Haiti disaster remains, in hindsight, an easily overlooked fact. The year saw US forces heavily engaged globally, most notably in Iraq and Afghanistan, and early 2010 witnessed the large-scale infusion of forces for the high-visibility Afghanistan "surge" commanded by Gen David Petraeus, an operation whose strategic success hinged upon meeting tightly coordinated troop delivery deadlines before the start of the spring fighting season.[37] The simultaneous accomplishment of a humanitarian operation on the scale of Haiti alongside the unabated support to other global logistics taskings validated the critical effectiveness of command-and-control functions.

C2 Operational Responsibility

Arguably the effective operational command and control exercised throughout the airlift proved to be the most critical aspect of Operation Unified Assistance's air mobility success. To be clear, this effectiveness was not a by-product of luck or chance but the outcome of deliberate planning and coordination on the part of the air mobility leadership before its required execution. Air Mobility Command, for example, had aggressively pursued memorandums of understanding outlining the integration of the DIRMOBFORs and associated staff with the geographic air operations centers in times of crisis.[38] Leaders then matched these policy directives with the development and validation of various communication assets, including electronic chat rooms and associated email distribution lists, designed to build working relationships and improve processes.[39] Finally, the Air Force's leadership made thoughtful, deliberate DIRMOBFOR selections, as both Brigadier General Milliman and Colonel Hurst brought valuable skill sets and real-world experience to their respective liaison roles. Collectively these initiatives proved absolutely vital when balanced against a USSOUTHCOM staff that exhibited severe deficiencies in its initial response capabilities, largely as a result of its orientation away from the traditional "J-staff" structure and toward a partnership-building model that was unable to effectively respond to the pace of demands.

When discussing the C2 operational element within the Haiti context, it is impossible to overstate the HFOCC's critical importance. One of the central elements of a successful humanitarian airlift is the appropriate prioritization of relief supplies and the subsequent enforcement of this determination among competing logistical organizations. This process, if not accomplished properly, may seriously threaten mission objectives. As Dr. Robert Owen elaborates, "As a humanitarian disaster in a country with only one jet-capable runway and one small parking ramp, the Haiti relief effort placed a premium on the prioritization of cargo and access to L'Ouverture, even as its circumstances complicated the process greatly. Dozens of countries and aid agencies wanted in and the majority felt that their loads deserved priority access. But particularly in the first days, delays or poor scheduling of critical cargoes and personnel could equate to death for hundreds, maybe thousands."[40]

Apart from the potential reduction in direct lifesaving aid, larger political concerns may have emerged and further complicated relief efforts if the allocation function was not performed in a fair, transparent manner. The HFOCC team, for example, handled over 1,000 slot requests in the first 24 hours and more than 4,000 total applications over the next month.[41] Its efforts to equitably broker the total available times into approximate one-third "shares"—among US military, US civilian partners, and international partners—was in direct response to claims the US was monopolizing the relief effort for its own geostrategic political purposes.[42] The HFOCC's accounting practices, while not completely defusing such charges, did much to assuage the broader concerns of critics and the international community.

C2 Support Responsibility

The Haiti case study highlights the powerful potential of contingency response group functions within the C2 support responsibility element. These specialized units have evolved significantly through both doctrine development and the crucible of experience to powerfully augment contemporary airlift operations. As the AMC History of Operation Unified Assistance notes, the CRG personnel arrived in Haiti with the ability to "handle everything from airfield management to aircraft loading," all at a modest cost of five equipment and personnel chalks (small groupings).[43] Planners embedded the amplifying functions of security, cargo processing, and communications within this spectrum of capabilities, which proved especially critical in the chaotic Haiti environment.

Capt Donovan Davis serves as a lasting testimony to the power of the CRG capability. As the officer-in-charge on the ground at L'Ouverture, he made his presence felt in organizing the ramp space, establishing the cargo processes, and increasing the airfield's aircraft-handling capability. This included, among other key enabling assets, requisitioning a portable air traffic control tower to replace both the damaged, permanent structure as well as the card table that had served the combat controllers faithfully since the opening days.[44] Leaders had such complete confidence in Captain Davis's abilities that Haiti's prime minister invested him directly with full responsibility for the airfield's support elements on just the third day of operations.[45]

Integrated Logistics

The concept of integrated logistics remained difficult to achieve in a complex scenario like Operation Unified Assistance largely owing to the size, complexity, and number of differing entities comprising the logistics chain. As Lieutenant General Keen notes, "The initial surge of forces and relief efforts [into Haiti] was ad hoc because no single agency or organization exists with the capacity to adequately respond to such an emergency. This effort was outside the formal U.S. military planning, sourcing, and tracking procedures, resulting in shortfalls in some areas."[46] Planners should consider this problem typical, however, of humanitarian response efforts where a majority of resources are likely sourced from either specialized interagency functions or the broader civilian community.[47]

USSOUTHCOM decision makers and the overwhelmed staff further complicated logistical efforts through critical early decisions. As the US Joint Forces Command post-action report notes, "SOUTHCOM initially adopted a 'push' approach to force deployment. Because speed was of the essence and the obvious requirement to respond to a disaster of such magnitude was great, the command opted to overcome ambiguity with mass in numbers. The comment by the JTF commander, Lt Gen Keen, illustrates this approach well: 'Just tell them to keep sending me stuff, I'll tell them when to stop.'"[48] The predictable result of such open direction was the uncoordinated sequencing of units, equipment, and supplies, a substantial problem that persisted through the first two vital weeks of response efforts. This lack of defined direction translated into operators lacking adequate visibility on "what they had, where it was, and what was coming" and a general resignation to using "whatever showed up on the airfield from well meaning contributors."[49]

Additionally, the lack of clear direction in the early stages (again promulgated by poor staff processes) invalidated other planning tools, such as the Joint Operation Planning and Execution System (JOPES), which produced a standardized logistical flow known as the Time-Phased Force and Deployment Data (TPFDD).[50] Although planners resolved this issue later in the campaign, in the near term it translated into aircraft loads arriving short on supplies and with priorities out of balance. Personnel throughout the enterprise, however, improvised effective workarounds to mitigate the shortfalls. In one notable example, ground personnel at L'Ouverture lacking information technology equipment relied on basic yellow sticky notes and torn scraps of paper to properly account for passenger and cargo manifests transiting the station.[51]

While the complexity of the problem set may have frustrated planning efforts at the operational level, as previously identified, the various logistical components at the tactical level performed exceptionally well. The response again validated many facets of the CRG model: the materials-handling equipment interfaced efficiently with the aircraft in the airlift over a range of nonstandard, nonmilitary loads; the planning functions maximized the ramp space and cargo loading functions to continually increase the number of aircraft serviced; and the aerial port functions performed commendably both on the ground in Haiti and, equally importantly, at the stateside supporting bases.

Technology

Operation Unified Assistance benefited tremendously from numerous technological investments that, over the previous several years, had matured within the air mobility enterprise. The Boeing C-17 Globemaster III is one such enabling technological innovation. The Haiti environment permitted the C-17 to showcase its unique direct delivery capabilities that allow it to carry the large cargo capacity of a strategic airlifter directly into the short, austere fields usually reserved for smaller tactical airlift. Furthermore, the Globemaster's agility in maneuvering on congested ramp space and its well-engineered integration with ground support equipment perfectly complemented the C-130 force that also performed well in such a setting.

