19

Risky Business

Reducing Moral Hazard in Airlift Operations

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Contents

Illustrations

Figure

Foreword

Unlike physics or literature, strategy does not comprise an academic discipline, per se. It is, in every way, an interdisciplinary enterprise. For some, this can pose a problem—for others, a golden opportunity. Lt Col Rob Bearden is of the latter sort.

As he might put it, in war resources are always a concern. Ordinarily, the fear is that "we won't have enough," but can one have too much? In other words, what risks do commanders assume when they enjoy an abundance of resources? This is not an abstract question. In 2011 some 43 forward operating bases in Afghanistan relied exclusively on aerial resupply. At the same time, supplies airdropped into Afghanistan doubled each year to reach a height of 75.9 million pounds in 2011. At the end of that year, AMC was "on track to drop 90 million pounds" of supplies in 2012. Certainly, such accomplishments are a cause for celebration, but they are also a cause for reflection. By carefully grafting theories of moral hazard and principal-agent relationships onto a close reading of military history, Bearden's work provides a startling insight. He demonstrates that consistent with the concept of moral hazard, agents do tend to take on additional risks in light of insurance; thus, demonstrating the role moral hazard plays in airlift operations.

As an object of inquiry, the relationship between moral hazard and war has not been a major concern for either scholars or practitioners. But as evidenced here, it should be. Originally developed as a master's thesis for Air University's School of Advanced Air and Space Studies (SAASS), Lieutenant Colonel Bearden's *Risky Business: Reducing Moral Hazard in Airlift Operations* received the Airlift/Tanker Association Global Reach Award for the best SAASS thesis on the subject of airlift operations or mobility. I am gratified to have played a small part in its completion and graciously commend it to the reader as a superb exemplar of in-depth research, compelling argumentation, and felicitous expression.

JAMES W. FORSYTH, JR.
Professor of National Security Studies
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About the Author

Lt Col Robert C. Bearden received his commission through the Air Force Reserve Officer Training Corps at Oklahoma State University in June 1997. His first operational assignment was as the assistant installation deployment officer at Eielson Air Force Base (AFB), Alaska. Following this assignment, he served as a logistics plans and vehicle management flight commander at Holloman AFB, New Mexico, and was subsequently reassigned to the Air Force Intern Program at the Pentagon. He then served as a flight commander and operations officer at Elmendorf AFB, Alaska, and later two years as an action officer in the Directorate of Logistics, Headquarters United States Air Force, Washington, DC. He has operational deployments to Saudi Arabia, Qatar, and Afghanistan where he provided logistics expertise to a variety of Air Force, joint, and coalition operations. Immediately prior to attending the School of Advanced Air and Space Studies, Colonel Bearden commanded the 8th Logistics Readiness Squadron at Kunsan Air Base, Republic of Korea.

Colonel Bearden has a bachelor's degree in political science from Oklahoma State University and a master's degree in organizational science from George Washington University. Following graduation from the School of Advanced Air and Space Studies, he took command of the 49th Logistics Readiness Squadron at Holloman AFB, New Mexico.

Acknowledgments

I would like to thank Dr. Jim Forsyth for his encouragement and direction. He shared my vision for this project when few others did and gave me the opportunity to explore a common topic in an uncommon manner. Dr. Richard Muller was also extremely helpful. In addition to reading and editing the manuscript along the way, he helped me ensure this work had contemporary relevance. Lastly, Dr. Thomas Hughes was the first to put the words "moral hazard" to the issue I was describing and assisted with the case selections.

I also thank my sister for her insightful edits. I will never master the English language in the way she has, but I appreciate her patience in teaching me. Thanks, sis.

I also must thank my wife, our daughters, and our son for their patience and understanding. Coming to SAASS following a yearlong remote tour was, in many ways, like two remotes in a row. They handled it like champions, encouraged me daily, and spurred me to success. I could not have done it without you four!

Finally, I thank the Lord for seeing me through this project. I began the year with the following psalm in mind: "Commit your way to the Lord, trust also in Him, and He shall bring it to pass." I made feeble attempts on my part, but He has been true to His. Any good that comes of this work is because of Him.

Abstract

This study examines the role of moral hazard in airlift operations. The author turns to the world of economics and insurance to define moral hazard and then examines two historical case studies through this lens. By conducting a comparative case study of the airlift-dependent operations at Dien Bien Phu and Khe Sanh and examining these in terms of moral hazard, the author establishes that moral hazard plays a role in airlift operations, that this role is not predictive in nature, that this role illuminates risks that may otherwise go unnoticed, and that there is a positive relationship between airlift capacity and moral hazard. The author then examines US airlift operations in Iraq and Afghanistan from 2001 to 2011 in light of the conclusions drawn from Dien Bien Phu and Khe Sanh. This comparison provides additional evidence for the case at hand and demonstrates the relevance to present-day events and concerns. The author postulates that a doctrinal solution best addresses moral hazard in airlift operations by informing the application of airlift in military operations while not arbitrarily curtailing or limiting those operations. The author concludes that such a doctrinal solution helps to inform military judgment and ensures risks associated with airlift-dependent operations are more fully accounted for than they would be otherwise.

Chapter 1

Introduction

The Problem and Its Setting

The line that connects an army with its base of supplies is the heel of Achilles—its most vital and vulnerable point.

—Col John S. Mosby
Commander, 43rd Battalion
1st Virginia Cavalry
Confederate States Army

According to the United States Air Force's (USAF) Air Mobility Command (AMC), in 2011 some 43 forward operating bases (FOB) in Afghanistan relied exclusively on aerial resupply.[1] At the same time, data from US Air Forces Central (USAFCENT) reveal that supplies airdropped into Afghanistan have doubled each year since 2006 to reach a height of 75.9 million pounds in 2011, and an *Air Force Magazine* daily report noted that AMC was "on track to drop 90 million pounds" of supplies for 2012.[2] Such statistics represent either moments for celebration or moments for pause and reflection. From the perspective of someone concerned with the achievements of airlift, the ability to support simultaneously more than 40 combat outposts solely by air while concurrently doubling airdrop tonnage five years in a row is certainly a testament to the capacities and abilities of the USAF and specifically those of AMC. At the same time, however, such exponential increases might be reason enough to pause and reflect on the risks they represent or obscure. This study seeks to take that pause and apply a novel lens to the study of airlift in combat operations, especially to those operations that use airlift as a sole means of supply. Before embarking on that journey full force, it is worthwhile to consider the impetus for the study and the research methodology employed herein.

Impetus, Methodology, and Case Selection

A reading of British colonel C. E. Callwell's *Small Wars: Their Principles & Practice* sparked this study. Originally published in 1896, Callwell's text represents one of the earliest and most comprehensive modern assessments of irregular warfare (IW) and captures the wisdom and lessons gleaned from his

experiences in the Afghan and First Boer wars in the 1880s. While valuable in many ways, most striking is Callwell's discussion of the flying column. Callwell defined flying columns as "self-contained bodies of troops roaming through the theater of war," and he noted that these were common approaches to the conduct of IW.[3] These flying columns were, according to Callwell, free of their lines of communication (LOC) or lines of supply. In fact, LOCs remain a relevant part of today's military doctrine, and the Department of Defense defines them as "a route, either land, water, and/or air, that connects an operating military force with a base of operations and along which supplies and military forces move."[4] What Callwell correctly discerned was that LOCs represented a weak point for forces engaged in IW and that there were advantages available to those who could free themselves from reliance upon them. He did this by showing that flying columns had the distinct advantage of dispensing with their own LOCs and, therefore, gained the freedom of movement to protect those LOCs that were required for the support of the larger force.[5] Inherent in this freedom of movement, however, was obviously some level of risk. Clearly, a military unit can only survive for so long with no LOCs and, therefore, no connection to a means of resupply.

The risk these flying columns took in absence of a means of resupply seems relatively reminiscent of today's airlift-supplied FOBs. On the one hand, these bases so resemble Callwell's flying columns that they serve as a testament to Callwell's ability to discern a tactical truism for IW. On the other hand, they also represent fertile ground for a risk-related study. With the general idea that today's airlift-supplied FOBs represent an increased level of risk due to reliance upon a single or tenuous LOC, the situation seems to beg further analysis and offers an opportunity to apply a unique perspective to the problem.

While other comparative case studies involving airlift-dependent situations exist, the present study takes a novel approach and assesses the available evidence in terms of moral hazard.[6] The idea of moral hazard has likely been around as long as the insurance industry, but it gained popularity in the late 1960s thanks to the work of economist Kenneth Arrow, who later won the Nobel Prize in Economic Sciences.[7] In fact, Arrow's early discussion of moral hazard spawned an interesting scholarly debate that took place in *The American Economic Review* in which he and Mark Pauly laid out many of the foundational issues of the concept that still foster debate today.[8] Importantly, the discourse between Arrow and Pauly revolved around the tendency for actors to change their behavior in light of insurance.[9] This focus on behavior remains evident in contemporary definitions of moral hazard like the one provided by the Organization for Economic Cooperation and Development (OECD) that says, "Moral hazard describes behaviour when agents do not

bear the full cost of their actions and are thus more likely to take such actions."[10] Therefore, a key aspect of moral hazard is a change in behavior due to insurance. In fact, although implied in the OECD definition, moral hazard is a particular type of principal-agent problem in which the principal is the provider of some sort of insurance, and the agent benefits from that insurance. For the purposes of this study, moral hazard will be viewed as a principal-agent problem of this type, and I will employ Benjamin Hale's definition of moral hazard as "the danger that in the face of insurance, an agent will increase [its] exposure to risk."[11] Using an overall principal-agent approach and Hale's definition of moral hazard, I will present an analysis of historical cases where units dispensed with their traditional LOCs and relied solely upon airlift. In this way, airlift represents the insurance provided and brings several different principals and agents into view. Throughout the study, changes in behavior on the part of agents benefitting from airlift remain central; however, moral hazard spawns consideration of other interesting points involved in principal-agent relationships.

Particular among these aspects of principal-agent relationships, Arrow's work on insurance and economics dealt with information asymmetry. Arrow made this point in an essay on insurance and risk allocation wherein he noted that "the risk-bearer cannot completely define his risks," implying that there was a divergence for information held by the principal relative to the agent.[12] This information asymmetry is now recognized as a fundamental aspect of modern insurance theory and can be simply understood as the case where "a decision that is privately made by one party [is] not observable by the other."[13] Therefore, using moral hazard to assess airlift-dependent military operations not only provides a fresh approach but also facilitates viewing these operations in terms of altered behaviors, principals and agents, and information asymmetry. Doing so will provide unique insights into the risks associated with military airlift, especially in the cases of airlift-dependent operations.

All research has limitations, and this study is not unique in that regard. Although viewing airlift in terms of moral hazard provides a different perspective, a likely critique of this approach is that attributing moral hazard at the level of a nation-state or government is overly difficult. Such a critique is not without cause, as there are obviously countless factors that influence behaviors and decisions of agents. While this may be the case, it is still possible to consider the level of insurance provided by a principal and logically determine whether that insurance could have reasonably affected the agent's decision making. At the most fundamental level, this is possible simply by considering whether an agent's actions would have been possible without the insurance. If not, this altered behavior in light of insurance would be consistent with moral

hazard as debated by Arrow and Pauly and as defined by Hale. An additional limitation of the present research is readily apparent in the focus of the case studies because the research considers each case primarily from a fixed-wing airlift perspective. For both of the primary cases, many other views are available, but zeroing in on fixed-wing airlift is necessary for scope and clarity. Finally, although the two primary cases benefit from well-established historical narratives, a subsequent chapter compares these to contemporary operations that lack such established accounts. The primary impact of this limitation is a shift in the source material toward press releases and related media for that portion of the research. Within those limitations, two cases are foundational to this project.

The two primary case studies are the French experience at Dien Bien Phu and the US experience at Khe Sanh, each of which is an exemplary case of airlift dependency. These are viable cases because they represent situations where ground units relied solely upon airlift as a means of resupply. Both involved a ground force besieged by a much larger enemy, and they had widely divergent outcomes. They also took place in the similar geographic condition of Southeast Asia, and they offer a variety of opportunities to apply moral hazard and principal-agent logic and analysis. Other cases such as the German experience at Stalingrad in World War II and the US-led Berlin airlift, although viable, are not included primarily out of concern for scope. Finally, although no operations in the twenty-first century yet rise to the level of Dien Bien Phu or Khe Sanh, airlift dependencies in Iraq and Afghanistan make for interesting contemporary applications of the moral hazard ideas born out in the two primary cases.

Terminology and Definitions

The terminology for this study naturally involves a variety of military and economic terms. Already discussed from each of these categories are *lines of communication* and *moral hazard*. Each is critical as two primary propositions of the study are that moral hazard plays a role in airlift operations, especially in those cases where airlift represents a sole LOC, and that agents will take on additional risks in light of the insurance of airlift. Although this study is as jargon free as possible, a few airlift-related terms demand clarification. First, for the purposes of this study, *airlift* represents those "operations to transport and deliver forces and materiel through the air in support of strategic, operational, or tactical objectives."[14] Furthermore, to provide some measure of variety, the terms *airlift* and *aerial delivery* are interchanged throughout the study. In either case, it is crucial to note that both terms consist of a

combination of two distinct subsets: air land and airdrop. *Airland* refers to airlift operations where passengers or cargo disembark or unload after the aircraft has landed or while an aircraft hovers.[15] *Airdrop*, on the other hand, refers to the "unloading of personnel or materiel from aircraft in flight."[16] Therefore, air land and airdrop operations are two types of airlift or aerial delivery operations. They are the primary means of transportation considered throughout the study, but the study does focus on airlift and aerial delivery generally, not on air land or airdrop methodology specifically. Finally, for the convenience of the reader, other military-specific terms are spelled out and defined within the text.

Overview of Chapters

This introduction serves as chapter 1, and chapter 2 recounts the French experience at Dien Bien Phu. As the decisive battle of French influence in Indochina, Dien Bien Phu remains, to this day, a seminal case study in what not to do with airlift. At the same time, the crucible that was Dien Bien Phu forged many of the techniques and procedures that make airlift effective today. Additionally, the French experience provides several principal-agent relationships to explore and brings to light the propensity for agents to take on risks in light of insurance with incomplete knowledge of the principal's ability to make good on that insurance. This case also suggests that as airlift capacity increases, so, too, does the risk of moral hazard.

Chapter 3 expands on the moral hazard argument with an analysis of the US experience at Khe Sanh. Like the French at Dien Bien Phu, the US Marine Corps (USMC) at Khe Sanh was besieged by a force several times its size and relied solely upon airlift for its resupply. Despite an opening day that appeared tragic in the extreme, Khe Sanh ended in victory rather than defeat for the United States, and to this day, the USAF heralds it as an airlift success story.[17] If Dien Bien Phu helped forge the modern practice of airlift, then Khe Sanh honed it. With the refinement of tactics and techniques, Khe Sanh furthered the practice of airlift and brought new technologies to bear. As at Dien Bien Phu, principal-agent relationships illuminate the battle of Khe Sanh and provide a different perspective on the event, showing evidence of altered behavior in light of insurance, information asymmetry among the actors, and additional evidence for the capacity argument introduced in chapter 2. Most importantly, the Khe Sanh case study brings to light the fact that moral hazard helps to explain risk exposure but does not provide any prediction of outcomes. In this way, Khe Sanh helps to set outer limits of moral hazard analysis in airlift operations.

With the two major cases explored, chapter 4 reviews US operations in Iraq and Afghanistan from 2001 to 2011. Due to the broad span of time considered, this chapter employs a chronological format while tracing two major threads of airlift over the period. Because these post–9/11 operations have yet to produce a case of airlift dependency of the extent seen at Dien Bien Phu or Khe Sanh, these operations present a difficult test for the role of moral hazard but still serve to confirm conclusions drawn earlier in the study. Contemporary operations reviewed in chapter 4 show the same potential for the role of moral hazard and information asymmetry and bolster the evidence for a relationship between airlift capacity and risk of moral hazard situations.

Finally, chapter 5 draws on the analysis from the three previous chapters and explores a variety of possible correctives to the risk moral hazard presents in airlift operations. Solutions considered range from structural corrections like budget limits and fleet sizes to normative solutions like training and doctrine. After reviewing the available options, the chapter proposes a doctrinal solution based on a review of the relevant joint and service doctrine. The conclusion explores the enduring implications of this research and the broader benefits of the same and offers suggestions for further research.

Notes

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3. C. E. Callwell, *Small Wars: Their Principles and Practice*, 3rd ed. (Lincoln: University of Nebraska Press, 1996), 118.

4. Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 8 November 2010, http://www.dtic.mil/doctrine/dod_dictionary/.

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6. For examples of other comparative case studies of Dien Bien Phu and Khe Sanh, see John A. Tokar, "Provide by Parachute: Airdrop in Vietnam 1954–1972" (monograph, US Army Command and General Staff College, Ft. Leavenworth, KS, 17 December 1998), http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA366266&Location=U2&doc=GetTRDoc.pdf; or Gregory C. Kane, "Air Power and Its Role in the Battles of Khe Sanh and Dien Bien Phu" (master's research paper, Air Command and Staff College, Air University, Maxwell AFB, AL, March 1997), http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA398450&Location=U2&doc=GetTRDoc.pdf.

7. Benjamin Hale, "What's So Moral about the Moral Hazard?," *Public Affairs Quarterly* 23, no. 1 (January 2009): 3.

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12. Kenneth J. Arrow, *Essays in the Theory of Risk-Bearing* (Chicago: Markham Pub. Co, 1971), 142.

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14. Air Force Doctrine Document (AFDD) 3-17, *Air Mobility Operations*, 1 March 2006, 103, http://www.e-publishing.af.mil/shared/media/epubs/AFDD3-17.pdf.

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16. Ibid.

17. AFDD 3-17, *Air Mobility Operations*, 40.

Chapter 2

Dien Bien Phu

An overdependence on air support and supply can lead to disaster during a guerrilla-type campaign in difficult terrain or adverse weather conditions.

—Howard R. Simpson
Dien Bien Phu: The Epic Battle America Forgot

Nearly 60 years after the French surrender at the Battle of Dien Bien Phu, the name of this otherwise obscure valley and village in northern Vietnam remains etched in the collective memory of military historians and students of warfare alike. The same is true for strategists, logisticians, and tacticians who review and study this battle in hopes of avoiding the mistakes for which it is notorious and capitalizing on its otherwise forgotten successes. It continues to be a key subject of interest for military and civilian historians as evidenced by the publication of exhaustive scholarly works well into the twenty-first century.[1] The fact that a 60-year-old battle remains instructive is an initial indicator of the extent and gravity of the original affair, although it should come as no surprise that the battle is still relevant. In fact, one of its most recent chroniclers has stated that "war is not an aberration—it is what human beings do."[2] Accepting this, Dien Bien Phu remains an ever-relevant area of study, which illustrates at least that people still want to learn from their mistakes, especially in war.