Another key innovation, though less visible to casual observers, was the vital network of communications programs and equipment that linked each of the key air mobility nodes together to provide the common operating picture. Through scheduling programs such as the Global Decision Support System, the HFOCC was able to perform its essential slot time deconfliction process rapidly and efficiently. More importantly, the other air mobility planning elements in Arizona, Illinois, Haiti, and elsewhere could continually monitor these schedules as well as other data streams concerning cargo, maintenance, and aircrew availability and thus consistently update their respective organizational situational awareness. The effective accomplishment of a complex operation like Unified Assistance stands as a testament to the vision and sustained investment in command-and-control architecture in the air operations centers.

Finally, the technological investments facilitating the port opening actions—in this case at the airfield—more than proved their value. Complex relief operations began at L'Ouverture less than 24 hours after the devastating natural disaster and continued, unabated and safely, for the next month using portable, expeditionary-type equipment in the air traffic, airfield-management, and materials-handling roles. Leaders should not minimize the value of such systems in future test, development, and acquisition programs.

Training

Operation Unified Assistance provided a real-world validation of many sound training practices. These training regimens include, among others, the JAT's critical ability to validate airfield operating capacity; the expeditionary-type forces' capability to open, then sustain, an international airport and aerial port under rugged operating conditions; the operational ability to command and control a wide spectrum of forces using resources from three different combatant commands; and various aircrews' capability to operate into challenging flight environments under imposed time constraints to maximize cargo throughput.

Operation Unified Assistance also exposed additional areas that could benefit from an enhanced training focus. A recent RAND study examining the Haiti response proposed the creation of "a national framework for U.S. foreign [humanitarian assistance/disaster relief that] could document and guide a whole-of-government approach for U.S. efforts and facilitate related planning, training, and exercises."[52] Related to this idea, the study also proposed a standing organization to help develop this doctrine, formulate training plans, build collaboration among stakeholders, and conduct assessments to improve the US ability to respond in these situations.[53] Such an organization could address the seams that currently exist between military and nonmilitary approaches to humanitarian response and greatly enhance future efforts.

A final important point regarding training highlights the tremendous role that the Total Force partners—specifically the Air Force Reserve and National Guard components—played in the response. From the two key DIRMOBFOR leadership positions through the headquarters staffs and into the field activities, countless members leveraged the benefits of both their training and experience to seamlessly orchestrate a very difficult and complex operation as one unified force.

Final Analysis

In one sense disaster relief and humanitarian assistance operations on the scale of Haiti are nearly impossible to assess against the logistical principles of attainability and sustainability. Even in the intervening years these tenets still, arguably, have not been achieved within a country that lost nearly 5 percent of its population within a few minutes.[54] The model of air mobility utility is scalable and in this instance offers the greatest value when applied to the opening two phases of the relief operation. These initial stages focused on emergency response and initial relief actions, and, on that relatively narrow scorecard, the US air mobility response may be considered successful.

As the model below identifies, velocity was the most important attribute to the successful response. Almost immediately forces arrived and were able to begin operations, a critical element in a humanitarian crisis. The robust C2 network proved absolutely vital to this ability as air mobility leadership rapidly tasked different teams to establish access (JAT), build the logistical support foundation at the primary hub (CRG), and begin airlift operations (C-17 and C-130 aircrews). The HFOCC's organizing construct also proved imperative to maximizing the velocity of the airlift flow.

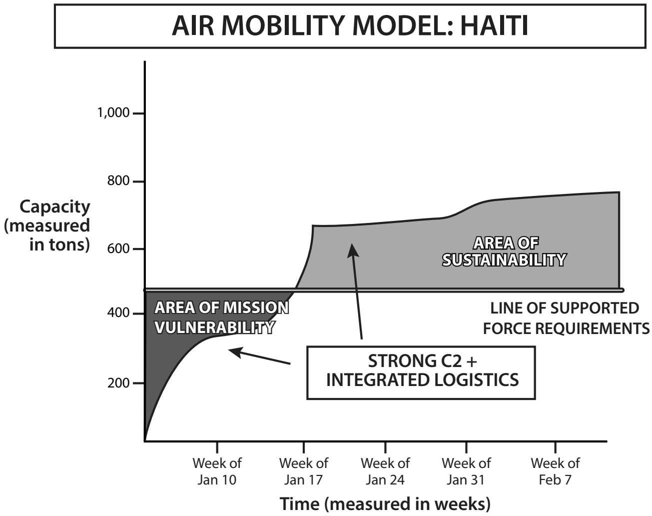

Figure 8.1. The Air Mobility Utility Model: Haiti, showing strong command and control and integrated logistics

The airlift's sustainment success points to the second essential and complementary element in Haiti: integrated logistics. Despite the many initial challenges that persisted at the operational planning level, the integrated system of handling equipment, aircraft, and process management at the tactical level ensured the cargo tonnage steadily increased over the course of the operation. This tonnage directly saved lives and eased suffering—a point that cannot be forgotten. Proper training and technological advances also played an important if seemingly muted role underpinning these key achievements.

In the end, disaster relief and humanitarian relief scenarios may appear as a peripheral mission set that distracts from the primary combat support role mobility forces are accustomed to. In truth, though, the same skill sets apply almost equally to both circumstances as the Haitian earthquake response so clearly illustrated. With the lasting benefits to larger national security policy equally recognizable, air mobility practitioners are well served in preparing for disaster and humanitarian relief situations as a central mission in the air mobility portfolio.

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Chapter 9

ISIS

The war against ISIS is a tanker war.

—Gen David Goldfein
US Air Force Chief of Staff

The United States's global campaign against terrorism, precipitated by the devastating attacks of 11 September 2001, has dominated the twenty-first century security landscape across its first two decades. Since that momentous summer day US military forces have executed operations in more than 75 countries spanning nearly every continent. Airpower's contributions to these efforts have proven both critical and far-reaching and, in virtually every instance, the United States's air refueling fleet underpinned the strategic national effects these efforts provided. A half-century after the Young Tigers's Vietnam exploits, tankers have continuously redefined the idea of global reach and global power, this time in the skies above Southwest Asia. Their contributions merit further examination within the context of the battle against the Islamic State of Iraq and Syria (ISIS), itself emblematic of the larger, extended counterinsurgency campaigns recently executed in Afghanistan and Iraq.

Campaign Background

Although ISIS first garnered widespread international attention in the opening months of 2014, its origin dates to the late 1990s when the Jordanian extremist Abu al-Zarqawi founded the group that evolved into the contemporary terrorist proto-state.[1] Zarqawi's vision and strategy for establishing an Islamic caliphate clashed with those of senior al-Qaeda leaders, including Osama bin Laden, who kept Zarqawi at a distance until the increasingly high-profile insurgent leader pledged loyalty following the 2003 US invasion of Iraq.[2] Zarqawi, who had figured prominently in Secretary of State Colin Powell's February 2003 United Nations speech, died in a coalition air strike in mid-2006.[3] His organization—al-Qaeda in Iraq—merged with other nascent Sunni insurgent groups within Iraq, ultimately forming the Islamic State in Iraq (ISI) in the fall of 2006.[4]

Operating primarily in the Sunni areas of Anbar Province, ISI suffered severe losses under the 2007 US troop surge and its accompanying "Anbar Awakening" led by the local tribal populace. By May 2010, US and coalition forces had killed over 80 percent of ISI's key leaders, prompting the rise of Abu Bakr al-Baghdadi, an ardent insurgent who had spent time in the US detention facility at Camp Bucca.[5] As the group's leader, Baghdadi recruited experienced former members of Saddam Hussein's military and Ba'ath Party elite, and following the US exit in 2011, ISI began to rebuild in strength.[6]

At nearly the same time as ISI's burgeoning return, Iraq's western neighbor Syria experienced large-scale demonstrations and progressively violent street protests as part of the sweeping "Arab Spring" movement that had begun months earlier in Tunisia.[7] Syrian president Bashar al-Assad's regime grew increasingly isolated as armed rebel elements seized upon the mounting national chaos to challenge governmental control across the country. One of these disparate rebel groups, the al-Nusra Front, received financing, training, and logistical support from ISI, prompting Baghdadi to announce his group's expansion from the Islamic State in Iraq to the Islamic State in Iraq and Syria (ISIS) as part of its growing caliphate.[8] In the following years the group identified by several names, including ISIL (Islamic State of Iraq and the Levant) or simply Daesh, in Arabic shorthand.

In combining a savvy social media strategy with brutally effective combat tactics,[9] ISIS rapidly grew from what Pres. Barack Obama at one point derisively called the "JV [junior varsity] team" into a seasoned force of more than 30,000 fighters boasting over $1 billion in assets and a nascent capital in Raqaa, Syria.[10] Employing stockpiles of captured military hardware—much of it high-quality US issue—ISIS successfully defeated rival groups near Aleppo, Syria, in 2013 before proceeding to rout Iraqi government forces en route to capturing the key cities of Fallujah (January 2014) and Mosul (July 2014).[11] "Moving with remarkable speed," notes author Joby Warrick, "ISIS vanquished four Iraqi army divisions, overran at least a half-dozen military installations, including western Iraq's largest, and seized control of nearly a third of Iraq's territory."[12]

On 29 June 2014 Abu Bakr al-Baghdadi, who now possessed "oil wells, refineries, hospitals, universities, army bases, factories, and banks," proclaimed ISIS a "worldwide caliphate" with an estimated 8 million people living in the more than 20,000 square miles of territory under its control.[13] By August 2014 ISIS forces in northern Iraq had captured the town of Sinjar and forced thousands of Yazidis (a minority religious sect) to seek refuge atop the remote Mount Sinjar.[14] This string of victories clearly highlighted ISIS's growing menace and consequently compelled the US and its allies to action.

The Air Mobility Campaign

As ISIS forces achieved their surprising gains throughout the summer of 2014, the United States responded by enhancing its theater intelligence, surveillance, and reconnaissance (ISR) assets while simultaneously deploying a small number of ground advisors to Iraq. Once the emerging Mount Sinjar humanitarian crisis became clear—ISIS massacred an estimated 5,000 Yazidi men and displaced several thousand more to the mountain's peak—the US Air Force joined other partner nations with a massive humanitarian supply drop beginning on 7 August 2014.[15]

In the following days US warplanes—primarily carrier-based fighters from the USS *George H. W. Bush*—began striking ISIS targets in the Sinjar region. Although small in number at the outset, these missions grew over the next several weeks until, by mid-January 2015, US and coalition aircraft had conducted 5,000 strikes in concert with 22,000 tanker refuelings.[16]

The Combined Joint Task Force Operation Inherent Resolve (CJTF-OIR) campaign plan envisaged a two-pronged effort to recapture Fallujah and Mosul in Iraq along with Raqqa in Syria.[17] Coalition special forces advisors, embedded with Iraq Security Force (ISF) and Syrian Democratic Front (SDF) fighters, would coordinate the airpower support to the ground forces executing these battle plans within Iraq and Syria.

Based from forward operating locations in the Gulf States of Qatar and the United Arab Emirates, as well as from Turkey along the region's northern border, the US Air Force KC-135 and KC-10 fleet saturated the air tasking order (ATO) to ensure enough airborne fuel to maximize combat operations. In the first year alone the American tanker fleet executed more than 14,000 sorties and completed 90,000 refuelings.[18] By comparison, tankers in Operation Allied Force (the air war over the former Yugoslavia) accounted for 20 percent of all air sorties flown. In Operation Enduring Freedom this figure rose to 27 percent. Inherent Resolve saw that proportion exceed 40 percent as part of the accelerating airpower trend toward extended range operations.[19] Air refueling tankers from the United Kingdom, France, Germany, Canada, Australia, and Italy also flew ATO taskings in support of key reconnaissance and strike missions, particularly as coalition operations increased following a string of ISIS-directed attacks across western Europe punctuated by the deadly Paris theater shootings in November 2015.[20]

The typical OIR tanker support sortie lasted between five and eight hours and refueled receivers executing both preplanned and time-sensitive targeting requests at a rate of one receiver every five minutes.[21] Early in the campaign these target sets included the 60-plus ISIS desert training camps that produced more than 1,000 new fighters each month.[22] Later missions included the 2016 strike on 188 ISIS oil tankers that eliminated more than $2 million in illicit oil revenue and further degraded critical ISIS governance and support infrastructure.[23]

The OIR airspace became increasingly dynamic following Russia's entry into the theater in September 2015. Ostensibly in support of the anti-ISIS campaign but also seeking to bolster its own strategic aims while sustaining Assad's beleaguered regime, Russia's air campaign complicated an already congested battlespace and led to the establishment of key coordination measures between the US and Russia to enhance flight safety and reduce the risk of inadvertent miscalculation and consequent escalation.[24] These measures included a signed memorandum of understanding between the countries outlining flight protocols and established airborne communication frequencies to enhance deconfliction as well as a ground communication line to resolve any outstanding coordination issues.[25]

Other regional actors similarly complicated tanker operations. In July 2016 Turkish president Recep Tayyip Erdogan cut both the electrical power as well as general access to Incirlik Air Base near Adana following the attempted military coup in Turkey earlier that summer.[26] (Turkish KC-135 tankers had operated from Incirlik as part of the coup attempt.) These actions posed a direct operational risk to coalition tanker missions originating from the northern (and closest) part of the theater. Additionally, in 2017 several Gulf nations led by Saudi Arabia took steps to economically and diplomatically isolate Qatar after labeling the small emirate a state sponsor of terrorism.[27] This move, and the corresponding uncertainty it engendered, also placed the heavy air operations from Al Udeid Air Base near Doha (where an aircraft takes off or lands every 10 minutes) at increased operational risk.[28]

After executing more than 14,000 missions and off-loading over 900 million pounds of fuel in 2015, tanker operations witnessed only a slight dip in tempo in 2016 (13,000 sorties and 800 million pounds) before dropping off further in 2017 (12,000 sorties and 700 million pounds).[29] These trends mirrored results on the ground as ISF troops first re-took Fallujah at the end of June 2016 following a three-month siege buttressed by heavy airborne intelligence collection and coalition support. This led to the drive toward Mosul where, after nearly seven months of intense urban fighting, ISF and Kurdish Peshmerga forces lowered the ISIS black flags from the city government centers on 17 July 2017.[30] Concurrently the SDF, supported by coalition airpower, engaged in four months of heavy fighting before defeating ISIS forces in Raqqa at the end of October 2017.[31] By the end of November coalition forces had stripped the one-time ISIS caliphate of 98 percent of its peak territory, including its key regional power centers in Iraq and Syria, in turn leading to the end of the major military campaign against the terrorist movement by the close of 2017 (although smaller military engagements against the group persisted).[32]