When it comes to learning from mistakes, it must be understood that Dien Bien Phu shares very little room at the top of a short list of operations that exemplify "what not to do" with airlift. Given that history is not inevitable, the echo of the words "Dien Bien Phu" would have died long ago had the outcome been different for the French. Had they instead succeeded, the battle of Dien Bien Phu would provide the 1950s-era model of how to use airlift in military operations. Interestingly, other successful airlift operations actually made supplying this remote valley solely by air a viable consideration.

Confidence in a Concept: 20 November–26 December 1953

Encouraged by airlift successes at Nghia Lo and the Battle of Na San, the French idea of supporting remote garrisons in Indochina solely by airlift was

more than plausible; to the French, it was a proven and vindicated concept.[3] This, along with concerns about a strengthening enemy and threats against French interests in Laos, led Gen Henri Navarre, France's commander in chief in Indochina, to establish the "base *aéro-terrestre*" (airhead or airland base) at Dien Bien Phu.[4] If the Viet Minh would offer battle at Dien Bien Phu, General Navarre hoped to accept and use French artillery, airpower, and armor against them in a defensive manner. Doing so would achieve the destruction of the Viet Minh by letting them throw themselves against the French stronghold. Alternatively, if the Viet Minh would not offer battle, then French forces could use Dien Bien Phu as a strongpoint from whence to take the fight to their enemy. Either way, a battle at Dien Bien Phu would facilitate, if not ultimate victory, a step toward the honorable French departure that was General Navarre's primary objective.

With these options in mind, Operation Castor began in earnest on 20 November 1953 with the intent of retaking the area of Dien Bien Phu. The French forces had withdrawn from that area nearly a year prior, leaving a vacuum the Viet Minh happily filled. French intelligence was aware of Viet Minh forces in the area; however, they knew that the bulk of these forces was out on the Laotian border, leaving relatively little expected resistance at the field itself. What French intelligence did not know or expect was that portions of the remaining units would be on the airfield conducting exercises and thus were well prepared to give armed resistance. Despite an insertion that met greater resistance than expected, by the end of the day, the French had used three waves of every Douglas C-47 Dakota transport (known as Skytrains in USAF parlance) they could muster to deliver some 2,600 paratroopers and their associated supplies to an isolated location more than 200 miles behind enemy lines.[5] Although the initial seizure of the airfield by airdrop facilitated a level of surprise that an airland delivery could not offer, airdrop was in fact the only viable option for all of the early deliveries because the airfield was unserviceable—the work of the Viet Minh, who had dug numerous holes across the airstrip. This necessitated the aerial delivery of a bulldozer to repair the runway and make it available for airland operations that would augment the multiple drop zones already in use for the ongoing airdrop missions.

Although sources disagree on the specific date, all agree that sometime in the first four days of Operation Castor, a Fairchild C-119 Packet transport (known as Flying Boxcars in USAF parlance) unsuccessfully dropped a bulldozer that quite spectacularly came free of its rigging and free-fell to the earth. A subsequent attempt was successful, and USAF official histories note that C-119s delivered the blade and dozer in separate sorties and that the drop was the first "known attempt to drop a bulldozer from a C-119."[6]

Following the arrival of the bulldozer, airfield repairs began in earnest, and by 25 November 1953 the first C-47 was able to land at Dien Bien Phu.[7] With the airfield open and the drop zones secure, Dien Bien Phu was a viable French base deep in Viet Minh territory that could be supplied, augmented, and if need be, evacuated by air.

Because of the isolated nature of the location, the French forces relied solely on aircraft for all movements into, and out of, Dien Bien Phu. However, it is notable that the French pursued this effort with the foreknowledge that they lacked adequate aircraft for the task and would require American assistance to keep Dien Bien Phu supplied.[8] This is evident not only in the fact that France had obtained US air support in Indochina with the signing of the mutual defense agreement in late 1950 but also in the composition of its transport fleet. Although there is some discrepancy among the major works regarding unit designations, all agree that the transport aircraft employed by the French were entirely of US make and were a combination of C-47s and C-119s.[9] In fact, Bernard Fall's accounting of the French air force fleet shows that all of the fixed-wing aircraft available were of US origin except a few reconnaissance and liaison aircraft.[10]

The extent to which the French relied on US support is further evident in the fact that as the battle of Dien Bien Phu developed, the French air force made an "urgent request" in late January 1954 for USAF aircraft maintenance support. This request was of sufficient urgency to drive a four-day deadline for the delivery of support. This request was subsequent to a September appeal for 25 additional C-47 aircraft intended to stand up another airlift squadron in Indochina.[11]

The January request also drove the direct involvement of USAF general officers, one of whom flew from Japan to the Philippines to brief personally the US Airmen tasked for the mission.[12] It is also notable that the United States responded to a French request and sent five C-119s to Indochina as early as 14 November 1953 to train French crews, clearly indicating an understanding on the part of the French of the need for additional lift capacity prior to the retaking of Dien Bien Phu.[13] With this fleet of US aircraft and support personnel, the French air force (with the help of some commercial carriers and later the Central Intelligence Agency's [CIA] Civil Air Transport [CAT] airline) would endeavor to supply by air every need of the base until its eventual fall on 7 May 1954. Fortunately, early flights into Dien Bien Phu met with relatively little resistance and were able to supply the base effectively.

Within 10 days of establishing their base at Dien Bien Phu, the French forces received their first orders to begin conducting raids from that location.[14] From the latter part of November through December, the raids conducted

from Dien Bien Phu facilitated the reconnoitering of enemy strength, link ups with other friendly forces in the area, and, in one case, support for the evacuation of an embattled village. These raids continued until they were no longer tenable, given the enemy's strength around the base. In the years since, scholars have consistently noted the dichotomy these raids present with regard to General Navarre's goals concerning Dien Bien Phu. If the base was to be a defensive position that could withstand waves of Viet Minh attacks, then these ventures out into the jungles only served to weaken that position by preventing further strengthening of the base. In fact, during the conduct of these early raids, efforts were under way to strengthen defensive positions at Dien Bien Phu. This divided effort between the offensive and defensive attracts consistent critiques because the lack of focused effort highlights that there was no consistent understanding as to how the force at Dien Bien Phu would be utilized. These deep excursions out of Dien Bien Phu continued until 26 December 1953, when the French realized a direct linkage with friendly forces in Laos was unrealistic.[15]

Even as these efforts were under way, major support from the United States came in the form of Operation Iron Age. Originally, Iron Age was a classified operation due to the secret nature of US support to the French in Indochina. Declassified unit histories reveal that Iron Age began on 5 December 1953 with the delivery of 12 C-119s to Cat Bi Air Base.[16] These aircraft were given French markings at Clark Air Base in the Philippines, and then delivered to Cat Bi at Haiphong. At Cat Bi they were maintained by US Airmen but flown by French crews. Initially, the loan period for the C-119s was limited to five days, but this was quickly extended as the reality of Viet Minh movements toward Dien Bien Phu became clear. By the time the first iteration of Iron Age ended, the planned operational end date for Iron Age had crept from 10 December to 22 December, and planning for subsequent Iron Age operations was already under way.[17] In this manner, Iron Age support took on a continuous nature, with one operation following another throughout the French occupation of Dien Bien Phu. In all, there were six Iron Age operations, and history seems to show that by the last iteration, the perpetual nature of the support was finally a given. Iron Age VI provided the French with 12 C-119 aircraft and the necessary support for "an indefinite period."[18]

Arrivals: 26 December 1953–12 March 1954

Following the last deep raid that ended on 26 December, the activity at Dien Bien Phu was characterized by arrivals both in the literal sense of the open and operating airfield and in a broader sense that included the arrival of

substantial enemy forces. In addition, there was the arrival of bad weather that hampered supply efforts in December 1953 and throughout January 1954, completely suspending air operations on at least four days of the latter month.[19] Weather would play a factor throughout the French occupation of the base. Notably, Dien Bien Phu was subject to regular fog that often did not burn off until midmorning, and the seasonal monsoon rains worsened this condition, providing even more moisture to an already fog-prone valley. Fog and low ceilings were such a dominant condition that the French ground crews went so far as to use a weather balloon to mark one of Dien Bien Phu's drop zones in hopes of making drop operations viable when airland operations were not. In spite of efforts like these, weather would present a consistent limitation for air operations, and the later monsoon rains would eventually turn the ground at Dien Bien Phu into a muddy mess.

This period witnessed another significant arrival in the form of 15 additional aircrews that arrived in the month of January.[20] 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. The extent of the crew shortage has been subject to some debate, and the numbers are not consistently agreed upon. Martin Windrow noted that there were only 78 crews in Indochina (60 of which were operational), and Fall stated the shortage was so drastic that there were only 40 twin-engine crews left in reserve back in France. Fall later asserted that there were only 52 C-47 crews in Indochina to man 70 aircraft.[21] Regardless of the additional crews that arrived in January, scholars have consistently cited crew limitations as a major issue. One of these scholars, John Plating, noted that crew limits were bad enough that Colonel Nicot authorized flying the C-47s without a copilot, thus theoretically increasing his crew to aircraft ratio by twofold.[22]

Aside from the arrival of bad weather and replacement aircrews, a more significant arrival to the valley came in the form of enemy forces. Led by Gen Vo Nguyen Giap, Viet Minh units began building up in the area around Dien Bien Phu as early as December. Expertly camouflaged on the high ground around the valley, Viet Minh forces had installed numerous artillery pieces, rockets, and antiaircraft guns primarily with manpower and little to no mechanized assistance. Brashly, the French, who assessed the area as too rugged for the primitive Viet Minh to take advantage of, thought the emplacement of

this kind of hardware on the subject terrain was impossible.[23] Contrary to this expectation, the Viet Minh emplaced significant artillery around the valley. Although the actual numbers are unknown, recent scholarship puts the total at 24 105 mm howitzers, as many as 24 75 mm howitzers, 20 120 mm mortars, an unconfirmed number of 82 mm mortars, several Katyusha rocket launchers, and at least 36 37 mm antiaircraft guns.[24] Along with this complement of artillery, by early March, Giap amassed forces in the area totaling some 49,000 combat troops accompanied by an unconfirmed number of support troops (estimates range from 10,000 to 50,000).

In contrast, French forces at Dien Bien Phu numbered about 15,000. Despite the sheer numerical superiority of the Viet Minh, the French were confident in their ability to eliminate enemy artillery through air attack or counterbattery fire. The use of local air assets to achieve this (six or more Grumman F8F-5 Bearcats occupied revetments near the airstrip until 14 March 1954) proved more difficult than expected due to two factors. First, the level of camouflage the Viet Minh achieved made the positions difficult to attack from the air or the ground. Second, the viability of local air support became questionable on 31 January 1954 when the Viet Minh first unleashed their 75 mm and 105 mm howitzers on the airstrip and damaged an aircraft. Having revealed their artillery capacity and accuracy, the Viet Minh showed that the airfield might not remain available unless the French could counter Viet Minh firepower.

For their part, the last of the French artillery assets arrived 2 March 1954 in the form of four quad fifties (four-barreled .50-caliber guns). In addition to the quad fifties, the French had brought in by air 10 US-supplied M24 Chaffee light tanks, 24 105 mm howitzers, four 155 mm howitzers, and a heavy mortar company. Earlier, some old 105 mm and 75 mm guns had been brought in, but these were later swapped for more modern and accurate weaponry. The extent of the airlift effort is notable in the case of the 10 18-ton tanks, each of which had to be stripped down to 180 component parts and flown in on six C-47s and two commercial freighters (Bristol 170s).[25]

With the French and Viet Minh forces largely in place, the French made local reconnaissance ventures to determine actual enemy strength and attempt to destroy Viet Minh artillery, which had proved seemingly impervious to French artillery and air attacks. These ventures continued in spite of losses, and on 15 February an assessment revealed that since their arrival on 20 November, the French had lost 10 percent of their officers and 8 percent of their troops. This, along with the reality of impending Viet Minh encirclement, caused the French commander of northern land forces, Gen René Cogny, to direct Brig Gen Christian de Castries, who was tasked with the

defense of the base, to limit any excursions. The intent of this restriction was to limit casualties and conserve the strength of the garrison.[26] The last of these more limited excursions came on 11 March 1954. This particular mission revealed that the Viet Minh were now digging approach trenches toward the base in daylight. Previously, the Viet Minh had limited such work to more nocturnal or crepuscular efforts.

Throughout this period, the dependence of the base upon airlift had become more and more of a concern. Crew shortages, weather, and competing airlift priorities elsewhere in Indochina exacerbated the already strained limits of the C-47s and the C-119s provided by the United States. To alleviate these concerns, the French entered into a contract with the CIA's CAT airline. Started by retired US Army Air Force major general Claire Chennault and Whiting Willauer in China during that country's civil war, the CIA later purchased CAT to fly its covert operations. With combat-tested veterans as pilots, CAT had a proven ability to provide airlift where and when needed. Although CAT had previously assisted the French in Indochina, a new contract was initiated in early March 1954, and CAT pilots were flying missions over Dien Bien Phu as early as 12 March. With 24 pilots and the 12 USAF-provided and maintained C-119s as part of Operation Iron Age, CAT brought Colonel Nicot some much-needed additional capability. CAT flew almost 700 missions in support of Dien Bien Phu and lost only one aircraft and crew to enemy fire over the base.[27] As far as significant support goes, the arrival of CAT on 12 March was the last major boost the French would receive.

Desperation: 13 March 1954–7 May 1954

Although the French leadership had expected the Viet Minh to attack in earnest in January, General Giap instead chose to build his forces through early March. Then, on 13 March, he began his siege of Dien Bien Phu with artillery shelling of the airfield and its associated strongpoints. By the end of the day, Viet Minh artillery destroyed six of the garrison's F8Fs, highlighting both the accuracy of the artillery fire and the vulnerability of the French base. From this point onward, it was clear that the airfield and any aircraft on the ground were vulnerable to Viet Minh targeting. By 14 March all of the Bearcats were destroyed or forced to relocate to an alternate field, rendering the local air support that the French had counted on as a key strength no longer viable.

Between 14 and 17 March, Giap's forces used artillery, approach trenches, and infantry attacks to seize French strongpoints. The first of these to fall was strongpoint Beatrice, which fell in a matter of hours and was followed by two others over the next several days. The effect of these losses was that the Viet

Minh not only had the demonstrated ability to attack the airfield at will but also the positional advantage on any aircraft attempting to land, take off, or drop at Dien Bien Phu. Despite this advantage, French airmen continued successful airland operations up through 27 March. During this period, antiaircraft fire threatened the Dakotas as they approached, as did artillery fire while they were on the ground, but they continued their missions out of necessity and were able to evacuate 324 wounded from the installation. On 28 March, a Dakota on a medical-evacuation mission was destroyed on the ground and became the last Dakota to land at Dien Bien Phu.[28] From 28 March forward, everything that arrived had to come in by parachute.

The fact that future supplies would have to arrive by parachute was concerning in itself but was complicated further by the Viet Minh seizure of French strongpoints. Not only did these strongpoints give the Viet Minh positional advantage as mentioned previously, but they also served to restrict the physical size of the drop zone available to the French and CAT crews. In addition, effective Viet Minh antiaircraft fire forced aircraft to make their drops from higher altitudes, which, in turn, made the drops more inaccurate. In this way, the individual effects of seized strongpoints and effective antiaircraft fire yielded a compounding negative effect upon French airdrops, making them even more difficult and inaccurate as time went on. This restriction of the drop zone and persistence of enemy artillery and antiaircraft guns led the French to consider napalm as an alternative means of regaining some superiority. Initially the French attempted these drops from C-47s, but these proved ineffective. They then determined that the C-119 would be the more drop-capable platform. However, due to the nature of the loaned aircraft and the fact that most of the pilots flying the C-119s were Americans working for CAT, the US government was presented with a delicate issue of whether or not to approve napalm drops from the C-119s.[29] Eventually, the US granted approval, and the C-119s performed this service more or less ineffectively in late March and early April. Additionally, this effort had a negative effect on the garrison at Dien Bien Phu by limiting the number of aircraft dropping vital supplies.[30]

In spite of the constricting drop zone and the effective antiaircraft fire, the French went to great lengths to keep the base functioning. Not only did aircrews continue airland operations until such operations were no longer feasible, but actual unit reinforcements also arrived by airdrop despite the threat. Notably, reinforcements into Dien Bien Phu included volunteers from staffs and elsewhere in Indochina. Many of these were not jump qualified and made the first and only jump of their careers into the besieged base. Despite this level of courage, reinforcing the garrison in this manner had a limited

effect even though it continued until the early morning of 7 May when the "luckiest paratroopers in Indochina" were not dropped because units engaged on the ground needed the light of flares more than they needed the reinforcements that would require darkness to survive the jump.[31]

Dien Bien Phu finally fell on 7 May 1954. By the end of the battle, the French had suffered total casualties (killed, wounded, and missing) of more than 7,000 and possibly 9,000 or greater taken captive at the end of the battle, with the odds stacked against them for surviving their imprisonment.[32] In similar fashion, Viet Minh casualties were also high with estimates nearing the 23,000 mark. The fact that the estimated casualties on the Viet Minh side far exceed those of the French begs the question, why did it go so wrong for the French?

Why Did It Go So Wrong?

In answering the question of why Dien Bien Phu went so wrong for the French, it is fair to say they were outgunned, outcamouflaged, and outfought in that they overestimated their own abilities while underestimating those of their enemy. To illustrate this, consider first the French efforts to strengthen their defenses. These defenses required lumber harvested from the valley to build emplacements. This, combined with routine needs like cooking fires, systematically deforested the lower portion of the valley. This ultimately meant that the French battlements contrasted distinctly against the landscape and became clear targets or reference points for Viet Minh gunners. Those same gunners enjoyed two distinct advantages over the French. First, they had expertly camouflaged emplacements, making them almost impossible to attack effectively either from the air or from the ground.[33] Second, they simply outnumbered the French guns three to one. Both of these advantages sat in stark contrast to French assumptions regarding the Viet Minh. Namely, these were that the Viet Minh would not be able to move and emplace extensive firepower around the valley, and if they did, they would not be able to withstand French counterfires.

These assertions and the overall assumption regarding French preeminence are most evident in the declaration that Fall attributed to the French artillery commander, Col Charles Piroth, at Dien Bien Phu. According to Fall, Piroth regularly made the following statement to distinguished visitors at the camp: "Firstly, the Viet-Minh won't succeed in getting their artillery through to here. Secondly, if they do get here, we'll smash them. Thirdly, even if they manage to keep on shooting, they will be unable to supply their pieces with enough ammunition to do us any real harm."[34] Although Fall also asserted

that Piroth was personally less than certain of the situation (because he corresponded with higher headquarters regarding the relatively small amount of artillery at his disposal compared to the French standard) and that he likely tailored his comments depending on his audience, Piroth obviously held his beliefs with great conviction. This conviction was so extensive that, following the start of the siege and the ineffectiveness of his fires in the face of it, he vocally lamented that he had let de Castries down. In fact, he took this failure so personally that he committed suicide only days after the Viet Minh artillery proved so effective.[35] In a real way, Colonel Piroth gave voice to a French belief that they would prove superior to their opponent. This confidence could not have been more misplaced.

Each of the preceding factors for the French defeat is true in its own accord and accounts at least partially for the eventual outcome of the battle. However, it may be more important to acknowledge that the defeat ultimately resulted from a misapplication of airpower. Significant works of scholarship have highlighted this issue. Windrow devotes the bulk of a chapter to the role of airpower. Fall stated that considering all that has been said about "the many major and minor errors which led to the French debacle at Dien Bien Phu . . . one single fact stands out above all others. *Air power on a more massive scale than was then available . . . would have saved Dien Bien Phu*" (emphasis in original). Notably, on the same page, Fall established that Dien Bien Phu, like many besieged fortresses that went before it, "died from its supply deficiencies."[36] The inextricable tie between these two concerns (supply deficiencies and airpower) at Dien Bien Phu made the misapplication of airpower the ultimate mistake.

A Lack of Concentration

Today's Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine, Organization, and Command*, asserts that there are certain basic tenets of airpower that, as guiding truths developed over time, reflect both specific lessons learned and today's corporate knowledge on the application of airpower.[37] Among these tenets, the concept of concentration refers to the use of airpower in a manner that brings the appropriate level of force to bear at the right place and time. AFDD 1 goes on to caution against a lack of concentration for airpower, which comes with three combined risks that can ultimately bring defeat: missed operational objectives, delayed or diminished decisive effects, and increased attrition rate among air forces. Such a dilution of airpower was evident at Dien Bien Phu, with known and drastic consequences.

Concentration of airpower requires several basic elements. First among these would be a sufficient number of aircraft and crews. At first glance, it would seem that the French were set in this regard. Certainly, compared to their adversary, who had no air assets, the French were by default the Goliath of the skies. In addition to this initial advantage, the French had a guarantee of US assistance thanks to the previously mentioned mutual defense agreement. Although there were obvious limits to US support (Pres. Dwight D. Eisenhower drew a firm line that no US troops were to engage actively in combat), it is hard to understate the value of US aid regarding airpower. As previously mentioned, the French air fleet was essentially a US fleet on loan to them. Additionally, the political environment at the time seemed to drive an unending amount of US support, making it appear that the French air force could obtain additional aircraft as needed. This tenor of the times comes through clearly in a message from US Army major general Thomas Trapnell, then chief of the Military Aid Advisory Group in Saigon. In his assessment, General Trapnell stated that the United States must provide aircraft to the French per their requests lest the United States be subjected to "adverse criticism from diplomatic and political sources."[38] This, along with the previously discussed US response to French requests for aircraft and maintenance support, shows senior-level support for French requests and illustrates the extent to which the French could expect approval for their requests. On the surface, it seems there were sufficient (and unending) numbers of aircraft available. Yet, even with sufficient aircraft, those machines still required human operators. Those operators were in short supply. Certainly, the necessity of a contract with CAT in March 1954 to obtain additional crews for the C-119s is a good indicator of an overall shortage. Other good indicators are that officers like Nicot and his staff were required to fill cockpits for major operations and that Nicot authorized the piloting of C-47s with a single pilot. All of these factors point to serious crew shortages among the air transport aircraft. The same limitations plagued the bomber crews as well, with only 76 percent of authorized strength on hand and only 52 percent of strength actually available for missions in April.[39] Given these crew shortages, the likelihood of concentrated air efforts was thus diminished, no matter how many aircraft were available or where those aircraft came from.

In concentrating airpower, it is obviously necessary to have sufficient aircraft and operators. Without these, there is no airpower to concentrate. However, given any limitations on aircraft and crews, the tenet of concentration would demand that those limited assets be used in the most effective and focused manner possible. In the case of French Indochina there were, however, "simultaneous and conflicting demands."[40] The fact that General Navarre's

driving concern was an honorable exit rather than a decisive victory created fertile ground for competing requirements throughout Indochina. In fact, competing requirements were a consistent problem. As discussed earlier, Colonel Nicot was faced first with the use of his C-47s and then his C-119s for napalm drops, and he had to support other ongoing French operations primarily in the Red River Delta. These competing requirements whittled away at the level of effort that could have sustained the garrison at Dien Bien Phu.[41]

John Plating, who asserted that the failure of the French really was marginal and not complete, illustrated the extent to which a more concentrated effort could have been the deciding difference. By comparing the estimated artillery supplies of the two forces, Plating showed that by the end of the siege, it really was a close-run contest and that errantly dropped artillery ammunition might have been the decisive advantage that allowed the Viet Minh to outlast the French despite their significant casualties. Accepting that marginal differences were crucial, it is possible that even minor alterations to the French application of airpower, and particularly airlifts, could have produced significant effects. To this point, there were concerns among American advisors at the time that the French use of air transportation was misguided.[42]

USAF major general Chester McCarty, who commanded the 315th Air Division (the principal US unit supporting the French) and served on the commission that developed the pattern of US aid to France in Indochina, considered the French concept of air transportation in Indochina "extravagant in the extreme" when compared to USAF standards.[43] McCarty was concerned about airlift transporting unnecessary items like champagne and ice that would normally move by surface means. Such excesses did in fact occur. An interview with Maurice Casey, USAF lieutenant general, retired (at the time Colonel Casey and commander of a wing of C-119s from which the US loaned aircraft to the French) confirms this fact, citing concerns about the air transport and airdrop of ice and champagne to Dien Bien Phu.[44] Further confirmation exists in the fact that upon his promotion to brigadier general, de Castries' new rank and congratulatory bottle of champagne were airdropped to him but fell instead into Viet Minh hands.[45] Certainly not all airlifts into Dien Bien Phu were excessive. Dien Bien Phu was from the start an isolated base that relied solely on aerial resupply. As such, a certain amount of lift had to support morale-related items. The overall health and welfare of the garrison might have suffered otherwise. Even so, both the close-run nature of the battle and the limited amount of airlift available demanded that airpower in this situation be used in the most efficient manner possible. In this case, the use of whatever aircraft and airmen were available in the most focused and ef-

ficient manner may have been enough to prevent what otherwise became a French disaster.

No matter the level of concentration for air transport, such an effort would have also required a commensurate effort to establish and maintain air superiority in and around Dien Bien Phu. As already discussed, effective Viet Minh antiaircraft artillery forced airdrops from higher altitudes. This made more of the drops errant and ultimately benefitted the Viet Minh in terms of supplies. In this way, air superiority over the Viet Minh antiaircraft emplacements was a key missing factor. It prevented the concentrated use of airlift to resupply the base and illustrated that concentration was required both for airlift and air superiority missions. The seminal tie between supplies and airpower at Dien Bien Phu demanded an application of airpower in the most concentrated way, in both the logistical and combat roles of airpower.

The Role of Moral Hazard

Dien Bien Phu offers countless opportunities to explore what went wrong. Nevertheless, the role of moral hazard provides a novel area of study. As discussed in the introduction, attributing moral hazard at the level of a nation-state or government is very difficult due to the number of factors that influence behaviors and decisions of agents. However, it is possible to consider the level of insurance provided by a principal and determine whether that insurance reasonably could have affected the decision making of the agent. Given the earlier definition of moral hazard as the danger that in a principal-agent relationship an insured agent will take risks they would not otherwise, clear instances of moral hazard exist in the case of Dien Bien Phu. The first of these principal-agent relationships that deserves consideration is between the United States and France.

The most obvious case of moral hazard in the US–French relationship is evident in the aircraft provided by the United States. Would the French have taken the risks they did at Dien Bien Phu without US-supplied aircraft? No, simply due to the fact that, as demonstrated earlier, all of the French fleet was of US origin with the exception of a few small spotter type aircraft. Even discounting the case of US-supplied aircraft, the fact that the French had to make additional requests for aircraft and aviation-related support as the battle went on is a clear indicator that they would not have been able to undertake their efforts at Dien Bien Phu if it were not for US-provided insurance. Another interesting aspect of the US–French relationship is that no USAF unit histories reveal a trend of denied or disputed requests. Certainly, the case of using the C-119s for napalm drops made it to high levels in the US government, and the

request was delayed for some time while its merits were debated. However, even that request ultimately met with approval. Similarly, as mentioned earlier, the nature of Operation Iron Age support became so repetitive as to become continuous in nature.[46] In combination, these two facts definitely create an image that insurance was present, available, and assumed. This assumption of insurance surely played into decision making and enabled a battle that otherwise could not have taken place.

As it has been determined that the battle could not have occurred without US support, it is clear that a principal-agent relationship and the resultant moral hazard existed between the United States and the French. In this way, insurance enabled, and therefore changed, French behavior. This simplistic understanding gains additional credence when considered in light of the *extent* of insurance provided by the principal. It would be one thing if a principal provided only a minor level of insurance, for example insurance that did not legitimately cover any unexpected courses of action or undesirable outcomes. However, the extent of insurance does matter, and with moral hazard, there is at least some expectation that agents will increase their exposure to risk as insurance increases. So, what evidence is there for the extent of insurance provided by the US?

The 315th Air Division unit history captures several aspects regarding this extent including the continuous nature of support mentioned above. Additionally, the role of parachutes and aircraft in-commission rates came into play. As discussed, the reinforcing effect of a shrinking drop zone and effective antiaircraft fires necessitated airdrops from higher and higher altitudes. These higher altitude drops were of course then all the more inaccurate. The ever-constricting drop zone further reinforced this inaccuracy. All of this combined to create a situation in which, as the battle went on, fewer and fewer of the parachutes landed in areas where the French could recover them. This meant that prior to 28 March any decrease in the number of parachutes recovered was a direct reduction in the number that could be returned to the supply system and reused on subsequent drops. After 28 March, when the last Dakota landed at Dien Bien Phu and was destroyed on the runway, no parachutes could be returned to the system because no aircraft could pick them up and return them for reuse. The extent of this concern was such that US parachute stocks in Japan were all but depleted and eventually required replenishment from stocks in the United States proper.[47]

The 6424th Air Depot Wing unit history captures a similar instance that again shows the extent of US-provided insurance. Even having provided mechanics and equipment to support a logistics system in Indochina that "lacked many of the basic elements of an effective system," there were "only a few of

the basic supply procedures . . . to provide effective service."[48] Such failings combined with operational stresses in a way that made it increasingly difficult to prevent in-commission rates from falling. Therefore, when C-119 availability rates fell to 55 percent, the solution was simple: send additional C-119s from Japan to supplement the fleet in Indochina.[49] So not only was the French mobility fleet US-provided and US-maintained, but when parachute stocks were depleted or maintenance numbers fell, the French air force could count on seemingly endless support with everything from additional parachutes to aircraft sent to alleviate shortages.

A final case helps illustrate the extent to which insurance was assumed, and it deals with the previously discussed usage of C-119s for napalm drops. It is interesting to note that although the United States did not agree with using the C-119s for napalm (having made similar attempts during the Korean War), it did offer the French a viable alternative. In fact, the United States advised that the B-26s it had provided were much more suitable for this task. In discussing this option with Colonel Casey, 483rd Troop Carrier Wing commander, Gen Paul Ely, French Chief of Defense Staff, explained that if French forces were to lose an attack aircraft in the napalm drops, a replacement would be out of the question. However, if the French were to lose a C-119, the US would simply provide another one.[50] General Ely's position was such that he really did speak for the government of France, and thus his comments clearly indicate that the insurance provided by the United States influenced French behavior. However, even if Ely did not speak for the government, his comment would still indicate a behavior changed in the face of insurance. General Ely's approach is consistent with the other actions by the French in light of US-provided insurance. The US-provided fleet made the battle of Dien Bien Phu a possibility, and the additional support provided later on insured that it could continue longer than it would have otherwise. All these factors clearly indicate that US-provided insurance influenced French decision making relative to Dien Bien Phu. Consistent with the idea of moral hazard, this behavior involved greater exposure to risk than otherwise would have been expected. Beyond this, the case of Dien Bien Phu illustrates yet another aspect regarding risks in principal-agent relationships.

It is worth noting that in principal-agent relationships like the one described, not only does the agent take on additional risk in light of insurance, but also there is an information asymmetry as discussed in the introduction. This lack of information exists between the principal providing the insurance and the agent receiving it. This situation exists when the agent withholds information from the principal in their initial dealings and is the typical case in which the "moral" aspect of moral hazard is considered. This is because of the question-

able nature of agents who withhold information from principals. A typical example in the world of insurance would be the agent who does not disclose all of his or her dangerous behaviors to a health or life insurer. A more interesting aspect when considering cases like this one is the extent to which the agent lacks information about the principal, especially regarding the principal's ability to make good on the insurance the agent assumes the principal will be able to provide.

In simple terms, this lack of information for the agent means that although he or she is able to take risks thanks to insurance, he or she cannot control additional risks the principal may be taking and may not even be aware those additional risks exist. The relationship between the French and CAT is a case in point. Although CAT enabled the French to increase their overall exposure to risk in Indochina, the French lacked both information and control when it came to their relationship with CAT. For example, Col Thomas Julian, who served as a USAF first lieutenant advisor to the French at Cat Bi, stated that the CAT crews did not document all of their maintenance issues on the C-119s because taking the aircraft down for maintenance limited their flying hours and, in turn, their pay.[51] Additionally, on more than one occasion the CAT crews simply walked out on the French as a means of voicing their displeasure with the situation at hand.

In each of these cases CAT (as a principal) was providing a level of insurance for the French, but the French lacked full information regarding the principal's motives and they could not control additional risks the principal might take on. In this way, the drive for more flying hours and pay meant that the principal was taking on additional risks without the agent's knowledge, and these risks had the potential to affect the agent negatively. As maintenance issues went undocumented, the aircraft became both increasingly unsafe to fly and subject to longer repairs. This meant that the level of insurance the French expected might not have been available when they needed it.

This same issue existed among relationships within the French military system as well. On the one hand, the French air force provided a level of insurance for the garrison at Dien Bien Phu. On the other, the garrison lacked information about the air force's competing priorities and about risks to which the air force was exposed but did not control. Weather is a clear example of this. From the perspective of the garrison as the agent, it might take risks in expectation of resupply but be unaware that the air force will opt against flying in certain weather. In that case, neither the principal nor the agent can control the weather, but the agent's exposure to risk is exacerbated if the principal does not share the same sense of urgency (opting not to fly in weather it could theoretically fly in) or is prevented by outside factors (weather

that physically prevents the principal from making a flight). This expansion on the relationship between principals and agents in a combat environment highlights the fact that not only will agents take on risks in light of insurance, but also they may do so without full knowledge of the principal's ability to come through with that insurance when and if needed. In the case of the French defeat at Dien Bien Phu, they took risks in light of insurance in spite of the fact they lacked full confidence in the ability of principals to provide the necessary insurance when and where needed. Considering this aspect alone makes an understanding of these relationships in the combat environment of the utmost importance.

However, the case of Dien Bien Phu is instructive in a final regard. Although referred to earlier in simplistic terms, had it not been for insurance, the French would have not even been able to entertain thoughts of using Dien Bien Phu as a *base aéro-terrestre*. This would seem to indicate that as airlift capability increases, so too does the risk of moral hazard. If the French case is a valid indicator, capacity, whether or not in the form of insurance, may come with additional risks.

To explore this further, it is necessary to turn to another garrison that depended on airlift as its lifeline. Considering the successful outcome at the Battle of Khe Sanh will provide an effective test for the effect of moral hazard in airlift operations.

Notes

1. Published in 2004, Martin Windrow's, *The Last Valley: Dien Bien Phu and the French Defeat in Vietnam* (Cambridge, MA: Da Capo Press, 2005) is a comprehensive 700-plus page account of the battle. This work and John Plating's thesis, "Failure in the Margins: Aerial Resupply at Dien Bien Phu" (master's thesis, Ohio State University, 2000) provided the basic facts and timeline within the present study.

2. Windrow, *Last Valley*, 48.

3. Ibid., 117 and 123. See also Bernard B. Fall, *Hell in a Very Small Place: The Seige of Dien Bien Phu* (Cambridge, MA: Da Capo Press, 2002), 34.

4. William Leary, *Perilous Missions: Civil Air Transport and CIA Covert Operations in Asia* (Tuscaloosa: University of Alabama Press, 1984), 180.

5. Windrow puts the total number of men dropped on the first day at 2,650 with 15 killed, 34 wounded, and 13 with jump injuries. Fall puts the numbers at 1,827 dropped with 11 killed and 52 wounded. The difference in the wounded numbers is likely because Fall does not break out jump injuries from wounded, and some allotment must be made for the fact that many French records were destroyed at the battle, which makes sourcing difficult. Despite the difference in numbers, both authors agree that the French had to mobilize all of their available C-47s to move these men some 200 miles behind enemy lines.

6. Maj Robert L. Lovelace and Evelyn B. Simonson, "315th Air Division (Combat Cargo) Participation in French Indo-China, May 1953–July 1954" (Maxwell, AFB, AL: Air Force Historical Research Agency, 1 September 1954), 5.

7. Both Windrow (*Last Valley*, 253) and Fall (*Hell in a Very Small Place*, 53) agree on this date although the USAF 315th Air Division unit history cites this as the date for the successful delivery of the bulldozer, which would make the 25th an unlikely date for the first arrival of a C-47. The unit history may have mistaken the date of the drop for the date the field became operational or it could be that repairs made by hand made enough of the runway available to land a C-47. This would be consistent with the fact that both Fall and Windrow assert that Beaver aircraft were able to land days before the first C-47 (see Windrow, 248, and Fall, 18).

8. Leary, *Perilous Missions*, 180.

9. Windrow, *Last Valley*, 704; and Fall, *Hell in a Very Small Place*, 485.

10. Fall, *Hell in a Very Small Place*, 485.

11. Lovelace and Simonson, *315th Participation in French Indo-China*, 9.

12. 6424th Air Depot Wing, "Support to the French Air Force in French Indo-China" (Maxwell, AFB, AL: Air Force Historical Research Agency, 17 Jul 1954), 1.

13. Lovelace and Simonson, *315th Participation in French Indo-China*, 4.

14. Fall, *Hell in a Very Small Place*, 58.

15. Ibid., 76.

16. Lovelace and Simonson, *315th Participation in French Indo-China*, 14.

17. Ibid., 21–22.

18. Ibid., 24.

19. Windrow, *Last Valley*, 355. USAF unit histories also note that weather completely prevented airlift operations for an entire day as early as December 1953. See also Lovelace and Simonson, *315th Participation in French Indo-China*, 21–22.

20. Windrow, *Last Valley*, 355.

21. Ibid., 234, 355, 544; and Fall, *Hell in a Very Small Place*, 3 and 304.

22. Plating, "Failure in the Margins," 62. See also Windrow, *Last Valley*, 543.

23. Howard R. Simpson, *Dien Bien Phu: The Epic Battle America Forgot* (Washington, DC: Brassey's, 1994), 35.

24. The most recent scholarship comes from Windrow, who provides a detailed annex on the Viet Minh order of battle on pages 709–10. These match well with those used by Plating ("Failure in the Margins," 88) and are synthesized herein along with Simpson's numbers (*Dien Bien Phu*, 35).

25. Windrow, *Last Valley*, 308.

26. Ibid., 339; and Fall, *Hell in a Very Small Place*, 84.

27. William M. Leary, "CIA Air Operations in Laos 1955–1974 (U)," 30 January 2005, http://www.air-america.org/About/History.shtml.