Analysis of Key Air Mobility Principles: Freedom of Movement

Air Superiority

For the duration of the air campaign against ISIS, the United States and its coalition partners enjoyed the high degree of air superiority that had similarly marked its previous campaigns in Afghanistan and Iraq. The complex and shifting nature of both the conflict and the parties involved, however, required a persistent focus on maintaining this superiority. While ISIS's weapons caches primarily included SA-7 MANPADS and ZSU-23-2 antiaircraft guns effective against low-altitude targets, by 2015 the group had captured three SA-3 surface-to-air missiles batteries previously employed by Syrian government defense forces to down a US unmanned aerial vehicle operating within standard tanker flight altitudes.[33]

Although ISIS fighters typically lacked the technical acumen to operate these more sophisticated weapons systems, coalition planners still had to account for the capability and potential employment of Assad regime air defenses—a dense, integrated network bolstered by the introduction of advanced Russian antiaircraft technology near the port of Latakia in 2015.[34] Tanker crews operated almost exclusively within these threat rings during the tactical portions of their flights as well as increasingly within advanced Iranian antiaccess/area denial (A2AD) systems that covered transit routes through the Arabian Gulf. Although these threats had a minimal impact on overall operations, the unpredictable and unstable command and control of these lethal systems remained an important and potentially disruptive factor that planners and crews worked to mitigate.

Access

Dating to Saddam Hussein's invasion of Kuwait in August 1990 and further enhanced by the uneasy Persian-Arab competition for regional influence, the United States possessed nearly uninhibited access to Gulf airbases that, notes one regional expert, leave "almost nothing to be desired."[35] Qatar, for example, remains "committed to a broad strategic partnership with the United States" largely owing to its geopolitical stature as a small nation-state with controlling interests in the world's largest natural gas field.[36] In 2000 the Qatari government built Al Udeid Air Base, with the region's longest runway, at a cost of more than $1 billion and allowed the US to invest more than $459 million more in expansion and upgrades from 2002 to 2011.[37] Those investments continue and further align with the Gulf's broader role in the "fundamental reshaping of the map of global aviation" as world-class airlines Etihad, Emirates, and Qatari Airways have ascended to prominence as "super connectors" linking industrial and financial hubs in Europe with Asia.[38] Improvements in the professional air traffic control and flight management services across the region have accompanied this ascendency to the added benefit of coalition tanker crews.

In a related note, tanker missions transiting to the operational areas over Iraq and Syria often required multiple diplomatic country clearance approvals along the flight route.[39] This element, in concert with the impact of the region's political instability upon basing access, remained the single biggest challenge to effective coalition mobility operations. At Incirlik Air Base, for example, the Erdogan government's isolation tactics (particularly regarding electricity) forced coalition leadership to rely on emergency generator power for basic functions with a full return to ATO operations achieved only three days later.[40] Furthermore, persistent Turkish suspicions regarding US involvement in the coup d'état frayed critical allied command relationships and resulted in operational impacts ranging from diplomatic clearance delays to outright flight plan and mission cancellations across the ensuing months.[41] Similarly, a string of tense incidents that resulted in deteriorating diplomatic relations between Germany and Turkey forced the German A310 tanker providing Luftwaffe Tornado support to relocate from Turkey to Jordan.[42] Qatar's diplomatic and economic isolation had a muted impact on Al Udeid's 120-plus aircraft operations, but lingering questions regarding the emirate's support to Hamas and other terrorist entities clouded the base's long-term future.

Command and Control

The *U.S. Army–Marine Corps Counterinsurgency Field Manual* notes that "COIN (counterinsurgency) operations require a joint, multinational command and control architecture for air and space that is effective and responsive . . . [that] applies to more than just US forces . . . [and] involves coordinating air assets of multinational partners and the host nation."[43] To be truly effective, the manual adds, COIN planners "must thus establish a joint and multinational airpower command and control system and policies on the rules and conditions for employing airpower in the theater."[44] After a decade-and-a-half of refining airpower command and control in support of similar ground-centric operations, the effective execution of the anti-ISIS campaign validated much of the earlier, important efforts to establish just such a joint structure and system.

C2 Operational Responsibility

In reflecting on the successful opening stages of Operation Enduring Freedom, author John Andreas Olsen asserts that one of "the three pivotal ingredients that made this achievement possible [was] long-range, precision airpower managed by a uniquely sophisticated and capable CAOC."[45] The Combined Air Operations Center (CAOC) serves as the focal point for the centralized control of airpower at the operational level in the United States Central Command area of responsibility, and while Olsen correctly applauds its success, such accolades for the CAOC were not necessarily preordained.

Indeed, in the first Gulf War Lt Gen Buster Glosson, then director of Air Campaign Plans in Riyadh, lamented the difficulties in producing a timely ATO as well as the inherent challenges of ensuring a proper air refueling flow. After a series of tanker scheduling issues ultimately forced critical mission cancelations, Glosson admitted regretfully, "I did not put my best and brightest on air refueling during the planning phases."[46] Lt Gen William Begert echoed his sentiments a few years later in Operation Allied Force, noting the air refueling section was "largely a pickup team with widely varying levels of training . . . [that] in the first month of the campaign . . . was nearly overwhelmed."[47]

By the time of the ISIS campaign, however, the CAOC had matured into a state-of-the-art Air Force weapon system using advanced technology and planning processes to build a common operating picture among airpower planners and liaison officers representing allied nations as well as ground and naval forces. Tanker interests are effectively represented in both the CAOC's Air Mobility Division (AMD) and Combat Plans Division (CPD) which directly integrate specific refueling sorties into the ATO schedule with their combat air force counterparts. Near real-time maintenance reliability data and crew availability metrics, which in the anti-ISIS campaign encompassed dozens of aircraft and crews, further inform these taskings.

Authors Ian Slazinik and Ben Hazen argue this integration of tanker expertise, not only within the AMD and CPD but throughout the five CAOC divisions and the Combined Forces Air Component Commander's (CFACC) scheme of maneuver, is the critical success factor for air mobility C2.[48] Additionally, the authors contend, any organizational attempts to centrally manage the global tanker fleet from a single node such as the 618 AOC (TACC) must take into account the specific theater dynamics that regional AOCs are best attuned to.[49]

Building on this, in the ISIS air campaign the CAOC expertly performed its theater C2 responsibilities in two key respects. First, given its position at the fault line between the European and Central combatant commands, air operations in the Middle East are susceptible to byzantine command relationships, specifically around Turkey and the Levant. The CAOC's single ATO synchronized aircraft operations from Turkey (US European Command) with those from the Gulf

States (US Central Command) in a mostly seamless air plan that embodied centralized control and decentralized execution. Second, the CAOC coordinated critical, high-level deconfliction policy with its Russian Air Force counterparts and issued clear guidance to aircrews operating in the airspace over Iraq and Syria. Such direction ensured safe and effective operations while minimizing opportunities for mishaps or miscalculation, particularly following the large increase in Russian combat activities. All of these combined efforts brought a semblance of order to the dynamic air battlespace and enhanced the overall C2 effectiveness of coalition assets.

C2 Support Responsibility

The C2 support activities were generally very effective throughout the bases supporting the anti-ISIS air operations as a result of the gradual transition to "enduring location" levels of support over the previous two decades. In essence, this translated into robust entities at the forward locations that mirrored high levels of support functions found at established stateside bases. Of particular note, the key leadership positions at the deployed squadrons transitioned to year-long tours versus shorter, more frequent rotations of personnel. The greater leadership continuity endowed by this personnel policy served to ensure the necessary focus on the C2 support functions with corresponding gains in operational effectiveness.

Integrated Logistics

As identified in a previous section, US planners benefited greatly from the host of airbases available across Southwest Asia, almost all that were marked by high quality logistics infrastructure. "Air Forces . . . cannot live off the land," write authors Robin Higham and Stephen Harris before noting how the neglect of maintenance, fuel, and supply infrastructure can threaten an air force's effectiveness.[50] Importantly, this was not the US Air Force's experience in the Middle East.

As Olsen expounds, "The Air Force has access to a large number of bases throughout the Gulf region—bases from which its aircraft had been operating for over a decade and which therefore were well-equipped with maintenance, facilities, fuel, ammunition, spare parts, and excellent quarters for those who flew or maintained aircraft."[51]

For the tanker mission specifically, however, fuel remains the central integrated logistics element, and the air bases' geostrategic location in the oil-rich Middle East greatly eased supply concerns in this respect.

Al-Dhafra Air Base in the United Arab Emirates, for example, provides a textbook example of the well-designed and -maintained integrated fuel logistics structure typical of the region. As writer Jennifer Hlad explained in *Air Force Magazine*,

> Operation Inherent Resolve uses a lot of fuel. Not just for the fighter jets dropping bombs on ISIS but for the aircraft gathering intelligence, surveillance, and reconnaissance, for the generators powering the air-conditioning units cooling the bases, and for all the trucks and other vehicles transporting troops on the ground.
>
> About eight million gallons of that fuel is stored here, the largest fuel bladder farm in the Department of Defense. The farm—made up of more than 20 giant dirt pits holding enormous tan bags of fuel—processes roughly 500,000 gallons each day.
>
> The fuel bladders range from 50,000 to 210,000 gallons and are checked daily for leaks. . . .
>
> The aircraft fuel is moved to the flight line using a constant-pressure hydrant system, which is much faster and more efficient than using trucks . . . .[52]

Additionally, although the pace of operations remained high across the three-year campaign, Operation Inherent Resolve fuel requirements never approached Operation Iraqi Freedom's opening kinetic phase when fuel demands of 1.7 million pounds per day at one base alone outstripped the UAE's daily 1.2 million-pound aviation fuel refining capabilities.[53] The location of nearby deep-water ports capable of off-loading jet fuel from anchored supertankers, however, further alleviated any lasting concerns regarding sustained fuel access.

Technology

More than a half-century after it formed the technological centerpiece of Vietnam's Young Tigers campaign, the venerable Boeing KC-135 performed a similar role in the fight against ISIS (with, in fact, many of the same airframes serving in both conflicts).[54] In the intervening years the aircraft had undergone several infrastructure enhancements, most notably a complete re-engining of the entire 400-plus fleet that began in the mid-1980s and increased the fuel-carrying capacity of the newly designated R-model airframes by 50 percent.[55] In the early 2000s the fleet also began critical avionics and instrumentation upgrades, known as Pacer CRAG (compass, radar, and GPS), to meet new international communication and navigation standards as well as heighten crew situational awareness through improved displays.[56] Additionally, the upgrades further enhanced connectivity with air traffic and command-and-control nodes through satellite communication and automatic dependent surveillance position reporting features. This allowed for dynamic mission retasking from C2 authorities as required (a feature that was employed with other specialized equipment during OIR sorties to respond to developing time-sensitive refueling requests).

By 2002 the KC-135 force began to dramatically show the effects of the large operational burden it shouldered when nearly one-quarter of the fleet was in depot-level heavy maintenance at any given time.[57] As such, another important element of US air refueling capability in general—and the anti-ISIS fight in particular—has been the KC-10 Extender, the military version of the popular DC-10 civilian airliner. With nearly one-fourth of the 59-aircraft fleet on permanent rotation to the Middle East, the KC-10 adds enhanced operational flexibility by possessing both a boom and drogue capability to refuel coalition, naval, or US Air Force receivers on any sortie.[58] In contrast, a KC-135 must be specifically configured on the ground for either drogue or boom receivers but not both (unless the aircraft is one of a small number of Multi-Point Refueling System KC-135s in the US inventory).[59] Additionally the KC-10 may be refueled in flight, in turn increasing its loiter and off-load capability and partially accounting for the 2 KC-135s–equals–1 KC-10 utilization factor applied by mission planning cells.

In 2017, with the average age of the KC-135 inventory at 55 years and the "new" KC-10 tanker fleet at 31 years, the Air Force recognized a desperate need to introduce its next-generation tanker, particularly owing to the high operational stress placed on current tankers. "Between Fiscal Year 2012 and Fiscal Year 2016, Air Mobility Command's (AMC) tanker fleet—the KC-135s and KC-10s—overflew their program flying hours by 237 percent and 178 percent respectively," said Gen Carlton D. Everhart II to industry reporters, noting how, for four straight years, "USAF's tankers flew about twice as many hours as expected."[60]

To address this need, in 2018 the US Air Force received delivery of the first of 179 planned KC-46 Pegasus air refuelers. This modern tanker design, based on the Boeing 767, is 20 percent larger than the KC-135 and can deliver three times as much fuel while boasting dual boom/drogue configuration and inflight receiver refueling capability.[61] It also offers "significant advances in survivability, allowing tankers to refuel much closer to combat zones," a trait that, while beneficial in the OIR campaign, will likely prove essential in future conflicts.[62]

Finally, another key technological advancement centers on the Combined Air and Space Operations Center itself. Built at a cost of $60 million, the CAOC serves as the "operational bridge that integrates and synchronizes strategic decisions to tactical-level execution" and relies on more than 67 miles of high-capacity and fiber-optic cable to support the hundreds of people—ranging from planners to imagery analysts to network design experts—who execute airpower across the theater and varying mission sets.[63] The iconic combat operations "floor," which boasts large-screen wall monitors hovering over a maze of connected desks and planning cells, each with flickering computer displays, stands in stark contrast to earlier C2 nodes such as those found in the Battle of Britain, with its wooden models, paper maps, and radio relays. Additionally, the recent introduction of the digital tanker planning tool Jigsaw (replacing the ubiquitous whiteboards and dry erase markers) has generated efficiency savings of between 400,000 and 500,000 pounds of fuel each week—or close to $1 million.[64] As rapid, multidomain C2 becomes even more critical to future warfare, the AOC's ability to sustain its technological edge will prove vital to air commanders operating within increasingly accelerated decision cycles.