28. Windrow, *Last Valley*, 451.

29. Simpson, *Dien Bien Phu*, 87.

30. Windrow, *Last Valley*, 440.

31. Ibid., 606.

32. The sum of the 9,000 prisoners and 7,000 casualties is greater than the estimated French strength of 15,000. Reinforcements throughout the battle, MEDEVAC operations, and a lack of records account for this difference. See Windrow, *Last Valley*, 624, for an insightful look at the total casualty numbers.

33. The extent and quality of Viet Minh camouflage seems confirmed by the fact that even during the greatest attempts to suppress the Viet Minh air defenses, the French were not effective. This is based on a lack of evidence to show any verifiable suppression (i.e., there is no evidence of destroyed assets during that time), which could just as easily indicate poor use of artillery or airpower as good camouflage. For an insightful airpower view of this, see Windrow, *The Last Valley*, 560.

34. Fall, *Hell in a Very Small Place*, 101.

35. Ibid., 157; and Windrow, *Last Valley*, 412.

36. Fall, *Hell in a Very Small Place*, 455.

37. Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine, Organization, and Command*, 14 October 2011.

38. Lovelace and Simonson, *315th Participation in French Indo-China*, 9.

39. Windrow, *Last Valley*, 557.

40. Ibid.

41. This same concept of concentrated effort applies to the use of airpower in an attack role, and both Fall and Windrow note that these efforts too were not concentrated in a manner that would effectively interdict supplies for the Viet Minh or sufficiently suppress their antiaircraft artillery. See Fall, *Hell in a Very Small Place*, 451; and Windrow, *Last Valley,* 553.

42. Plating, "Failure in the Margins."

43. Lovelace and Simonson, *315th Participation in French Indo-China*, 10–11.

44. Lt Gen Maurice Casey, interview, Air Force Public Affairs Alumni Association, 24 May 1971, 5.

45. Fall, *Hell in a Very Small Place*, 257.

46. Lovelace and Simonson, *315th Participation in French Indo-China*, 24.

47. Ibid., 29.

48. 6424th Air Depot Wing, "Support to the French Air Force," 7.

49. Lovelace and Simonson, *315th Participation in French Indo-China*, 90.

50. Lt Gen Maurice Casey, interview, Air Force Public Affairs Alumni Association, 24 May 1971, 7.

51. Col Thomas Julian, interview, Air Force Public Affairs Alumni Association, 8 June 1971, 3.

Chapter 3

Khe Sanh

The siege of Khe Sanh highlighted the increasing importance of air power in the American way of war and demonstrated some of the new military aviation developments that were coming to fruition at the time of the siege.

—Ian Horwood
Interservice Rivalry and Airpower in the Vietnam War

Following the French defeat at Dien Bien Phu, international peace efforts in Geneva ended the Indochina War and established a demilitarized zone (DMZ) between North and South Vietnam. The Geneva Accords went on to mandate free and fair elections within two years that would establish a unified Vietnamese state. Ultimately, this was not to be, and even as the United States attempted to fill the vacuum left by the French in South Vietnam, the communist state of North Vietnam, aided by Viet Cong paramilitary elements, strove instead to establish a unified communist state. In an effort to stem the perceived global spread of communism, the United States ultimately found itself in its twentieth-century war of choice, known today as the Vietnam War. Early US efforts in Vietnam focused principally on assistance to the South's fledgling government and to its Army of the Republic of Vietnam (ARVN). As such, the primary US military organization in Vietnam was appropriately designated United States Military Assistance Command, Vietnam (USMACV). Headed by Gen William Westmoreland from mid-1964, USMACV had made progress in stemming violence in South Vietnam, training the ARVN and strengthening the struggling Vietnamese economy. With these successes behind him, General Westmoreland addressed a joint session of Congress on 28 April 1967 and presented a hopeful outlook on the nation's ability to provide the required protection that would allow the government of the Republic of Vietnam to grow and stand on its own.[1] Notably, during the course of his trip to Washington, DC, combat engagements around the village of Khe Sanh, which lay in the northwest corner of what was then South Vietnam, had intensified.

Opening Moves

Having detected a buildup of North Vietnamese Army (NVA) forces in the northwest, USMACV elected to reinforce the area in order to curtail the influx of NVA units. As one of several bases near the DMZ and the border between South Vietnam and Laos, Khe Sanh sat upon a plateau and was a strategic position for US forces. Failure to control it would allow the NVA unfettered access from both Laos and North Vietnam for invasion and logistics support purposes.[2] The Khe Sanh plateau also provided localized high ground from which to observe and prevent these enemy movements, and it sat between both the Laotian and DMZ borders and Route 9. Although not a proper highway, Route 9 served as a primary connection to Route 1, South Vietnam's foremost north-south artery. Thus, the geographical placement of Khe Sanh was such that a force stationed there could prevent much of the flow of NVA forces and supplies into South Vietnam. The downside of Khe Sanh's position was that NVA forces could (and would) cut Route 9 and make Khe Sanh reliant upon aerial resupply much as Dien Bien Phu had been some 14 years prior.

Not only was the larger geographic position of the base significant, but the local area included strategic positions as well. The base itself sat 450 m above sea level and provided the aforementioned benefit of observation. In spite of this advantage, nearby were hills of higher elevation that a foe intent on taking Khe Sanh would quickly recognize as valuable. The US forces at Khe Sanh somewhat blandly named each of these hills by its height in meters. Five sat to the northwest of the base and were designated Hills 558, 861A, 861, 881 North, and 881 South. Due north of the base were Hills 950 and 1015. Other important features were the village of Khe Sanh, which was south of the base; a US Special Forces camp to the southwest; and Camp Carroll and the Rock Pile to the northeast. US Army units based at these last two locations were equipped with artillery of sufficient range to support efforts at Khe Sanh.[3]

In the first quarter of 1967, the 3rd Marine Regiment had responsibility for operations at Khe Sanh and set to building defensive positions around the base and its 3,900-foot runway. They also began patrolling the nearby hills. One of these patrols to Hill 861 on 24 April 1967 encountered a dug-in and reinforced NVA unit. This drove the immediate reinforcement of the base with backup elements arriving on the 25th, 26th, and 27th of the month. By the 28th, the Marines had sufficient strength to begin sweeping the hills and, within two weeks, gained command of the hills as well as sufficient intelligence to deduce that the NVA division they had encountered was retreating. Having concluded the "Hill Fights" and obtained command of the surrounding

areas, the 3rd Marines were relieved by the 26th Marines.[4] Following the Hill Fights, activity around Khe Sanh ebbed and flowed, but engagements eventually increased enough for the defenders to demand additional reinforcements. For this, an additional battalion of firepower and manpower deployed to Khe Sanh in June. The summer also saw a change of command as Col David Lownds took command of the 26th Marines and assumed responsibility for Operation Scotland, the name given to the defense of Khe Sanh.

Following Lownds's assessment of the situation, he set his Marines to improving the defensive positions around the post and at the various surrounding hill sites. These positions would prove their importance in the future, but Lownds may have made a more crucial decision when he elected to close the airfield on 17 August 1967 for much-needed repairs. Navy Seabees had previously improved the airstrip, but the monsoon rains had overwhelmed the aluminum-matted surface. The surface, although it remained in place, compressed the water in and out of the mud beneath it every time an aircraft landed or took off, degrading the strip's weight-bearing capacity and threatening to make it useless.[5] As with all operational decisions, the choice to upgrade the strip depended upon the availability of logistical support to deliver the necessary materials. In this case, the primary unit responsible for support was the US Air Force's (USAF) 834th Air Division, which set about bringing in the appropriate materials and supplies for the runway project. They flew three 15-ton rock crushers to the Marines at Dong Ha, who subsequently disassembled and transported them to Khe Sanh via helicopter. With these in place, the 834th flew asphalt materials and new aluminum matting into the site. The closed runway mandated that the asphalt arrive using the USAF standard container delivery system for airdrops, but the size and weight of the matting necessitated a different approach. For matting delivery, the 834th employed the low-altitude parachute extraction system (LAPES).

The LAPES technique provided a means of delivering loads that were too large or too heavy to airdrop due to limitations of the parachutes and associated rigging system. The crews accomplished this by making a low approach over the airfield and releasing a parachute into the airstream behind the aircraft. This parachute, connected to the cargo, would pull it out of the aircraft's rear door to drop the five or so feet onto the ground and skid to a stop on the airfield. The parachute then served in much the same manner as a drag chute on a racecar as it, and the friction from the ground, dragged the cargo to an eventual stop. Although this technique may seem at first unsophisticated, it did require special components and was not without a means of control. To control the timing of the drop, riggers constricted the parachute from its full diameter of 28 feet to a diameter of just 4 feet. Riggers referred to this constric-

tion as "reefing" the parachute, as it is similar in concept to the reefing of a sail to regulate its size. The reefing of the parachute would allow the parachute to deploy into the airstream without removing the cargo from the aircraft. Then, at the appropriate time, the loadmaster could remotely free the reefing, which allowed the parachute to expand to its full capacity and pull the cargo from the aircraft.[6] This controlled cargo extraction method proved useful throughout the closure of the runway and would prove its worth later as well.

The runway at Khe Sanh remained closed until late October, which meant that the base relied almost solely on airdrop for its supplies for two and a half months. Fortunately, the smaller USAF de Havilland C-7 Caribous were still able to land on short portions of the strip. This allowed the C-7s to return LAPES components to the supply system. Helicopters aided this effort, flying out the LAPES platforms that were too large for the relatively small C-7s.[7] This combined effort was sufficient to ensure that LAPES deliveries could continue without interruption. With an airlift lifeline, US Marines and Seabees endeavored to renovate the Khe Sanh runway, and on 27 October 1967, some 10 weeks after closure, they reopened the airfield. The new strip had a crushed rock and asphalt foundation with an aluminum matting surface that would withstand both the monsoon rains and the pounding of aircraft tires and artillery shells that was to come.

Enemy activity seemed to drop off in November, only to resurge in December with Marine patrols making contact with the NVA more frequently and discovering evidence that indicated not only an increased NVA presence but also an intention to remain in force. In early January, a Marine patrol encountered six unidentified persons probing the outer defenses of the base. Marines killed five of the six in the encounter and were surprised to discover that all five were NVA officers. The fact that NVA officers were committed so far forward suggested to the Marines that Khe Sanh was a high priority for the NVA. This type of increased activity, along with mounting intelligence of the buildup, had two primary effects. First, it forced USMACV to consider the possibility of defending a besieged Khe Sanh. Having precedent from the defense of Con Thien earlier in the year, General Westmoreland directed his staff to plan for the defense of Khe Sanh with massive applications of airpower combined with the base's own artillery. The extent to which he envisioned the application of airpower is evident in the name he gave it: Operation Niagara. He later stated that he gave it this name "to invoke an image of cascading bombs and shells."[8] Having recognized the buildup of NVA forces and selected a means of defense, Westmoreland's staff commenced planning for Operation Niagara on 5 January 1968. The second effect of the NVA buildup was to spur the transfer of an additional battalion of Marines to Khe Sanh,

bringing the total strength of the base to three battalions. Eventually, two more battalions (one of which was an ARVN unit) would arrive and bring the total strength of the base to about 6,000 men.

With the base reinforced and planning for air support under way, Colonel Lownds's reinforced regiment took up positions on the various hills and conducted reconnaissance and harassments throughout their area of responsibility. On 20 January, these efforts reached a new level of intensity, with a company of Marines attacking an NVA battalion on Hill 881N. The company found itself in a serious firefight that cost the lives of seven Marines, but with combined artillery and air support, the unit was able to overwhelm the NVA battalion. In fact, the Marines requested reinforcements to continue the attack and exploit the opportunity. Colonel Lownds, however, stopped the advance and ordered the unit to fall back based on intelligence from an NVA lieutenant who had defected earlier in the day. His rationale was simple: the NVA lieutenant indicated that a coordinated NVA attack of Khe Sanh was imminent, and if his information was accurate, Colonel Lownds would need every available Marine to repel the attack.[9]

Siege and Lifeline

The lieutenant was correct. At 0530 on 21 January 1968, the NVA began its attack on Khe Sanh in earnest, bombarding the base with hundreds of 82 mm mortars and 122 mm rockets. The siege of Khe Sanh by an estimated two to three NVA divisions, numbering 18,000 to 20,000 soldiers, had begun. Defense Minister Vo Nguyen Giap, the victor of Dien Bien Phu, was in charge of the NVA efforts. Early on in this attack, the Marines' main ammunition storage area took a direct hit, causing secondary fires and explosions that ultimately resulted in the loss of 98 percent of the munitions stored there. The attack continued throughout the day, with coordinated attacks on Khe Sanh village and Hill 861 as well. In fact, the ARVN unit at Khe Sanh village repulsed the enemy attackers twice before Colonel Lownds decided to withdraw the unit to the base, which offered more defensive value than the village did. The NVA also made direct attempts on the base proper and succeeded with some penetrations of the perimeter. At the end of the day, Marine casualties were relatively light given the nature and extent of the attack, but effective NVA targeting had gouged the runway while secondary explosions from the ammo storage area littered it with debris. As a result, the base that was reliant solely upon aerial resupply had only 50 percent of its runway in service.[10]

The 834th Air Division unit history wryly notes that prior to the designation of a special airlift mission to support Khe Sanh, the base "had been simply one

of the more than 90 C-130-capable airfields in-country, into which the Air Division had been running regularly-scheduled resupply airlifts."[11] This of course changed as the loss of ammunition at Khe Sanh drove a tactical emergency that allowed the 834th to divert any necessary resources to support the embattled garrison. Fortunately, the useable 2,000 feet of runway was long enough for USAF Fairchild C-123 Providers to land on, albeit not the more capable Lockheed C-130 Hercules. In spite of darkness and a runway lighting system rendered inoperable by enemy fire, six C-123s were able to make deliveries totaling about 26 tons of ammo on the same night. Antiaircraft fire confronted these emergency deliveries upon approach and departure, and mortar fire targeted the aircraft while on the ground. In the face of these threats, the Providers lived up to their name, providing still another 88 tons of ammunition the following day.[12] Although the 834th had fortified the Marines' ammunition supplies, the threat of artillery and antiaircraft artillery would remain a consistent problem throughout the siege.

Having planned for aerial support of Khe Sanh, USMACV lost little time in initiating its plan, and on 22 January Operation Niagara began.[13] True to General Westmoreland's concept, the operation began big with Boeing B-52 Stratofortresses bombing four targets near the base. Although the limited number of targets seems to belie the idea of cascading bombs, the impact of each bomber carrying 108 500-pound bombs surely felt like being under brutal waterfalls for those unfortunate enough to be in the four target areas. Marine, Navy, and USAF strike aircraft followed these attacks the next day and undermined enemy emplacements around Khe Sanh. Aerial support of this type continued throughout the month, and the airstrip repairs allowed C-130s to join the C-123s in keeping the garrison supplied. In addition to bringing in supplies, the aircraft filled a secondary role in evacuating locals who sought sanctuary at the base.[14] Even though the early number of refugees was relatively small, the aircraft provided a much-needed outbound capacity, relieving unnecessary strain on the human support functions of the base.

By the end of the month, the NVA subjected the Marines at Khe Sanh to regular shelling of the hill outposts and the main base. They also occasionally probed the base perimeter. However, the Marines viewed these as minor events, summed up their situation as "enemy attack imminent," and spent their time preparing for the big attack they felt was inevitable.[15] And they waited. For a time it seemed the NVA effort encompassed every place in South Vietnam but Khe Sanh. Then, early on the morning of 30 January 1968, the Viet Cong launched their Tet offensive during an agreed-upon ceasefire for the Lunar New Year. This ceasefire would have facilitated the movement of soldiers and civilians alike to their ancestral homes for annual celebrations.

The Viet Cong, however, leveraged this opportunity with attacks throughout South Vietnam in hopes of instigating a revolt among the people. Although their efforts did stun the American populace, such a revolt never took place, and Viet Cong losses were high.[16]

Despite the relative quiet at Khe Sanh at the outset of the Tet offensive, it offered no enduring respite as indications of an NVA attack on the hills mounted and the daily shelling of the base continued.[17] These indications proved reliable, and coordinated attacks on the base and Hill 861A on 5 February and on the Special Forces outpost at Lang Vei on 7 February involved bitter fighting. In fact, during the attack at Lang Vei, the NVA employed Soviet PT-76 light tanks to overrun the camp. In the end, relief efforts by Colonel Lownds's Marines extricated some survivors while others made their way to Khe Sanh by foot. The nature of the Special Forces' efforts involved the training of the local populace, and as such, a mixed bag of some 3,000 refugees (some military and some civilian) sought solace at Khe Sanh following the fall of Lang Vei. Many of these returned on foot to their ancestral homes, while the 834th and Marine helicopters evacuated others by air.[18]

Although these air evacuations were an effective use of outbound aircraft and crucial to keeping the population of the base within limits of the available support for housing, feeding, and medical care, the NVA did not idly watch as aircraft arrived and departed. In fact, both enemy fire and weather seemed to conspire to limit the effectiveness of airpower with the real possibility of strangulating the base. On 10 February NVA artillery successfully targeted a Marine Lockheed Martin KC-130 upon arrival. Since the primary mission of the KC-130 was refueling, the aircraft arrived with full fuel bladders that were ignited by NVA artillery. The KC-130 ultimately crash-landed, killing six and injuring several others. The 834th unit history records the arrival of a C-130 the next day that, in spite of expedited offloading techniques, drew effective NVA fire even as it slowed to begin downloading. This particular volley lasted 20 minutes, killed two of the C-130 passengers, and seriously wounded the loadmaster. Over the course of the next two days, the crew attempted a variety of field repairs to make their craft airworthy and finally departed Khe Sanh under the cover of fog on 13 February. Upon arrival at their home station, the maintenance crews noted that the aircraft had at least 242 bullet holes in it and had sustained hits from at least two mortar rounds. This latter case was one of the most extreme, still the NVA propensity for attacking cargo aircraft upon arrival and departure led the Marines to refer to them simply as "rocket bait" and "mortar magnets."[19] Beyond generating appropriate nicknames, these instances gave Gen William W. Momyer pause.

General Momyer served as the USAF's Seventh Air Force commander and General Westmoreland's deputy for air operations. Coincident with his duties, General Momyer directed air operations in South Vietnam and, to an extent, over North Vietnam.[20] With the loss of a Marine KC-130 on 10 February and the near loss of a USAF C-130 the very next day, General Momyer decided that no more C-130s would land at Khe Sanh. This decree effectively limited all deliveries to airdrop means, with the exception of aeromedical evacuation and delivery of cargo too sensitive for airdrop.[21] This restriction would remain in force for all but a few days in February and throughout the month of March.[22] With the restriction in place and NVA shelling continuing daily, airpower would have to adapt to ensure the livelihood of the base.