Training

The tanker crew force (including aircrew, planners, and support personnel) that participated in Operation Inherent Resolve was a veteran one that had deployed frequently over the preceding years in support of similar operations in Afghanistan and Iraq. This important experience ensured a seamless transition of operational continuity to the anti-ISIS campaign and allowed for the rapid build-up of operations within a short time. As Olsen relates, "Notwithstanding the later involvement of a large number of conventional ground troops in Operation Anaconda, the [Operation Enduring Freedom] campaign was not a land war but a SOF-centric air war that largely accounted for the success of the Afghan resistance forces."[65] Similarly, in OIR's Iraq and Syria, experienced tanker crews proved accustomed to supporting special operations forces embedded with indigent ground forces. This often required rapid shifts from standard ISR "pattern-of-life" collection tracks, for example, to time-sensitive targeting requests in a specific "killbox" or "keypad" supporting troops in contact.

Two additional important training elements further underpinned the combat readiness of the tanker fleet in Operation Inherent Resolve. The first key development occurred with the dramatic and inclusive shift in realistic training within the Air Force over the decades following the Vietnam War. The Air Force's premiere training event—Red Flag—morphed from a narrow air superiority or fighter/bomber-centric exercise to a broader representation of how the Air Force would fight future theater wars. "Over the course of the 1980s and 1990s," notes author Brian Laslie, "the exercise grew to include night operations, electronic warfare, space and cyberspace operations, and 'nonkinetic operations' as well as some events that were molded to simulate counterinsurgency operations."[66]

This shift necessarily included a broader array of aviators and support personnel apart from the exercise's previous, almost exclusive combat air forces focus. To subsequent complaints that the exercise had become too inclusive, answers Laslie, "In reality the changes to Red Flag represented not a form of inclusion for all air force personnel but a representation of innovation as the air force continued to adapt its training program to perceived threats." In addition to Red Flag, the US Air Force also significantly expanded other training-focused exercises. At one point the service hosted "eighteen different exercises that bore the 'Flag' name [and] trained participants in aerial warfare, command and control, aircraft maintenance during war, and other applications applicable to the way the air force conducts war," continues Laslie, so that in the end "the Air Force found that realistic training demonstrated results beyond the fighter and bomber forces."[67]

Critically, joint and coalition exercise participation grew steadily as well, and allied nations readily integrated both their tanker and combat aircraft into the exercise scenarios. These efforts consequently paid large dividends over Iraq and Syria, where it was common to find an Air Force KC-135 ferrying two Navy F-18s to the operating area or a US KC-10 refueling French Dassault Rafale fighters en route to a strike.[68] "At its heart," concludes Laslie, these training efforts "remained committed to training aircrews to execute an air war in an operational theater."[69]

The second important training development was tanker specific: the establishment, in the early 2000s, of the KC-135 Weapons School at Fairchild Air Force Base, Washington, under the larger umbrella of the US Air Force Weapons School. The Weapons School's mission remains to develop experts in employing airpower across the tactical, operational, and strategic levels of war, and its graduates are highly respected for the results they produce, not only behind an aircraft's controls but ranging from the squadron and wing to the highest staffs.[70]

As author Mark Hasara elaborates, "In the post 9/11 world, the [weapons] school's graduates' worth cannot be measured. Desert Storm and Allied Force refueling operations did not benefit from refueling planners and operators educated at the graduate level. Weapons School graduates have been invaluable in employing Air Force tankers supporting everything the U.S. does on the world stage."[71] In perhaps its most critical role, the school provides a singular repository for the collected expertise as well as proven tactics, techniques, and procedures of the wide-ranging tanker fleet. It remains charged with ensuring the tanker force can still execute its core mission in spite of emerging adversary threats and changing geostrategic trends.

In the air war against ISIS as well as in the earlier counterinsurgency campaigns, the Weapons School graduates (also referred to as "patch wearers") serving in the CAOC optimized tanker orbit placements while maximizing tanker scheduling and aircraft utilization rates. They refined tactical guidance for mitigating regional air defense threats or the impact of potential GPS spoofing. They integrated unique tanker capabilities, as well as limitations, into the CFACC's broader air strategy and conversely instructed at the crew level on key considerations to maximize tanker performance. Ultimately—and as these few examples illustrate—the small but growing cadre of Weapons School graduates greatly boosted the overall impact of America's key strategic enabling force.

This broader pool of talented, experienced, and well-trained mobility aviators cannot be taken for granted. As authors Robin Higham and Stephen Harris assert in *Why Air Forces Fail*, the "mismanagement of human resources is another major common denominator of defeat and failure" and air forces cannot succeed if they overlook "the human investment necessary to wage a long war in the air."[72] The looming pilot retention crisis facing the US Air Force, fomented by a nearly insatiable commercial need for experienced aviators forecasted to last for a decade or more, is one such complex human capital concern that the service must effectively address to ensure credible airpower options for the future.

Final Analysis

As reflected in the air mobility utility model in figure 9.1 below, the OIR tanker fleet effectively achieved the logistical tenets of attainability and sustainability across the three-year campaign. Similar to the Vietnam case study, the supported force requirements in the anti-ISIS battle did not remain static but varied depending upon the campaign phase, although the fluctuations were not as dramatic as in Vietnam, which included conventional as well as counterinsurgency phases. The anti-ISIS tanker war benefited from a strong command-and-control structure optimized for counterinsurgency warfare and administered through a capable and technologically advanced CAOC. The aircrew and support personnel were also well trained and highly seasoned in the type of warfare OIR consisted of, and the aircraft used—nearing 60 years of service in the case of the KC-135—proved adequate, particularly given the systems and avionics upgrades over the past years.

The greatest risk to the mission persisted in the freedom of movement mobility factor, specifically the access element. Although the Middle East boasts numerous advanced airfields with sophisticated integrated logistics infrastructure capable of sustaining high-tempo combat operations, the political instability of the host nations posed the greatest threat to successful mobility operations. As the attempted coup d'état in Turkey and Qatar's diplomatic and economic isolation crisis illustrate, the United States often has little recourse for addressing these constraints outside of lengthy diplomatic channels. In these instances, some degree of operational impact may prove unavoidable when unfettered access is not possible. The balanced basing approach used by the US across the region did help mitigate some loss in operational capacity, but this strategy may not always be feasible in future conflicts.

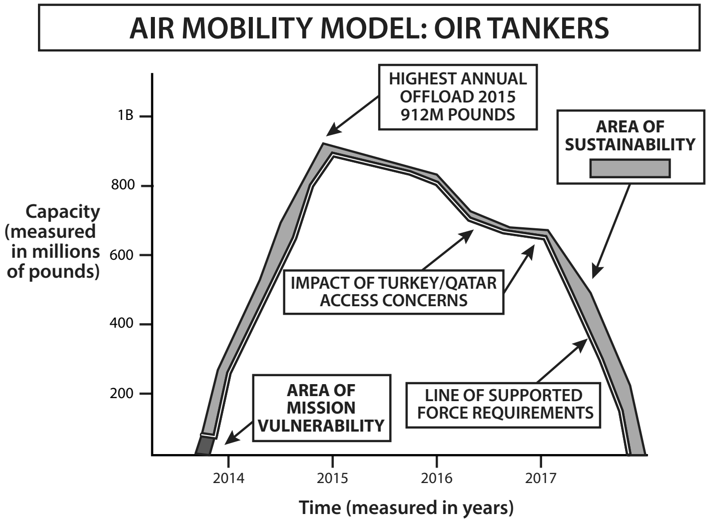

Figure 9.1. Air Mobility Utility Model: Operation Inherent Resolve tankers

The high density of antiaircraft systems in the region, though only a potential and not an actual factor in this case study, points to another significant freedom of movement challenge for future tanker forces. If ISIS fighters possessed the technical acumen to operate the captured SA-3 batteries, or if Assad regime forces had further complicated the battlespace by engaging their integrated air defense systems, the overall ground campaign scheme of maneuver would have required major adjustments owing to the lack of timely air refueling support to ISR and strike aircraft. As these and other antiaccess/area denial weapons continue to proliferate, mobility strategists will need to similarly develop means to effectively address and mitigate their effects on a theater air campaign.