Airpower Adapts

In addition to the constant presence of enemy fire, the weather also threatened to thwart Khe Sanh's aerial lifeline. The reality of the one-two punch of weather and enemy fire is evident in the Marine history's chronological summation of the siege, which simply notes, "Feb–Apr: Paradrops, low-altitude extraction systems, and helicopters are primary means of resupplying 26th Marines due to bad weather and heavy enemy fire."[23] In fact, weather conditions at Khe Sanh were unique to the airfield. It was common for the weather in the surrounding area to be adequate for visual meteorological conditions, while at Khe Sanh fog would shroud the runway and limit visibility to instrument meteorological conditions (IMC). Since these latter conditions kept transport aircrews from seeing the runway until near the bottom of their descent, a ground-controlled approach (GCA) radar was necessary for safe landings. Such conditions were so pervasive at Khe Sanh that the 834th division commander, Maj Gen Burl McLaughlin, referred to Khe Sanh's runway as a perpetual "fog factory" and observed that the weather and mortar and rocket attacks limited the resupply window to about three hours per day.[24]

Within this limited window, the 834th attempted to maximize deliveries to the besieged Marines, and fortunately, unlike the siege at Dien Bien Phu, the 834th pilots had something more than a tethered weather balloon to guide their drops when they could not see the drop zone. Using the GCA radar, personnel on the ground were able to guide the aircraft to a known point over the field. From this point, the crews could navigate to a computed air release point and make their drop even though they could not see the drop zone. These methods proved effective with an average circular error of only 83 yards, which was sufficient to drop supplies in a safe manner to the Marines even through the weather.[25] Drops like these were often the only source of

supply in periods of bad weather, as on 17 and 18 February, when GCA drop procedures allowed supply efforts to continue. Despite these successes, a major concern among the members of the division was that there was no backup GCA unit in case enemy fire should take out the one at Khe Sanh.[26] Fortunately, a Marine radar typically used for directing fighters provided sufficient backup and was put to use on 19 February when enemy fire took out the GCA unit. Throughout the siege, the 834th developed and used operational protocols for airdrop in IMC, thus pioneering the operational application of radar-controlled airdrops.[27]

Radar control provided benefits beyond the realm of logistics. Similar to radar-controlled airdrops, the USAF Combat Skyspot system provided a means of directing strike aircraft to their targets via radar. Such attacks leveraged an established technology used to score USAF bomber crews on training missions back in the states. In Vietnam, however, this system included directing high-altitude bombing runs from B-52s.[28] Such strikes were understandably restricted to targets beyond 3,000 m from friendly lines to provide a buffer zone for US forces on the ground. Operational experience in Vietnam indicated, however, that B-52s could safely bomb within 1,000 m of friendly lines using radar controls. Given this possibility and the ongoing siege, General Westmoreland pressed the USAF to revise its restriction in hopes of increasing the effectiveness of B-52s supporting Khe Sanh.[29] With the restriction down to 1,000 m, close-in B-52 strikes in support of Khe Sanh began on 26 February and continued throughout the siege.

From the perspective of those on the ground at Khe Sanh, these close-in bombings likely arrived just in time. NVA forces had kept up their daily shelling of the base and, on 23 February, hammered the base with a record number of rounds in a single day: 1,307. This shelling once again hit an ammo storage area and started fires and explosions that ultimately cost the Marines some 1,600 rounds of artillery ammunition. As if the constant shelling and loss of ammunition were not enough, enemy trenches seemed to extend overnight and on occasion came within only 25 m of the perimeter. After more than a month-long siege involving daily shelling, effective close-in attacks by the B-52s were a welcome and awe-inspiring sight.[30] Even with these strikes, NVA forces made additional assaults on the base late in the month and on the first day of March. Despite these efforts, the NVA could not put together a substantial advance on the base, and the battle seemed to have reached a turning point.[31] All the same, close-in B-52 strikes continued throughout the month of March, much to the benefit of the embattled Marines. At the same time, clearing weather made strikes by attack aircraft all the more effective.

Even with these successes, the threat to aircraft, and therefore Khe Sanh's supply line, was real and ever-present. On 6 March a USAF C-123K succumbed to enemy fire over Khe Sanh and crashed nearby, killing all 48 on board. In addition to this loss, through the course of the siege NVA mortars hit two C-123s while on the ground at Khe Sanh and damaged eight other C-123s to varying degrees. NVA artillery strikes damaged at least 11 C-130s and killed two passengers.[32] The fact that the NVA destroyed or damaged relatively few aircraft is attributable both to US attempts (never fully achieved) to silence NVA antiaircraft fire and to the ablility of so many aircraft to deliver their cargo by airdrop, which avoided perilous landings. Those aircraft that did land continued to provide a necessary service in aeromedical and refugee evacuations with as many as 661 requiring movement in a single day and the total in March in excess of 1,400.[33]

As airpower continued to adapt to the conditions on the ground at Khe Sanh, intelligence indicators showed that the NVA units were beginning to withdraw from the area. While the Marines welcomed this news, remaining NVA forces did not let up their shelling of the position and managed to hit the base with 1,100 rounds on 23 March, setting a record for the month and only short of the single day record by about 200.[34] The continued pounding of the base drove additional innovations as well. The Marines at Khe Sanh called for additional construction materials to construct and strengthen their bunkers, but due to limited LAPES components and operational restrictions, a different means of delivery was required.

In response, the 834th operationally employed the USAF's ground proximity extraction system (GPES) for the first time ever. Instead of extracting the cargo with a parachute, a hook attached directly to the cargo engaged an arresting cable strung across the runway. Once the cargo was caught, this cable pulled the cargo from the plane. This system had the advantage of bringing the cargo to an immediate stop whereas the LAPES method allowed the cargo to skid along the surface for some distance. GPES also had the advantage of allowing the aircraft to maintain its speed and conduct what was essentially a touch-and-go. First employed on 30 March, the 834th leveraged the GPES technique 15 times at Khe Sanh with a 100 percent effective delivery rate.[35] Unknown to the crews employing GPES for the first time, 30 March also marked the end of Operation Scotland. Nipping at its heels was Operation Pegasus with the mission to relieve the siege. General Westmoreland opted for an airmobile division as the relieving force, which jumped from landing zone to landing zone along the eastern section of Route 9, ultimately linking up with the Marines at Khe Sanh on 8 April and declaring Route 9 officially open shortly thereafter.[36] With an alternate supply route open, the siege was at

an end, and the forces at Khe Sanh switched from static defense to mobile operations. These lasted into the summer, but consistent with Pres. Lyndon B. Johnson's new strategic direction for the war in Vietnam, the United States ultimately abandoned the base, and Khe Sanh fell back into relative obscurity. What was for 77 days a location of vital interest to the United States became, like Dien Bien Phu before it, a case study in the combined application of firepower and airpower supported by airlift.

Operation Scotland ended with some 1,600 confirmed NVA dead and the total dead estimated at 10,000 to 15,000.[37] Notably, even the low end of this estimate represents fully half of the force thought to have besieged Khe Sanh. Marine casualties totaled about 1,800, with 205 killed in action, 816 wounded in action and evacuated, 852 wounded and returned to duty, and one missing.[38] Unlike the outcome at Dien Bien Phu, the Marines, outnumbered by up to three times as many NVA, outlasted their besiegers and inflicted upon them an inordinate number of casualties. The US Marines' success in the face of a force similar in size to the one that besieged Dien Bien Phu certainly begs the question of why their results were so favorable compared to their French counterparts.

Why Did It Go So Well?

The parallels between Dien Bien Phu and Khe Sanh are striking. In both cases, a modernized, Western force occupied relatively disadvantageous terrain and relied upon its firepower and airpower in the face of an enemy that outnumbered it by at least three to one. In both cases, the Western military relied solely on aerial resupply, while the besieging force maintained a traditional ground line of communication for supplies and reinforcements. Furthermore, the siege forces employed similar tactics in both instances, with approach trenches at Khe Sanh reminiscent of the trenches at Dien Bien Phu. The trenches at Dien Bien Phu of course gave the Viet Minh the approaches and access they needed to cut off the airfield and to constrict the drop zone. This strangled the besieged French, and the trenches at Khe Sanh were surely intended for the same purpose. Ian Horwood noted that the similarities seemed to fit right down to the smallest detail with the fact that in both cases, NVA general Vo Nguyen Giap was ultimately in charge of the siege efforts.[39] With all of these similarities, it is curious that the outcomes were so different. Why was the United States able to pull off what its French predecessors were unable to accomplish?

Singular Focus

The extent to which French air support at Dien Bien Phu was a diluted effort was previously addressed. In contrast, however, the US effort at Khe Sanh was a singular focus not only in terms of the air effort but also in the larger political and strategic contexts as well. Where Navarre's marching orders were to obtain an honorable exit for the French, Westmoreland was working toward an honorable peace. Furthermore, in late 1967 and early 1968, the United States had certainly not yet come to the point of contemplating an exit as the French had at the time of Dien Bien Phu. Instead, President Johnson still sought to assert American power in response to North Vietnam's violation of the Geneva Accords and to establish a foundation for an honorable peace in Vietnam.[40] In this way, the perspectives were different from the start in that the United States was not yet to the point of focusing solely on its departure from Vietnam. Instead, the United States focused exclusively on holding Khe Sanh at all costs. In fact, political and media circles reinforced this focus, and the defense of Khe Sanh came to represent a vital national interest for the United States.[41] The same was not true for the French at Dien Bien Phu.

In addition to this focus, the United States had the benefit of Dien Bien Phu as a precedent to avoid. The similarities between the battles were lost on no one; in fact, Bernard Fall's *Hell in a Very Small Place* and Jules Roy's *The Battle of Dien Bien Phu* both enjoyed wide readership among the Marines at Khe Sanh.[42] Not only were the Marines on the scene aware of the precedent, the highest levels of government had made the connection as well. *Time* magazine quoted President Johnson saying "I don't want any damned Dienbienphu" and subsequently asserted that he extracted signatures from the joint chiefs stating that Khe Sanh was defensible.[43] John Prados and Ray W. Stubbe refute the claim that Johnson made the chiefs sign such an assertion but do not dispute his statement regarding the precedent of Dien Bien Phu.[44] The extent of the president's focus on Khe Sanh is reinforced by the fact that with all of the various operations going on at the time, he kept a to-scale relief map of the battle in the White House situation room and is said to have been obsessed with it while pacing the situation room (see fig.1).[45]

While the degree of the president's obsession with Khe Sanh might be debatable, his level of concern certainly percolated down to the unit level in Vietnam. As a case in point, the 834th unit history cites the rationale for supporting Khe Sanh as "personal interest by the president" and direction from the president "that the Commander, United States Military Assistance Command, Vietnam . . . hold Khe Sanh at all costs."[46] The 834th commander

Figure 1. President Johnson studying the Khe Sanh map in the White House Situation Room. (Lyndon Baines Johnson Library and Museum photo A5635-29)

echoed this emphasis in his later article for *Air University Review* in which he said that at the direction of Seventh Air Force, he was to assess airlift support for Khe Sanh and that the support of the base "would have to guarantee uninterrupted air resupply regardless of weather, hazardous terrain and enemy fire."[47] Such a mission statement certainly lends credibility to the case that Khe Sanh had become a vital national interest. So, too, does the fact that the interest from the White House caused flights to Khe Sanh to be programmed at 120 percent of the demand, that those flights were not to be diverted, and that intermediate stops in the northern part of South Vietnam were not to be scheduled.[48] This type of interest and detailed direction from the highest levels of government, along with General McLaughlin's understanding of his mission, indicates that everyone involved understood that Khe Sanh could not fall. From the president, to the operational commanders in Vietnam, and to the noncommissioned officers who wrote unit histories, it was common knowledge that the United States would apply all necessary measures to the defense of Khe Sanh. It could not and would not fall.

Sheer Capacity

Compared to the French experience at Dien Bien Phu, keeping Khe Sanh supplied by airlift would prove a more realistic undertaking for the US Marines simply in terms of capacity. Where the French scrounged every Douglas C-47 they could put their hands on, left copilot seats empty, and had staff officers backfill cockpits for operational sorties, the United States had no such concerns. Despite the impact on the rest of the airlift system, General McLaughlin noted that the demands of Khe Sanh were simply "absorbed" while "day-to-day requirements were still accomplished throughout the rest of Vietnam."[49] This is indicative of a capacity far in excess of what the French had at their disposal in 1954. Bernard Nalty offers an interesting comparison of the difference in capacities:

> The most efficient of the Air Force transports was the C-130, credited with a maximum payload in excess of 20 tons, which actually delivered an average of some 13 tons per sortie during the battle. Also available were Fairchild C-123's, considered capable of carrying almost 8 tons, and de Havilland C-7A's built to deliver 3 tons of cargo. Like the C-130, both of these types operated at about 60 percent of rated capacity. By comparison, in 1954 the French flew a small number of Fairchild Packets, twin-engine transports with a 7-ton maximum payload. They had relied primarily, however, upon old Douglas C-47's originally designed to carry 3 tons, the same maximum load as the smallest and least used of the Air Force transports available to the Khe Sanh garrison.[50]

Clearly, the US transport fleet enjoyed a capacity far surpassing what the French were able to muster. The size alone of the 834th reflects this capacity, with more than 7,000 personnel assigned to the division and 240 aircraft at its disposal.[51] A unit of such size with that many aircraft makes General McLaughlin's assertion that the needs of Khe Sanh could simply be absorbed quite realistic. The amount of ammunition delivered to the Marines at Khe Sanh further substantiates this fact. As mentioned earlier, NVA artillery hit the main ammunition storage area on the first day and destroyed 98 percent of the ammunition stored there. A subsequent attack took out another 1,600 rounds of ammunition. Despite these losses and the need for all resupply efforts to come by air, by March the Marines had more ammunition than it could safely store, allowing it to "generously" respond to NVA attacks and fire off excess green smoke on St Patrick's Day.[52]

At Khe Sanh, the United States benefitted not only from its overall logistics capacity but also from the combat capacity of airpower, so much so that General Westmoreland concluded that the key to success at Khe Sanh was firepower, principally delivered by air.[53] Here again, the capacity difference with Dien Bien Phu is almost beyond comparison. Where the French employed Grumman F8F Bearcats and Martin B-26 Marauders, the United States had jet fighters

and bombers like the McDonnell Douglas F-4 Phantom and the B-52 Stratofortress. Thanks to the singular focus of US leadership, nearly half of all the efforts of these modern jets over Vietnam directly supported the Marines at Khe Sanh.[54] For the fighters this meant close air support missions and cargo escort missions. In fact, as antiaircraft efforts intensified, Seventh Air Force mandated in March that a fighter escort would accompany all cargo aircraft approaching the base.[55] Observation craft supported the fighters and cargo planes, identifying and marking prospective targets and keeping a watchful eye for NVA antiaircraft artillery. The French, of course, had used a similar approach with their observation aircraft but could not have entertained mandating a fighter escort for every cargo plane, much less implementing such a scheme. For the bombers, this meant a capacity that must have seemed endless to the NVA on the ground. This is evident in the pace they kept, with three B-52s over Khe Sanh every one and one-half hours and then later six B-52s every three hours.[56] In the end, B-52s would fly more than 2,500 sorties in support of Khe Sanh and drop 59,542 tons of bombs around the base. This firepower, dropping within 1,000 m of friendly lines starting at the end of February, gave the Marines a level of aerial support never before witnessed. In fact, thanks to Operation Niagara, Khe Sanh infamously became the most bombed place in history up until that time.[57]

In addition to aerial capacity, the Marines enjoyed other means of support as well. The Army's 175 mm guns at Camp Carroll and the Rock Pile were outside the NVA encirclement and thus relatively free to support the Marines as necessary.[58] The Marines also had the benefit of a fleet of modern helicopters to keep the hill outposts supplied, evacuate personnel as necessary, and supplement USAF airlift measures.[59] These benefits, along with the aerial support capacities, gave the US forces at Khe Sanh a distinct advantage over the NVA and over the French before them. The real advantage was not in numbers of aircraft or tons of bombs themselves but instead in the concentrated application of firepower they made possible.

Not only did the United States have the crews and aircraft available, it also had excess aircraft at its disposal. C-130s dedicated to herbicide application could be converted for cargo use, and General Momyer apparently contemplated increasing the C-130 fleet in Vietnam more than once, with the fleet increasing by a full third from January through March.[60] This capacity alone would not have mattered, however, if it were diluted throughout Vietnam. Instead, as clearly indicated by the 834th unit history and the comments of General McLaughlin, the mission was clear: Khe Sanh was to be supported at all costs. This support required an integrated air effort to ensure the cargo aircraft enjoyed relative freedom of movement in and out of Khe Sanh. Fighter

escorts helped provide this, maintaining air superiority in the vicinity of Khe Sanh. Moreover, the aerial delivery and extraction techniques the 834th developed built upon this superiority, minimizing the extent to which hostile fire threatened US aircraft. It was this integration and concentration of the air effort that made the critical difference at Khe Sanh. The Marines could not have survived without the aerial lifeline preserved by fighter and bomber air superiority. Airlift, supported by air superiority, had won the day.

The Role of Moral Hazard

With such a successful integration of airpower at Khe Sanh, it may seem that moral hazard played no role. It is this initial appearance that makes Khe Sanh such a desirably difficult test for understanding moral hazard in airlift operations. Exploring moral hazard at Khe Sanh requires returning once again to the definition of moral hazard as the danger that in a principal-agent relationship, an insured agent will take risks they would not have otherwise. Although the battle at Khe Sanh does not offer an international principal-agent relationship like Dien Bien Phu does, the Marines at Khe Sanh certainly represents an agent acting in light of insurance provided by a principal. In this case, the primary principal is the USAF, but other principals exist as well, including the supporting Navy and Marine aviation assets and Army guns at Camp Carroll and the Rock Pile. However, limiting the relationship to the USAF as the principal and the Marines as the agent is valuable for the initial test of moral hazard at Khe Sanh. Just like at Dien Bien Phu, the primary question is whether insurance provided by the principal affected the behavior of the agent. The answer in this case is yes.

Just as the French would not have been able to consider the defense of Dien Bien Phu without US-provided aviation support, so, too, the Marines could not have contemplated defending Khe Sanh without USAF support. This is evident in the fact that USAF planes were the only effective means of transport for construction supplies to open the airfield and were similarly the only means of supplying heavy bunker materials demanded by the continued pounding of NVA guns. This reliance on USAF support provides initial evidence for a principal-agent relationship at Khe Sanh, and the fact that the highest levels of government acknowledged this reliance further supports this assertion. In fact, in his foreword to the standard history, *The Battle for Khe Sanh*, General Westmoreland acknowledged that to maintain US presence in the area of Khe Sanh, the "only choice at the time was to secure the airstrip we had built on the plateau since this facility was essential as the forward terminus of our supply line."[61] Clearly, the ranking commander in Vietnam understood

the extent to which the Marines would rely upon airlift. The fact that the president did also is well established. Notably, this reliance enabled the concept of operations at Khe Sanh not only at the base proper but at the outlying hills as well. Although not considered in detail herein, Marine helicopters provided critical support without which the hills would have likely fallen to NVA attacks.[62] Therefore, not only did principal-agent relationships exist at Khe Sanh but also, as at Dien Bien Phu, these relationships allowed the agent to employ a concept of operations that assumed a level of risk that depended critically upon the provided insurance. In fact, had the principal's insurance not been available, the agent's concept of operations in both cases would have been untenable.