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56. Cook, "Mobility Airmen," 72.
57. Cook, 74.
58. Hlad, "Forward Deployed: Al-Dhafra AB, United Arab Emirates," 8.
59. Wallwork et al., *Air Refueling*, 47.
60. Hebert, "Stretch Mobility," 4.
61. Brissett, "Global Reach, Through Tankers," 48.
62. Brissett, 48.
63. *Combined Air Operations Center, United States Air Force Central Command fact sheet*, 2017.
64. Hlad, "Forward Deployed: Raven, Jigsaw, and Chainsaw," 8.
65. Olsen, *History of Air Warfare*, 277.
66. Laslie, *The Air Force Way of War*, 182.
67. Laslie, 183.
68. Brissett, "Global Reach, Through Tankers," 45.
69. Laslie, *Air Force Way of War*, 182.
70. Bowers, "509th Weapons School."
71. Hasara, *Tanker Pilot*, 303.
72. Higham and Harris, *Why Air Forces Fail*, 415, 353.

Chapter 10

Conclusion

In the concluding chapter to his work on special operations, Adm William McRaven returns to Carl von Clausewitz's central criteria for judging a successful theory. The salient points include a powerful capacity to explain, a clear link between how the past informs the present, sufficient flexibility to allow for further development of its theoretical precepts, and a timeless aspect not constrained by current trends in military philosophy and technology.[1] The fundamental goal of this work has been to satisfy these tenets with respect to the practice of air mobility. The reader will be left to ultimately judge the success of the effort but not, however, before a brief, concluding summation.

With regard to the Clausewitz's first point—the powerful capacity to explain—this theory presents the model of air mobility utility (included again in fig. 10.1 below) for explanatory purposes. The model emphasizes velocity as the critical element differentiating air mobility from other possible logistics methods while noting the essential balancing act required between speed and capacity to achieve maximum effect.

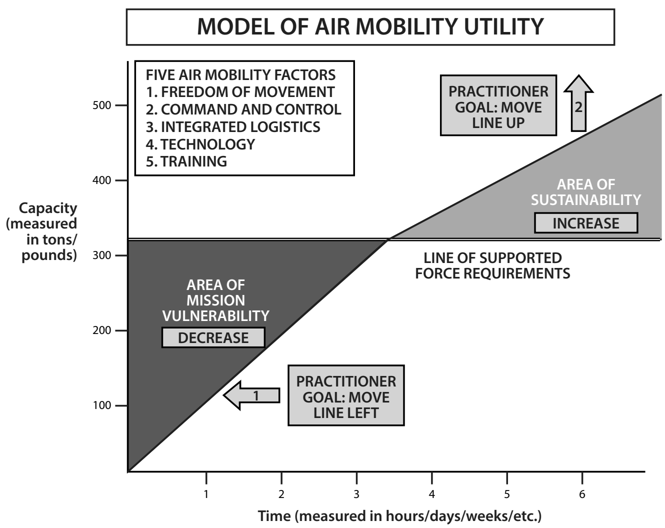

Figure 10.1. Model of air mobility utility with five air mobility principles noted

Practitioners ultimately seek to shift the velocity line as far to the left as possible to reduce the area of mission vulnerability that persists until achieving the logistical principle of attainability at the line's intersection with the supported force's requirements. Additionally, adjusting the velocity line upward beyond the supported force's requirements increases the area of sustainability and enhances the campaign's potential operational flexibility as the logistics base becomes more secure.

The theory further posits that practitioners may successfully influence the critical velocity line through careful attention to the five key mobility factors of freedom of movement, command and control, integrated logistics, technology, and training. To best achieve logistical success these factors cannot be addressed singularly or in isolation but instead through a comprehensive systems approach carefully weighing each factor's impact upon and relationship with the other factors. At times this may prove a challenging intellectual exercise, particularly given the complexity of the factors and the fact that, at certain points along the planning-to-execution spectrum, each factor may require different consideration. The five factors inverted triangle model in figure 10.2 graphically depicts how these elements build upon and ultimately influence one another. Importantly, while some factors earn greater prominence in the preparatory phase and others during the execution stage, no one factor remains exclusively at one end of the time continuum or the other. Each factor must be considered in a careful balance between its short-term execution functions and its long-range planning considerations.

In combination, then, the air mobility utility and the five key mobility factors models provide a powerful capacity to explain the eventual outcome of an air mobility operation.

This leads to Clausewitz's second tenet, the link between how the past informs the present. As the introductory chapter noted, I carefully selected each of the book's case studies to encapsulate the widest possible breadth of air mobility missions. Dien Bien Phu represented air mobility in counterinsurgency. Stalingrad and Burma reflected air mobility within a conventional theater campaign while the Berlin airlift and Nickel Grass were strategic mobility operations in their own right. Haiti demonstrated airlift during disaster and humanitarian relief operations while Vietnam's Young Tigers and the contemporary tanker war against ISIS offered case studies in air refueling.

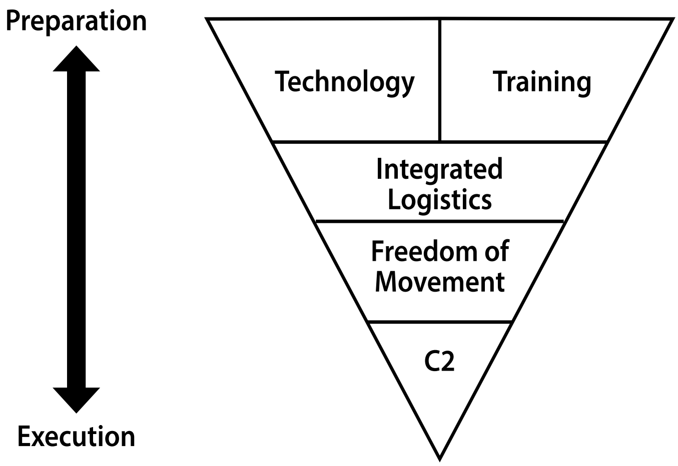

Figure 10.2. Five factors interaction model

In each case the air mobility theory provided a systematic structure for analyzing the role and impact of the air mobility enterprise. The theory offered insight, for example, into the successful outcomes of both the Berlin airlift and the Nickel Grass airlift to Israel due to strong command and control, integrated logistics, and vital freedom of movement. Equally clearly, the theory could identify and analyze the essential air mobility contributions to the strategic defeats at Stalingrad and Dien Bien Phu where the enemy limited freedom of movement, compounded by disjointed and ineffective logistics support. The models can be similarly applied to other key transport operations within the last century to include the Second World War's operations "Over the Hump" from India to China, the Korean War's bitter retreat from the Chosin Reservoir, or the coalition buildup during 1990–91 Operations Desert Shield and Desert Storm. Each instance makes clear the strong linkages from the historical record to the modern practitioner's contemporary lessons.

Clausewitz's third theory criterion demands sufficient flexibility to allow for further development of the theoretical precepts. This idea speaks to the future applicability of the theory, and here the five mobility factors provide a framework for where planners and policy makers should focus their attention. A short, generalized list of potential future considerations illustrates the point:

Freedom of Movement

- Consider strategies for A2AD operations and the impact on air mobility basing and access.
- Consider the proliferation of MANPADS and how global trends toward increased urbanization may impact the security of flight operations near congested airfields where transport aircraft are likely to operate and also are most vulnerable.
- Consider threats to national space assets and the maintenance of space superiority and the corresponding ability to operate within a degraded or nonexistent Global Positioning System environment.
- Consider the proliferation of miniaturized drones and unmanned aerial vehicles and their potential impact to mobility aircraft in either singular or swarm-type tactics.
- Consider the impact of climate change developments on access to potential global basing options.

Command and Control

- Consider the emerging cyber threat to the command-and-control network and incorporate resilient/robust mitigation strategies and policies.
- Consider effective information management strategies to ensure the appropriate level of decision-making authority and common operational picture between the strategic, operational, and tactical levels.
- Focus on mission-type orders based on sound commander's intent to enable mission execution in degraded and contested environments.

- Stay synchronized with broader joint, multi-domain command-and-control initiatives to ensure continued capability across the joint logistics enterprise, to include air mobility.

Integrated Logistics

- Consider the emerging cyber threat to the broader logistics network—including both military and civilian industry partners—and incorporate resilient/robust mitigation strategies and policies.
- Consider developing technologies—including 3-D printing, composite materials, and emerging exoskeleton technology—and assess the effects on the integrated logistics chain.
- Consider threats to the US industrial base as well as other elements of globalization and their potential impact on the integrated logistics chain.
- Consider artificial intelligence's role in automating the integrated logistics chain.

Technology

- Consider evolving unmanned aerial vehicle/system technology and assess its future potential applications within the air mobility arena for cargo, passenger, and air refueling missions.
- Consider new possibilities for airlift, tanker, and air mobility support platforms that incorporate the latest technological advances and offer the greatest operational flexibility.
- Equally pursue technological innovations across support functions/equipment including navigation, mission planning, airfield operations, and maintenance.

Training

- Consider a robust schedule of coalition, joint, and Total Force air mobility training exercises focused particularly on skills that may have atrophied during the last decade of counterinsurgency support.

- Consider the appropriate balance between virtual and live mission training for both aircrew and support elements, and assess against operational efficiency.
- Consider continuing investments in strategic language and cultural awareness training to facilitate future air mobility operations.

In his final tenet Clausewitz notes a theory must be timeless in application and not limited by current trends in technology or military philosophy. This principle may arguably be the hardest one to judge effectively, but the air mobility theory presented here has attempted to remain agnostic of the latest weapons platforms or emerging strategic dictates, even when those elements undeniably form a critical part of the larger structure employing air mobility forces. Indeed, the theory's tenets of velocity and capacity align more closely with the enduring principles of war such as mass, maneuver, and simplicity than other contemporary axioms.

In the final analysis this paper illustrates one modest but critical point—*successful air mobility operations do not just simply happen.* In other words, to return to General Welsh's apt analogy, the light bulb does not always simply turn on once the light switch has been flipped to "on." That US air mobility operations have largely been successful to this point testifies to the vision and dedication of past air mobility leaders at all levels of the enterprise working to ensure the system behind the light switch is in place. The responsibility for ensuring the light remains bright into the future falls to the next generation of air mobility professionals who dedicate themselves to first understanding, then improving, these intricate connections from light switch to light bulb within the air mobility system. The continuing security of the nation depends on nothing less.

Notes

1. McRaven, *Spec Ops*, 423.

Abbreviations

A2AD	antiaccess/area denial
AB	air base
AD	air division
ALCE	airlift control element
AMC	Air Mobility Command
AMD	air mobility division
AOC	air and space operations center
ARVN	Army of the Republic of Vietnam
ATC	air traffic control, Air Transport Command
ATO	air tasking order
C2	command and control
CALTF	Combined Airlift Task Force
CAOC	Combined Air Operations Center
CCK	Ching Chuan King Airport
CCTF	Combat Cargo Task Force
CFACC	Combined Forces Air Componen Commander
CIA	Central Intelligence Agency
CJTF-OIR	Combined Joint Task Force Operation Inherent Resolve
COIN	counterinsurgency
CONUS	continental United States
CPD	Combat Plans Division
CRAF	Civil Reserve Air Fleet
CRAG	compass, radar, and GPS
CRG	contingency response group
DIRMOBFOR	director of mobility forces
DZ	drop zone
EAC	Eastern Air Command
FMS	foreign military sales

GCA	ground control approach
GCI	ground control intercept
GPS	Global Positioning System
HFOCC	Haiti Flight Operations Control Center
IAF	Israeli Air Force
ID	infantry division
IDF	Israel Defense Forces
ISF	Iraq Security Force
ISIL	Islamic State of Iraq and the Levant
ISIS	Islamic State in Iraq and Syria
ISR	intelligence, surveillance, and reconnaissance
IS	Islamic State in Iraq and Syria
JAT	joint assessment team
JCS	Joint Chiefs of Staff
JTF	joint task force
LRC	logistics readiness center
MAAG	Military Assistance Advisory Group
MAC	Military Airlift Command
MANPADS	man-portable air defense system
MATS	Military Airlift Transport Service
MINUSTAH	United Nations Stabilization Mission in Haiti
NATO	North Atlantic Treaty Organization
OAPEC	Organization of Arab Petroleum Exporting Countries
OIR	Operation Inherent Resolve
PACAF	Pacific Air Force
PLM	production line management
RAF	Royal Air Force
RAMO	rear airfield maintenance organization

RAMCC	regional air movement control center
SAC	Strategic Air Command
SDF	Syrian Democratic Forces
SEAC	Southeast Asia Command
TACC	Tanker Airlift Control Center
TACS	Theater Air Control System
TCC	Troop Carrier Command
USAAF	US Army Air Forces
USAFE	US Air Forces Europe
USAID	US Agency for International Development
USNORTHCOM	US Northern Command
USSOUTHCOM	US Southern Command
USTRANSCOM	US Transportation Command
VHF	very high frequency
VVS	*Voyenno Vozdushne-Sily*, Soviet Red Air Force

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Index

This study offers a theory of air mobility intended to assist practitioners and policy makers in analyzing the efficacy of air mobility operations. It begins by presenting a model of air mobility utility that incorporates the key airpower and logistical principles of velocity, capacity, attainability, and sustainability to graphically illustrate air mobility's effects within a campaign. Additionally, the five critical factors of freedom of movement, command and control, integrated logistics, technology, and training are examined as essential elements that must be addressed to determine air mobility success. Next the theory's model and factors are applied to eight historical case studies, ranging from combat operations of the Second World War to recent humanitarian disaster relief efforts, which typify the broad air mobility missions set.

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