With the principal-agent relationships and increased exposures to risk established, another missing aspect for an equivalent comparison to the earlier discussion of moral hazard at Dien Bien Phu is the extent to which insurance was provided. Here again the parallels seem substantiated. Just as depleted parachute supplies in Japan drove redistribution from the United States to support French airdrops, so, too, a shortage of LAPES supplies drove a "world wide search for other systems."[63] Similarly, just as low availability rates for Fairchild C-119 Packet transports yielded the simple solution of adding additional aircraft, so too C-130 numbers grew steadily throughout the Khe Sanh siege. In both cases, not only did insurance alter the behavior of agents by allowing them to accept additional risks but also principals seemed to provide insurance to the maximum of their capabilities. In fact, the 834th went so far as to develop and operationalize new extraction techniques and methods for accurately airdropping supplies despite bad weather and limited visibility. In this way, the USAF went to significant lengths to ensure its ability to provide the insurance upon which the Marines relied. This fact is an important counter to arguments that insurance was either not a factor in the behavior of the agent or was of such insignificance to the principal as to be dismissible. Both at Dien Bien Phu and Khe Sanh, insurance made the concept of operations possible, and that insurance was of such an extent that the principal's role in supporting the operation is not easily dismissed.

An additional correlation between the two cases must be made with regard to information and uncertainty. Earlier discussions of moral hazard and risk considered the uncertainty on the part of the agent regarding the principal's ability to make good on promised insurance when and if needed. Certainly, General Momyer's cessation of USAF C-130 landings at Khe Sanh is evidence of the extent to which the principal made decisions that affected the availability of the insurance upon which the agent relied. Although the C-130s retained their airdrop capability, the amount they were able to deliver in this manner

was necessarily less than could be delivered via airland procedures. This was because the weight of parachutes and rigging supplies consumed some portion of the total weight-bearing capacity of the aircraft.[64] Furthermore, it appears the driving concern was reducing risks to expensive USAF C-130s, not minimizing risks to the mission at Khe Sanh.[65] Had the USAF been solely concerned with reducing risks to the Marines, C-130 landings would have continued unabated. Although in this case total USAF capability meant that the principal could adjust the method of providing insurance with no noticeable difference from the perspective of the agent, this does show that the agent lacked complete control of the principal's actions. As such, the agent did not necessarily have a full accounting of the risks, since the principal retained a significant measure of control. This too seems to indicate that, like the French at Dien Bien Phu, the Marines at Khe Sanh were subject to risk in light of insurance and that the extent of those risks remained at least in part a function of the behavior of the principal. All of these facts point toward moral hazard as a concern, despite positive or negative outcomes.

Since it appears moral hazard is at work despite the outcome of an operation, why is it the successful outcome at Khe Sanh instinctively promotes the conclusion that moral hazard played no role? Why does the evidence indicate moral hazard is at work in both cases, but the natural inclination is to equate moral hazard only with failed operations? The answers to these questions lie in the distinction between the definition of moral hazard and the mental picture created by the association of the words "moral" and "hazard." Defined, moral hazard is the danger that an insured agent will increase his or her exposure to risk. Notably, this definition places no limits on potential outcomes whether good, bad, or otherwise. In fact, as defined, moral hazard has no implications with regard to value whatsoever. Where value in terms of good, bad, right, or wrong enters the equation is in the fact that the terminology of moral hazard "invokes a moral notion, suggesting that changing one's exposure to risk after becoming insured is morally problematic."[66] It is in this aspect of moral hazard that the battle at Khe Sanh is particularly instructive.

Because moral hazard implies some sort of moral problem, it is easy to assume that insurance agents will do something morally questionable or otherwise engage in behavior they should not. As defined, however, moral hazard only indicates that the behavior of agents will change in light of insurance and that the agent will increase his or her exposure to risk. As shown in the case of Khe Sanh, an increased exposure to risk does not necessarily mean that such behavior was bad or ill conceived or would otherwise generate a negative outcome. Instead, Khe Sanh provides a clear case of an agent with increased risks in light of insurance and a corresponding positive outcome. When

contrasted with the result at Dien Bien Phu, it is clear that moral hazard plays a role in airlift operations despite the ultimate outcome. This is important because it sets definite limits on what can be attributed to moral hazard in terms of effects. Certainly, it would be fair to say that the French increased their exposure to risk in light of insurance provided by the United States. Similarly, the Marines increased their exposure to risk in light of USAF-provided insurance. It is not fair in either case, however, to say that moral hazard led to a negative or positive outcome. Moral hazard provides a means for understanding exposures to risks; it does not provide any capacity to predict outcomes resulting from those exposures to risk. When applied to military operations, therefore, it is important to isolate the role of moral hazard from any estimation regarding the outcome of an operation. Moral hazard helps explain increased risk exposure; it does not explain success or failure.

It is important to note that the preceding discussion accounts for all of the aspects of moral hazard discussed in chapter 1 except the possibility that moral hazard increases with capacity or capability. Probably the best evidence for this dynamic is the fact that the United States entertained a defense of Khe Sanh despite the precedent of Dien Bien Phu. Already mentioned are the facts that Marines at Khe Sanh read books on the French defeat at Dien Bien Phu and that the media reinforced US determination to hold Khe Sanh at all costs.[67] Additionally, the operation had the personal involvement and attention of the president, who was well aware of Dien Bien Phu and publicly stated he did not want a repeat of that event. So how does a nation acknowledge the specter of Dien Bien Phu and proceed down the same path? It would seem that US leaders acknowledged the possibility of another Dien Bien Phu and determined from the top down to ensure that such a thing did not happen to them. It is only fair to assume that such determination came in light of increased capacity over the intervening 14 years.

As mentioned earlier, Nalty showed that the United States had an airlift capacity—an order of magnitude greater than the French, with the most capable French aircraft in 1954 able to move only 35 percent as much as the most capable US aircraft in 1968. Further, Nalty noted that the 834th could theoretically provide Khe Sanh with three to six times as much daily cargo as the French had been able to muster for Dien Bien Phu.[68] Surely, there is a point below which increased capacity would not make a difference. A three- to six-fold increase, however, with single aircraft like the C-130 able to move what seven C-47s could move 14 years prior, just might have been a significant enough jump in capacity. Such an increase could justify an operation that so resembled the previous French defeat and employed a ground force two and one-half times smaller than the one employed by the French. The fact that

airlift restored to overflowing an ammunition storage area that was 98 percent destroyed on the first day surely gives credence to the capacity argument. This fact, combined with the smaller US force, indicates that with a greater capacity, the United States subjected itself to more risk. Having taken on more risk in light of additional insurance at least confirms the presence of moral hazard and anecdotally indicates that the role of moral hazard increases with airlift capacity. Notwithstanding, the French and US experiences together indicate that, at a minimum, airlift capacity demands comprehensive risk considerations.

The battles of Dien Bien Phu and Khe Sanh, therefore, confirm that moral hazard plays a role in airlift operations and that agents increase their risk exposure in light of insurance. These battles also seem to indicate that the agents increase their risk exposure in spite of full knowledge regarding the principal's abilities to make good on insurance and that as a nation's capacity increases, so too does the possibility that moral hazard will come into play. Finally, the battle at Khe Sanh serves as a unique validation of the proposition that in military operations, moral hazard cannot be viewed as a determinant of the outcome. Having viewed two major operations in terms of moral hazard, a question remains, how do these conclusions play out in the modern day?

Notes

1. William C. Westmoreland, *A Soldier Reports* (Garden City, NY: Doubleday, 1976), 228.
2. Moyers S. Shore, *The Battle for Khe Sanh* (Washington, DC: US Government Printing Office, 1969), 10. Shore's text and Bernard Nalty's *Air Power and the Fight for Khe Sanh* (Washington, DC: Office of Air Force History, 1973) provide the basic timelines and details of the battle for this chapter.
3. In Shore's work and others, the base at Khe Sanh is referred to as Khe Sanh Combat Base and abbreviated as KSCB. This is done to distinguish it from the village of Khe Sanh south of the base. However, herein Khe Sanh will be used to refer to the base, and the village will be clearly annotated as needed.
4. Shore, *Battle for Khe Sanh*, 16.
5. TSgt Bruce Pollica and TSgt Joe Rickey, "834th Air Division Tactical Support for Khe Sanh, 21 Jan–8 Apr 68" (Maxwell, AFB, AL: Air Force Historical Research Agency, 8 April 1968), 6–8. See also Shore, *Battle for Khe Sanh*, 25; and Nalty, *Air Power and the Fight for Khe Sanh*, 8.
6. Pollica and Rickey, "834th Air Division Tactical Support for Khe Sanh," 34–35.
7. Ray L. Bowers, *The United States Air Force in Southeast Asia: Tactical Airlift* (Washington, DC: Office of Air Force History, 1983), 291.
8. Westmoreland, *A Soldier Reports*, 339. See also Nalty, *Air Power and the Fight for Khe Sanh*, 15.
9. Shore, *Battle for Khe Sanh*, 39.
10. Nalty, *Air Power and the Fight for Khe Sanh*, 15.
11. Pollica and Rickey, "834th Air Division Tactical Support for Khe Sanh," 4.
12. Ibid., 5–6.

13. Shore, *Battle for Khe Sanh*, 183.
14. Nalty, *Air Power and the Fight for Khe Sanh*, 26.
15. Shore, *Battle for Khe Sanh*, 51.
16. Ibid., 57.
17. There are interesting discussions as to whether the Tet offensive was a diversion for the primary effort at Khe Sanh or if the opposite was true, making the Tet offensive the main objective. Shore cites the fact that two of the NVA's four divisions in the northern part of South Vietnam were engaged at Khe Sanh, making it the likely objective. See Shore, *Battle for Khe Sanh*, 53–55; and Nalty, *Air Power and the Fight for Khe Sanh*, 31.
18. Shore, *Battle for Khe Sanh*, 69. See also Nalty, *Air Power and the Fight for Khe Sanh*, 33–34.
19. Pollica and Rickey, "834th Air Division Tactical Support for Khe Sanh," 12–14.
20. Nalty, *Air Power and the Fight for Khe Sanh*, 11. The siege of Khe Sanh played an important part in the debate between US military services as to who had ultimate control of air operations. General Westmoreland appointed General Momyer as his single manager for air, and after much consternation and rivalry, Momyer's role as single manager came to fruition at least in name. As such, the single manager for air served as the predecessor of the joint force air component commander that exists in US doctrine today. For an interesting look at this, see Ian Horwood, *Interservice Rivalry and Airpower in the Vietnam War* (Fort Leavenworth, KS: Department of the Army, 2006). See also Nalty, *Air Power and the Fight for Khe Sanh*, 68–81.
21. Pollica and Rickey, "834th Air Division Tactical Support for Khe Sanh," 49.
22. Ibid., 12. See also Nalty, *Air Power and the Fight for Khe Sanh*, 36. Shore asserted that the destruction of the KC-130 on 10 February drove the restriction on landing C-130s at Khe Sanh. Nalty and the 834th unit history both state that Momyer's restriction went into effect on 12 February, which was after the USAF C-130 incidents on the 11th and 12th. As such, it seems this second incident would have at least affected General Momyer's decision making, but the important point is that the threat was significant enough to force the restriction, regardless of which incident was the final factor in the decision.
23. Shore, *Battle for Khe Sanh*, 184.
24. Burl W. McLaughlin, "Khe Sanh: Keeping an Outpost Alive," *Air University Review*, November–December 1968, 3.
25. McLaughlin, "Khe Sanh: Keeping an Outpost Alive," 6.
26. Pollica and Rickey, "834th Air Division Tactical Support for Khe Sanh," 26. Exhibit 124 of this unit history is a report of an 834th detachment commander stationed at Khe Sanh in February and March who includes on his request for supplies a backup GCA unit. This seems to indicate that the need was identified at more than one level.
27. McLaughlin, "Khe Sanh: Keeping an Outpost Alive," 4. Techniques were being tested in this regard, but none were approved for operations at the time.
28. Nalty, *Air Power and the Fight for Khe Sanh*, 67.
29. John Prados and Ray W. Stubbe, *Valley of Decision: The Siege of Khe Sanh* (Boston: Houghton Mifflin, 1991), 406.
30. Nalty, *Air Power and the Fight for Khe Sanh*, 86.
31. Shore, *Battle for Khe Sanh*, 125.
32. Nalty, *Air Power and the Fight for Khe Sanh*, 58. Note that Nalty puts the number of damaged C-130s at 18, but I have used the more conservative estimate of 11 included in the 834th Unit History.
33. Shore, *Battle for Khe Sanh*, 127.
34. Ibid.

35. Pollica and Rickey, "834th Air Division Tactical Support for Khe Sanh," 37–38, 51–52.
36. Horwood, *Interservice Rivalry and Airpower in the Vietnam War*, 145.
37. Shore, *Battle for Khe Sanh*, 131.
38. Prados and Stubbe, *Valley of Decision*, 453–54. These authors provide an interesting assessment of US casualties, countering the traditional US casualty numbers for Khe Sanh that have been limited to the Marine numbers at the base. Using a campaign view that includes the losses at Lang Vei, the village of Khe Sanh, and Operation Pegasus increases the number of killed in action (KIA) up to 650, wounded in action (WIA) to 2,600, and missing to seven. Adding in the operations from Khe Sanh following Pegasus until its abandonment brings the totals to 1,000 KIA, 4,500 WIA, and 13 missing. This suggests that both the costs of the battle and the campaign were higher than otherwise traditionally indicated.
39. Horwood, *Interservice Rivalry and Airpower in the Vietnam War*, 141.
40. Nalty, *Air Power and the Fight for Khe Sanh*, 22.
41. Horwood, *Interservice Rivalry and Airpower in the Vietnam War*, 141.
42. Prados and Stubbe, *Valley of Decision*, 110.
43. "A Long Way from Spring," *Time*, 9 February 1968, 26.
44. Prados and Stubbe, *Valley of Decision*, 289. Johnson's statement is quoted throughout the Khe Sanh literature.
45. Stanley Karnow, *Vietnam: A History*, 2nd rev. and updated ed. (New York: Penguin, 1997), 554; and Yuen Foong Khong, *Analogies at War: Korea, Munich, Dien Bien Phu, and the Vietnam Decisions of 1965* (Princeton, NJ: Princeton University Press, 1992), 172.
46. Pollica and Rickey, "834th Air Division Tactical Support for Khe Sanh," 3–4.
47. McLaughlin, "Khe Sanh: Keeping an Outpost Alive," 2.
48. Bowers, *United States Air Force in Southeast Asia*, 300.
49. McLaughlin, "Khe Sanh: Keeping an Outpost Alive," 11.
50. Nalty, *Air Power and the Fight for Khe Sanh*, 20.
51. Ibid., 42.
52. Shore, *Battle for Khe Sanh*, 107.
53. U. S. Grant Sharp and William C. Westmoreland, *Report on the War in Vietnam* (Washington, DC: Government Reprints Press, 2001), 171.
54. John Schlight, *The War in South Vietnam: The Years of the Offensive, 1965–1968* (Washington, DC: Department of the Air Force, 1999), 285.
55. Pollica and Rickey, "834th Air Division Tactical Support for Khe Sanh," 14.
56. Nalty, *Air Power and the Fight for Khe Sanh*, 82–83.
57. Horwood, *Interservice Rivalry and Airpower in the Vietnam War*, 144.
58. Nalty, *Air Power and the Fight for Khe Sanh*, 20.
59. The French did have some helicopters at Dien Bien Phu, but these were relatively few in number. The French did not enjoy the air superiority of those used at Khe Sanh.
60. Nalty, *Air Power and the Fight for Khe Sanh*, 42.
61. Shore, *Battle for Khe Sanh*, vii.
62. Ibid., 80–83.
63. Pollica and Rickey, "834th Air Division Tactical Support for Khe Sanh," 51; and Bowers, *United States Air Force in Southeast Asia*, 311.
64. Martin Windrow, *The Last Valley: Dien Bien Phu and the French Defeat in Vietnam* (Tuscaloosa, AL: Da Capo Press, 2005), 417.
65. Nalty, *Air Power and the Fight for Khe Sanh*, 36.
66. Benjamin Hale, "What's So Moral about the Moral Hazard?," *Public Affairs Quarterly* 23, no. 1 (January 2009): 1.

67. Nalty, *Air Power and the Fight for Khe Sanh*, 40–41. Nalty provides an interesting summary of the media coverage at the time, with references to the original articles in his text and notes.

68. Ibid., 42. Nalty noted that the theoretical maximum was six times as much, but maintenance and logistical considerations cut that in half.

Chapter 4

Modern Implications

The history of airpower is a story of all but incredible technological advance.

—Colin S. Gray
Airpower for Strategic Effect

The events of 11 September 2001 will remain forever etched in the memories of all who witnessed them. For the United States, they signaled the start of more than a decade of continuous combat operations beginning with Operation Enduring Freedom in Afghanistan in early October 2001 and continuing with Operation Iraqi Freedom starting in March 2003. While neither of these operations produced a twenty-first-century version of Dien Bien Phu or Khe Sanh, both relied heavily upon airlift and witnessed an increasing reliance upon airlift as a sole means of supply.[1]

Continuing Challenges

Despite the fact that Enduring Freedom was the first operation out of the gates, Iraqi Freedom quickly took center stage, especially as roadside bombings, executed with the now infamous improvised explosive devices (IED), wreaked havoc on US forces and accounted for more and more casualties.[2] By November 2004, the threat of IEDs had become so ubiquitous that, upon returning from a trip to Iraq, Gen John Jumper, US Air Force (USAF) chief of staff, told reporters he had "a little fit" when he realized the USAF was not doing all it could to reduce the need for ground convoys.[3] With a mandate from the chief of staff, the phrase "convoy mitigation" became commonplace in USAF logistics and air mobility discussions, and keeping convoys off the roads became a primary aspect of USAF operations in Iraq. Only a month after his proclamation, an *Air Force News* article quoted General Jumper: "The Air Force is clearly focusing its efforts, helping the Army give the ground forces the opportunity to reduce the traffic on the most dangerous routes."[4] As a testament to the capacity and the efforts of the USAF, the same article went on to note that in November 2004 Boeing C-17 Globemaster III and Lockheed C-130 Hercules transports had flown an average of 450 tons per day, which was up from the daily average of the previous four months of only 100

tons per day. Having more than quadrupled its efforts, clearly the USAF had embraced convoy mitigation and was chipping away at the amount of cargo that would otherwise move by ground.[5]

Only three months later, however, the fleet taking cargo off the roads suffered a setback when USAF officials grounded 30 C-130s and placed another 60 on restricted flying status.[6] Engineers based the groundings and restrictions on the number and severity of cracks in the center wing boxes of the aircraft, which are the sections of the planes that connect the wings and the fuselage. The groundings obviously kept the most at-risk aircraft out of the air, although the restrictions allowed the majority of the affected aircraft to continue to operate—albeit within set parameters that offered a greater margin of safety. For the convoy mitigation operation and ongoing operations in Afghanistan, the center wing-box issue fortunately did not cause "a significant disruption to support for operations Iraqi Freedom and Enduring Freedom."[7] It was not without perturbations, however. In fact, the issue drove aircraft rotations within the active duty fleet, as well as with the Guard and Reserve, and necessitated that some of the restricted aircraft fly solely on training missions. Even as the USAF wrestled to manage its fleet of C-130s and account for the wing-box issues, operations in Afghanistan witnessed the first use of a new technology that brought innovative aerial delivery capabilities to the fore.

On 31 August 2006, the Joint Precision Air Drop System (JPADS) made its combat debut as part of a C-130 delivery supporting soldiers in Afghanistan.[8] In the history of airdrop up to that point, aircrews played a central role with regard to accuracy. Gains in technology, like the ground-controlled approach radar at Khe Sanh, increased aircrew awareness of their location and airdrop accuracy. This awareness, combined with meteorological advances, made up the primary components of airdrop accuracy. The novelty of JPADS stemmed from the introduction of technology that made the cargo aware of its position relative to its intended destination. While "awareness" may be an overstatement, JPADS does employ a computer that uses a global positioning system signal to calculate the position of the cargo in the air and compare that with the desired point of impact on the ground. This, combined with a steerable parachute, made airdrops far more accurate and less dependent upon aircrew abilities.

Despite the use of this new technology in Afghanistan, operations in Iraq still demanded most of the attention, as convoy mitigation efforts continued. Fortunately, by November 2006 a USAF aircraft maintenance depot was in the process of replacing C-130 center wing boxes with brand new ones of the same make and design as those used on the latest C-130 variant, the Lockheed Martin C-130J Super Hercules.[9] By that time, only 47 aircraft were restricted

while 30 remained grounded, so there was real progress in returning the fleet to its prerestriction status.[10] This progress was welcome news for USAF officials, as convoy mitigation efforts in Iraq continued to grow throughout 2007—with one USAF aerial port in Iraq claiming to have kept 12,000 personnel off the roads in only a five-month span.[11] Additionally, a 2007 article in one of the US Army's professional logistics journals praised the extent to which convoy mitigation reduced the risks to Soldiers and sped the delivery of supplies.[12] Clearly, convoy mitigation efforts were on the rise and were a major concern. Fortunately, Iraq's airfield structure made airdrops a relatively rare necessity.[13] Afghanistan, on the other hand, was a different situation altogether. By 2008 operations in Afghanistan relied more and more upon aerial delivery and, in particular, airdrop. Airdrops in the USAF Central (USAFCENT) area of responsibility (AOR) had tripled in amount from 2006 to 2007 and were increasing in importance due to the number of locations in Afghanistan that relied solely upon airdrop for sustainment.[14] An *Army Times* article noted that by that time 28 locations throughout Afghanistan depended solely upon aerial resupply and quoted the Combined Joint Task Force 101 services chief, Maj Jay Schroder, who said of airdrops, "Everywhere else it's emergency supply, here it is regular supply."[15] The tripling of USAFCENT airdrops and the sheer number of sites in Afghanistan dependent upon aerial delivery marked a new era for airdrop, just as the convoy mitigation mission in Iraq marked an increased reliance upon traditional airlift. Certainly, this growing dependence upon airlift came with its share of risks.

Risks

As the seventh year of operations in Afghanistan came to a close, the means and methods of supplying US units there caught the interest of more than the military leadership. In February and March 2009, the House and Senate Armed Services Committees both called upon the commander of US Transportation Command (USTRANSCOM), USAF general Duncan McNabb, for his thoughts on the logistical situation in Afghanistan. Of particular concern in both instances was the development of the Northern Distribution Network. This network offered an alternative to the primary ground line of communication that connected Pakistan's seaport to destinations in Afghanistan. It also offered an alternative to the air lines of communication that moved those items deemed too sensitive or critical to go by ground. Commenting on this network, General McNabb told the committee,

> I know that last week, Admiral [Mark] Harnitchek showed you that there are five major ways to get into Afghanistan and that is from historic times. It is just tough to get

> through those very, very high mountains in a reasonable way, which is one of the reasons we have looked to the northern side today [so we] can bring in things from the north. Whenever I think about a ground network, I would like to have lots of options. If you have [only] one, you kind of are at risk. So as a logistician, you are always saying, "Well, I want to have multiple options. So that whatever way you go, I can go a different way if I end up having some trouble."[16]

Thus, he summarized for the committee the longstanding logistical principle of maintaining multiple lines of communication to ensure an alternate route is always available. In fact, later in his testimony, he referred to aerial delivery as the "ultimate guarantee," having assured his counterparts on the ground that if they needed something and it could not be delivered by surface means, air would provide the alternate solution.[17] His comments to the Senate Armed Services Committee the following month reflected this same type of thinking when he said, "The big part that you want to do on the supply chain is to make sure you have lots of options, you have lots of ways to get in there, so you're not relying on [only] any one of those."[18] Interestingly, while General McNabb's comments confirmed the role aerial delivery would continue to play as an alternative to a sole ground line of communication, he made no mention of what alternatives existed for the roughly 28 sites that depended solely upon aerial resupply. For those sites, in fact, there were no multiple options.

Meanwhile, reliance upon aerial delivery in Afghanistan was quite clearly increasing. *Air Force Magazine* noted in October 2009 that the number of airdrop and airlift requirements in Afghanistan had increased so much that a new airlift squadron had to activate at Kandahar Airfield that March.[19] It flew the C-130J, the newest and most capable C-130 in the inventory, which fortunately did not suffer from any of the wing-box groundings or restrictions. Even so, the wear and tear of continuous combat operations revealed itself elsewhere in the USAF airlift fleet. In December 2009, *Air Force Magazine* noted that while original estimates were that each C-17 would fly only about 1,000 hours per year, averages in the recent years had been higher than 1,250 hours per year. This 25 percent increase, according to Gen Arthur Lichte, commander of Air Mobility Command (AMC), stemmed from the fact that the USAF "started flying much harder" once operations in Afghanistan and Iraq began.[20] As the article further noted, it was fortunate for the USAF C-17 fleet that the average was falling back toward the desired levels as additional C-17s entered service. Despite the increasing fleet size, January 2010 saw the already burdened fleet stressed even more.

On the afternoon of 12 January 2010, a magnitude 7.0 earthquake devastated Haiti, causing over 300,000 casualties and leaving more than 500,000 people reliant upon some form of humanitarian assistance.[21] As the United

States rushed to support Haiti, AMC found itself at the forefront of US relief efforts. The command provided a variety of aircraft and personnel to manage its portion of the US-led humanitarian operation but had to do so in light of existing requirements. The command's monograph on the operation captures the friction between the competing requirements succinctly: "With the United States involved in two major wars—Operations Enduring Freedom and Iraqi Freedom—finding enough C-17s to support Haitian relief operations quickly became problematic."[22] In actuality, the requirements for Haiti were relatively small compared to AMC's overall capacity. Even so, Maj Gen Brooks Bash, AMC director of operations, noted that the additional aircraft came at the expense of training, because aircraft had to be recalled from Pacific Air Forces and Air Education and Training Command to support the effort.[23] This would ultimately derail training for some time and, when combined with unfortunate weather, cause some three months of training fluctuations at the USAF's primary C-17 training facility, Altus Air Force Base, Oklahoma.[24] Between the demands of Haiti and General Lichte's earlier concerns about the usage of the C-17 fleet, it would seem that the USAF was testing the limits of what might otherwise have appeared an endless capacity. In fact, much as the venerable C-130 was subject to fatigue, the newer C-17 was showing its own signs of wear.

A briefing provided by the USAF's C-17 engine program manager is revealing in this regard. The briefing compares calendar-year 2010 usage of the C-17 engine, the Pratt and Whitney F117, with its civilian counterpart, the Pratt and Whitney 2040, which powers the Boeing 757.[25] As would be expected, the C-17 engines are subject to much longer average sortie lengths (4.0 hours versus 2.7 hours) and experience maximum thrust takeoffs close to 53 percent of the time while the civilian engines experience these less than 20 percent of the time. Flights to and from the USAFCENT AOR account for at least some of the longer sorties, and short fields and combat conditions in those areas certainly demand more maximum thrust takeoffs than would be expected from civilian aircraft. The fact that C-17s are doing more of this kind of work is evident in the sortie distribution chart included in the briefing.

The chart in figure 2 clearly shows an overall increase of C-17 sorties within the USAFCENT AOR from July 2004 on and an increase in flights to and from the AOR from July 2003 to July 2005.[26]

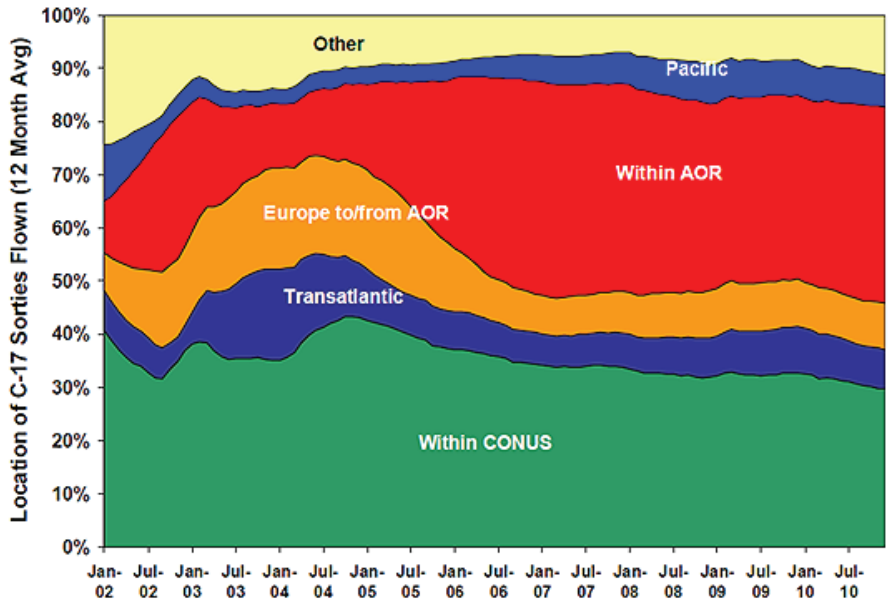

Figure 2. C-17 sortie distribution. (*Image from* Chuck Darnell, lead program manager, Tinker AFB, OK, to the author, e-mail, 24 February 2012.)

Interestingly, although the flights within the combat area have increased, flights in the other areas captured by the chart do not appear to have decreased proportionately. Therefore, not only are C-17s (and their engines) being subjected to the harsher demands of flying in combat conditions but these are in addition to, not in lieu of, other requirements. Finally, the briefing showed that in spite of the C-17 and Boeing 757 engines being almost identical, the C-17 engines accrued specific types of damage almost seven times as frequently as the civilian engines due to the operational strains placed upon them. These operational stresses result from flights in the combat environment and, when combined with additional demands like the operation in Haiti, further test the limits of the fleet. These clearly constitute some of the risks that have accrued in the last 10-plus years. Tellingly, though, even as these risks grew, so too did overall requirements.

Addicted to Airlift?

Lt Gen Mitchell Stevenson, US Army deputy chief of staff (G-4), chronicled the history of airdrop and the extent to which operations in Afghanistan

constitute a renaissance of this means of supply.[27] Interestingly, the general noted that although airdrop was historically a means of *emergency* resupply, that dynamic had changed in Afghanistan, and "aerial delivery has become *increasingly vital*" (emphasis added).[28] True to this fact, the Air Force reported in January 2011 that airdrops in Afghanistan had reached a record level of 60.4 million pounds (fig. 3).[29] Compared to the meager 3.5 million pounds dropped in 2006, the record for 2010 represented an overall increase of more than 17 times the requirement from just four years prior. Not only was this so, but data from USAFCENT also revealed that the amount of supplies airdropped into Afghanistan had essentially doubled each year since 2006 to reach its height of 60.4 million pounds in 2010. Remarkably, subsequent data released for 2011 showed that 2011 was the only year in the previous six that the amount did not at least double from the previous year. Despite this fact, 2011 still set a new record with a total of 75.9 million pounds airdropped in Afghanistan.[30] In fact, when plotted in chart form, the raw airdrop numbers collected by USAFCENT take on the mountainous quality of the Afghan terrain (fig 3). The only question would be, which one is the steeper of the two? Assuming there is an eventual limit to the amount that can be airdropped in one year, the good news is that as of 2011 the amount no longer seems to be doubling each year. The possible bad news is that the trend as a whole appears durable in direction, even if not in scope.

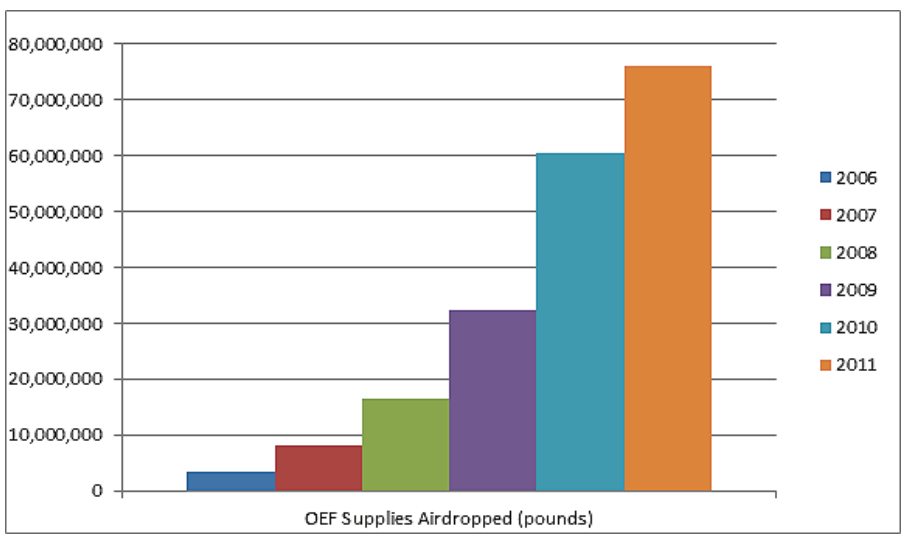

Figure 3. Pounds of supplies airdropped for Operation Enduring Freedom. (Derived from Combined Force Air Component commander's airpower statistics, USAFCENT website)

On this backdrop of airdrop dependence, comments from senior members of the US military do not seem to indicate these trends will change anytime soon. In April 2011 General McNabb again testified to the House Armed Services Committee and noted the extent to which operations in Afghanistan relied upon aerial delivery and to which his command was working on new methods to support these demands.[31] Most notably, his prepared statement indicated the command would "invest in intelligent unmanned aircraft technology to autonomously deliver critical supplies to forward points of need. Our intent is to address extended lines of communication susceptible to weather, degraded road conditions and enemy threats, such as improvised explosive devices, ambush, and sabotage."[32]

Within only a couple of months of these comments, an *Air Force Magazine* article included excerpts of an interview with Brig Gen Paul Johnson, 451st Air Expeditionary Wing commander. Per the article, units assigned to General Johnson's wing were making record monthly airdrops in Afghanistan, which the article attributed to several factors: "There are better delivery parachutes, coupled with larger capacity C-130J models carrying more cargo, which can place larger loads in increasingly accurate drop zones."[33] After discussing the limited roads in Afghanistan and the fact that airdrop allowed US and coalition forces to be more isolated and dispersed, the article quoted General Johnson as saying, "Because we can do this, [it] allows us to ponder going places [that we] previously wouldn't have gone before."[34]

A stream of news articles in the following months seemed to reconfirm the allure of this newfound capacity. *Air Force Magazine* included a daily report titled "Airdrop Explosion Making the Difference" that said AMC was "on track to drop 90 million pounds" of supplies in Afghanistan.[35] A subsequent US Army news article titled "Sky's the Limit for Airdrops" discussed the benefits of JPADS drops and asserted that the "number of precision deliveries . . . will only increase."[36] Yet another article from the *Wall Street Journal* discussed the exponential increase in airdrop in Afghanistan and made the case that such drops were not without correspondingly exponential costs. In fact, it charged that the fully burdened cost of airdropping fuel to outlying locations was up to $400 per gallon.[37] Finally, an article in *USA Today* continued the theme, asserting that as "the drops have become more accurate, they are being depended upon more by troops" and that, according to AMC, in 2011 there were 43 forward operating bases that relied exclusively on aerial resupply.[38] All of this seems to confirm that airlift and airdrop have risen to new levels of importance in the last 10-plus years. Airlift operations in Iraq took on great significance in light of the threat of IEDs, while terrain, conditions, and capabilities seem to have created an insatiable hunger for airdrop in

Afghanistan. All the while, equipment risks and competing operations have lurked in the background. This being the case, has moral hazard been as evident as it was at Dien Bien Phu and Khe Sanh?

The Role of Moral Hazard

One of the greatest difficulties in assessing the role of moral hazard in the Iraq and Afghanistan operations is their recent and ongoing nature. The Dien Bien Phu and Khe Sanh cases have the benefit of elapsed time that allows the historical dust to settle and the narrative to take shape. With military operations, an important component of this narrative typically derives from declassified unit histories and other operational documents. These, of course, are readily available for French operations in Indochina and US operations in Vietnam. Most unit histories and operational documents from Iraq and Afghanistan, however, remain classified. This limitation affects the extent of analysis and is readily apparent in the nature of the source material for this chapter, which is clearly limited to unclassified and open-source information. Despite this limitation, there is still plenty to consider with regard to moral hazard. Previous chapters established that moral hazard plays a role in airlift operations and that agents tend to increase their exposure to risk in light of insurance. Operations in Iraq and Afghanistan seem to confirm this yet again.

Iraq provides a particularly interesting case in that USAF-provided airlift clearly influenced the behavior of US ground forces in Iraq by altering the primary delivery mode for cargo, but at the same time, this case seems to invalidate the idea of moral hazard. This is because it reduced the agent's risk exposure (by taking convoys off dangerous roads) rather than increasing the exposure by enabling the agent to take additional risks. It is important, however, to return to the definition of moral hazard as the *danger* that in a principal-agent relationship, insured agents will increase their exposure to risk. Much like the case at Khe Sanh illuminated that moral hazard cannot be viewed as a determinant of outcome, so too Iraq highlights the fact that the *danger* that agents will increase their exposure to risk is not the same as the *fact* or *certainty* that they will take on more risk. This more nuanced view fosters yet another perspective. When viewed simply from the perspective of risk to convoys, airlift did reduce risk for the ground forces with every truck it kept off the IED-laden roads. It is critical to clarify, though, that just because the airlift clearly reduced the number of convoys at risk, it does not necessarily mean that the agent was not susceptible to additional risk exposure. In fact, by broadening the level of analysis, it is possible that the convoy mitigation efforts reduced the risks to individual convoys but potentially increased the

total duration of the effort in Iraq by reducing American discontent over IED casualty numbers. In this way, the national exposure to risk may have increased despite risk reductions to specific units. Again, much like Khe Sanh, Iraq provides a difficult test for the role of moral hazard in airlift operations and, while not as clear a case, does not refute the idea that airlift presents a danger of increased risk exposure. At the same time, the Iraq case helps to clarify the fact that moral hazard refers to a *potential* for increased risk—not certainty of the same.

Afghanistan, on the other hand, is a somewhat less difficult test simply because it more closely mirrors the earlier case studies with regard to sole reliance upon aerial delivery. Although relying on news sources, this chapter has shown that in 2008 up to 28 locations in Afghanistan relied solely upon aerial delivery for their means of supply. Similarly, this number increased to at least 43 by 2011. In the same time frame, total airdrops in Afghanistan increased by more than 4.5 times from 16.5 million pounds to almost 76 million pounds, bolstering the case for increased reliance upon aerial delivery (see fig. 3). Clearly, aerial delivery has changed the behavior of the ground forces because such operations would not be possible without it. At the same time, the increase from 28 to 43 isolated locations represents an increased risk exposure, with these constituting 43 potential Dien Bien Phu–like scenarios. Notably, USAF-provided airlift enabled this increased risk to ground forces in Afghanistan; so the USAF as a principal is providing a level of insurance to the ground forces, which as an agent have increased their exposure to risk. This closely replicates the cases at Dien Bien Phu and Khe Sanh and seems to confirm again the role of moral hazard in airlift operations. Further, the Afghanistan case shows an increased risk exposure despite the assertion by the senior logistician in the US military, the USTRANSCOM commander, that when it comes to the supply chain, one wants to have multiple options for resupply.[39]

Both the Iraq and Afghanistan cases resemble the case studies from the earlier chapters in that, despite the provided insurance, an information gap existed between principals and agents. While USAF aircraft enabled convoy mitigation operations in both Iraq and in the ever-increasing airdrop missions in Afghanistan, the ground forces in both instances lacked certainty regarding the principal's ability to make good on the insurance provided. In the case of Iraq, one risk associated with this lack of information was that forces would become reliant upon airlift for cargo movements only to have those movements cease due to groundings or restrictions. Fortunately, the groundings and restrictions that occurred did not have this effect, but the groundings that took place at the height of convoy mitigation operations

illustrate the potential for the additive risks already demonstrated to exist in principal-agent relationships. The demands on the C-17 fleet by operations in Iraq, Afghanistan, and Haiti represent a similar potential for additive risk, and this chapter has shown that unexpected operational tempo may exceed or degrade the principal's estimates of fleet health and availability.

Finally, the cases of Iraq and Afghanistan lend anecdotal evidence in favor of the argument that as capacity increases, so too does the risk of moral hazard. Support for this is most evident in the case of Afghanistan, which includes an exponential rise for airdrop and a subsequent increase in the number of sites that rely solely on aerial delivery. These trends stand in stark contrast to the historical cases considered above where aerial delivery provided a sole means of support to a single location within a theater of operations. Instead, these trends seem to confirm General Stevenson's categorization of airdrop as historically a "means of emergency resupply" that is now becoming "increasingly vital."[40] Certainly, even though the French were able to sustain Dien Bien Phu for as long as they did, they would not have been able to sustain 43 locations simultaneously. Likewise, given the priority of effort allocated to Khe Sanh, it is highly doubtful that the United States could have supplied additional sites in that manner in 1968 in a fashion similar to that achieved in Afghanistan. Additionally, neither of the principals in the earlier cases could have dreamt about a capacity to drop 76 million pounds in a year while simultaneously estimating that drops the next year would exceed 90 million pounds. The difference in scale from 1954 to 1968 and 1968 to 2011 is just phenomenal. True to General Johnson's remark that airlift capacity and technology enable support to previously unsupportable locations, it seems that aerial delivery makes possible that which was previously deemed imponderable. What is notable though is that in each case capacity and moral hazard have had a positive relationship. The evidence seems to indicate that as capacity has increased so too has the potential for moral hazard in airlift operations.

Taken as a whole, aerial delivery operations at Dien Bien Phu, Khe Sanh, Iraq, and Afghanistan illustrate that moral hazard plays a role in airlift. These operations also show that insurance provided by a principal will tend to result in, but cannot guarantee, a subsequent increase in risk exposure on the part of the agent. These risk exposures frequently occur with unidentified risks resulting from a lack of clarity and information between the principal and agent and seem positively linked to overall aerial delivery capacity. With this understanding of what to expect regarding moral hazard and aerial delivery, means of reducing or controlling that relationship's effects deserve consideration.

Notes

1. At the time of this writing, Operation Iraqi Freedom is drawing to a close. This operation included one instance of a Marine unit relying solely on airdrop for at least two months in 2004. When the historical narrative for this event takes shape, it might rise to a level worthy of comparison to Dien Bien Phu or Khe Sanh. For more on this, see US Army Field Manual 3-24/US Marine Corps Warfighting Publication 3-33.5, *Counterinsurgency*, appendix E. In Afghanistan, operations continue, and as will be discussed, many units rely solely on airlift. Therefore, Afghanistan also could yet yield a case that rises to the level of Dien Bien Phu or Khe Sanh.

2. To appreciate the scope and extent of the IED problem, consider that a *Washington Post* article from 30 September 2007 noted that, up to that point, IEDs accounted for 63 percent of those killed and 69 percent of those wounded in Iraq. Rick Atkinson, "The Single Most Effective Weapon against Our Deployed Forces," *Washington Post*, 30 September 2007, http://www.washingtonpost.com/wp-dyn/content/story/2007/09/29/ST2007092900754.html?sid=ST2007092900754.

3. Eric Schmitt, "Threats to Convoys Mean More Airlifts," *New York Times*, 15 December 2004, http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2004/12/15/MNGUMAC5B61.DTL.

4. Don Nelson, "Increased C-130, C-17 Flights Relieve Army Ground Convoys," *Air Force Print News Today*, 15 December 2004, http://www.af.mil/news/story.asp?storyID=123009422.

5. Ibid.

6. "C-130s Grounded," *Air Force Print News Today*, 11 February 2005, http://www.af.mil/news/story_print.asp?id=123009806.

7. "AMC Continues to Meet Warfighters' Needs," *Air Force Print News Today*, 1 March 2005, http://www.af.mil/news/story_print.asp?id=123009927.

8. Bruce Rolfsen, "Airdrops Guided by GPS Promise Precise Delivery," *Air Force Times*, 18 September 2006.

9. Damian Housman, "Air Logistics Center Upgrades Center Wing Boxes on C-130s," *Air Force Print News Today*, 15 November 2006, http://www.afmc.af.mil/news/story_print.asp?id=123032021.

10. Ibid.

11. Bryan Ripple, "Convoy Mitigation—Al Asad Aerial Porters Saving Countless Lives Moving Air Cargo in Operation Iraqi Freedom," *Air Force Print News Today*, 31 May 2007, http://www.youngstown.afrc.af.mil/news/story_print.asp?id=123055307.

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13. Mark V. Schanz, "The Airpower Surge," *Air Force Magazine*, January 2009, 32, http://www.airforcemag.com/MagazineArchive/Documents/2009/January%202009/0109surge.pdf.

14. Andrea Thacker, "Air Drops Surge in 2008," *Air Force Magazine*, 27 August 2008, http://www.airforce-magazine.com/DRArchive/Pages/2008/August%202008/August%2027%202008/AirDropsSurgein2008.aspx.

15. Michelle Tan, "Army Hopes New Airdrop 'Chute Delivers," *Army Times*, 24 November 2008.

16. House, *U.S. Transportation Command's (USTRANSCOM) Airlift, Sealift, and Surface Lift Programs: Joint Hearing before the Seapower and Expeditionary Forces Subcommittee Meeting Jointly with Air and Land Forces Subcommittee of the Committee on Armed Services*, 111th Cong., 1st sess., 25 February 2009, 6–7, http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg52943/pdf/CHRG-111hhrg52943.pdf.

17. Ibid.

18. Senate, *Hearing to Receive Testimony on United States Southern Command, United States Northern Command, United States Africa Command, and United States Transportation Command: Hearings before the Senate Armed Services Committee*, 111th Cong., 1st sess., 17 March 2009, 13, http://armed-services.senate.gov/Transcripts/2009/03%20March/A%20Full%20Committee/09-09_3-17-09.pdf.

19. Mark V. Schanz, "Enduring Airlift," *Air Force Magazine*, October 2009, http://www.airforcemag.com/MagazineArchive/Documents/2009/October%202009/1009airlift.pdf.

20. Marc V. Schanz, "Airlift Upsurge" *Air Force Magazine*, December 2009, http://www.airforce-magazine.com/MagazineArchive/Documents/2009/December%202009/1209airlift.pdf.

21. Ellery D. Wallwork, Kathy S. Gunn, Mark L. Morgan, and Kathryn A. Wilcoxson, *Operation Unified Response: Air Mobility Command's Response to the 2010 Haiti Earthquake Crisis* (Scott AFB, IL: Office of History, Air Mobility Command, December 2010), 1, https://www.my.af.mil/gcss-af/USAF/AFP40/d/s6925EC13535B0FB5E044080020E329A9/Files/editorial/Operation%20UNIFIED%20RESPONSE%20(Haiti).pdf?channelPageId=s6925EC13535B0FB5E044080020E329A9&programId=t6925EC2E52490FB5E044080020E329A9.

22. Ibid., 46.

23. Ibid., 47.

24. Ibid., 86.

25. Chuck Darnell, lead program manager, Tinker AFB, OK, to the author, e-mail, 24 February 2012.

26. Ibid. The briefing that included this chart is limited in that not all factors and rates for the engines are made available to the USAF because some of that data remains proprietary to Pratt and Whitney. Therefore, my conclusions reached from reviewing the charts are limited at the outset by the fact that the USAF data is necessarily limited.

27. Mitchell H. Stevenson, "Aerial Resupply on the Forefront in Afghanistan," *Army* 60, no. 6 (June 2010), 23–24.

28. Ibid.

29. Scott T. Sturkol, "Afghanistan Airdrop Levels Reach New Frontier in 2010," *Air Force Print News Today*, 19 January 2011, http://www.amc.af.mil/news/story_print.asp?id=123238918.

30. USAFCENT Public Affairs, "Combined Forces Air Component Commander 2006–2011 Airpower Statistics" (news release, USAFCENT, 2 January 2012), http://www.afcent.af.mil/shared/media/document/AFD-120102-001.pdf.

31. House, *National Defense Authorization Act for Fiscal Year 2012 and Oversight of Previously Authorized Programs: Hearing before House Armed Services Committee*, 112th Cong., 1st sess., 5 April 2011, 48–61, http://www.gpo.gov/fdsys/pkg/CHRG-112hhrg65808/pdf/CHRG-112hhrg65808.pdf.

32. Ibid.

33. Mark V. Schanz, "Boom Time in Afghanistan," *Air Force Magazine*, June 2011, 32, http://www.airforcemag.com/MagazineArchive/Pages/2011/June%202011/0611Afghanistan.aspx.

34. Ibid.

35. "Airdrop Explosion Making the Difference," *Air Force Magazine*, 20 September 2011, http://www.airforce-magazine.com/DRArchive/Pages/2011/September%202011/September%2020%202011/AirdropExplosionMakingtheDifference.aspx.

36. Bob Reinert, "Sky's the Limit for Airdrops," *US Army News*, 5 October 2011, http://www.army.mil/article/66478.

37. Nathan Hodge, "U.S.'s Afghan Headache: $400-a-Gallon Gasoline," *Wall Street Journal*, 6 December 2011, http://online.wsj.com/article/SB10001424052970204903804577080613427403928.html.

38. Jim Michaels, "Military: Pinpoint Airdrops Key to Success in Afghanistan," *USA Today*, 1 February 2012, http://www.usatoday.com/news/world/story/2012-01-26/afghanistan-airdrops/52902982/1.

39. Senate, *Hearing to Receive Testimony on United States Southern Command, United States Northern Command, United States Africa Command, and United states Transportation Command*, 13, http://armed-services.senate.gov/Transcripts/2009/03%20March/A%20Full%20Committee/09-09_3-17-09.pdf.

40. Stevenson, "Aerial Resupply on the Forefront in Afghanistan," 23–24.

Chapter 5

Mechanisms to Reduce Moral Hazard

Doctrine: fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application.

—Department of Defense
*JP 1-02, Dictionary of Military and Associated Term*s

Given that moral hazard is the danger that an insured agent will increase his or her exposure to risk and that the case studies considered illustrate that moral hazard is rife in airlift operations, reducing this phenomenon demands attention. It is important to note that, as already shown, moral hazard in airlift operations is not a determinant of the success of those operations and that moral hazard in these instances has no necessary implications for the value—good, bad, or otherwise—of the operations. Thus, it is possible for moral hazard to exist and have an operation turn out well or turn out badly. In either case, the necessary factors influencing the outcome are exogenous to the role of moral hazard. While superficially these facts might call into question the need to reduce moral hazard, such a question ignores the remainder of the evidence. The evidence clearly indicates that agents will take on additional risks in light of insurance; they will do so with incomplete knowledge of the principal's ability to come through when needed, and the overall potential for moral hazard seems to increase with capacity. Each of these factors, therefore, demands full consideration for reducing moral hazard. Unfortunately, the skyrocketing airdrop trends and comments from senior leaders discussed in the previous chapter indicate this risk is getting little, if any, consideration.

Available Mechanisms

Determining the available mechanisms to reduce moral hazard in airlift operations begins with a simple assessment of the factors involved. The previous chapters have brought each of these major factors, including fleet size, fleet health, and number of crews, to light. As such, these represent the structural aspects of the problem, which, if altered, would change the potential extent of moral hazard problems in operations supported by aerial delivery. For example, in each of the cases considered, there is a certain fleet size that would have

been insufficient to support the aerial delivery operation. Similarly, each of the involved fleets had to be of sufficient health to continue to operate for the duration of the mission, and a sufficient number of crews had to be available as well. Therefore, it is theoretically possible to reduce any one of those factors to a minimum and thereby negate the risk of moral hazard in airlift operations. Doing so, however, would require a complete assessment of all potential demands on the aerial delivery system, followed by draconian measures to limit the overall capacity by restricting one or more of these factors. Another approach could involve placing limits on USAF budgets that would reciprocally limit fleet size and health or crew availability. While possible, each of these approaches seems unnecessarily severe, especially given that the intent is to reduce moral hazard specifically—not airlift operations generally.

Another structural aspect of the problem that deserves consideration is the principal-agent relationship, which has been noted from the outset as a core aspect of moral hazard problems. Without the principal's insurance, the agent would not necessarily increase his or her exposure to risk, so both the principal and the insurance are key elements. The removal of the principal, therefore, would eliminate the risk of moral hazard. At the same time, eliminating the principal-agent relationship would eliminate any concerns regarding the asymmetry of information that might exist between the principal and agent and the potential pitfalls that accompany that asymmetry. While plausible, this too seems like an overreaction to the problem and likely fails to address the central issues. This potential failure is due largely to the fact that the most ready solution along this line is the integration of air and ground services or assets. The hypothesis here would be that if airlift assets were in the same military service as the ground assets they supported, there would be no principal-agent relationship and therefore no risk of moral hazard. This solution, however, assumes that a single service thinks and acts as a unified whole, which does not seem to be the case in practice. Moreover, that scenario would demand that the supported unit own and operate all airlift assets required for its mission. Any division at all between the aircraft or crews and the unit on the ground would create a potential principal-agent relationship and a resulting asymmetry of information. The elimination of such divisions does not seem likely for established air forces that are historically separate from their ground counterparts, but such might be a consideration for a nation just standing up an air service.

Thus, it is clear that there are mechanisms available that affect the structural relationships involved, and these could potentially reduce the likelihood of moral hazard associated with airlift. It is also apparent, however, that these measures would tend to be broad in both approach and effect and, therefore,

run the risk of doing more harm than good. Consequently, it is important to consider the nonstructural mechanisms in hopes of identifying a solution that is less severe in its impact and better tailored to the problem at hand. The obvious choices for nonstructural solutions are normative approaches that influence the problem by adjusting the norms or rules of the road affecting the system. In this case, likely available norms include training, regulations, and doctrine.

Because contemporary Western militaries focus so heavily on preparing for the job they hope never to execute, training is the major aspect of day-to-day operations for most militaries not actively involved in combat. This is true for both operational units and support units because even though the support units likely execute their combat mission on a daily basis in a noncombat role, they do so in support of operational units focused on training. It would seem then that it would be simple enough to train appropriate individuals on the risks of moral hazard so that when they are planning and executing airlift operations, they know at least to acknowledge this concern. While ostensibly this is logical and potentially effective, the reality is that the backgrounds and career paths of the individuals who might end up planning such an operation are numerous and diverse. For example, a logistics staff for a joint commander is typically comprised of officers from several different services, and each of them comes with a unique background and approach. This is simply because each of the services trains its officers separately both for basic officer and career-field-specific training.[1] This broad pool of sources alone makes a training solution an unlikely and unwieldy candidate. Regulations are another alternative. Thanks to the disciplined nature of modern militaries, their regulations tend to spell out many operational specifics. Here again, however, the number of sources is varied, with each of the services having its own regulations for its operations, not to mention the joint regulations that dictate the way the services work together.[2] Therefore, while a regulatory solution is possible, a better alternative would be a solution that causes each of the services to consider the role of moral hazard when developing regulations and training personnel. Such a solution is available via doctrine and would ultimately have the benefit of leveraging each of the other normative arms more or less simultaneously.

Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, defines doctrine as "fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives . . . [which] is authoritative but requires judgment in application."[3] Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine, Organization, and Command*, expands on this definition, stating that doctrine "shapes the manner in which the Air Force organizes, trains, equips, and

sustains its forces."[4] In this way, doctrine underpins both regulations and training, and it guides the development of each. This alone makes a doctrinal solution appealing. Such a solution, however, has an additional benefit because doctrine, by definition, "requires judgment in application."[5] As this study has shown, the outcome of airlift operations does not depend solely upon the existence of a principal-agent relationship or a moral hazard situation. Instead, multiple factors are at work, and outcomes are variable. Given that it is not possible to predetermine outcomes, a measure of judgment will always be required. At the same time, an understanding of the moral hazard associated with airlift will help inform this judgment regarding the risks involved with airlift operations—especially in those cases where units rely solely upon airlift for their means of supply. In this way, a doctrinal solution is the obvious choice and best fit for the problem as identified. It helps to highlight the potential risks involved and brings the issue to a decision maker's attention, while not summarily restricting potential operations.

Applicable Doctrine

Despite the fact that a doctrinal solution has a more narrow scope than training or regulatory solutions, numerous doctrine documents still deserve consideration. These include those joint, USAF, and US Army doctrine documents that cover air mobility, distribution and sustainment, and counterinsurgency (COIN) topics. The first of these to consider is JP 3-17, *Air Mobility Operations*. JP 3-17 provides a basic overview of air mobility and highlights its risks and advantages. In doing so, it establishes some important foundations such as the vulnerability of air mobility aircraft from the air and from the surface and the preferability of the airland method of aerial delivery to airdrop due to the former's greater efficiencies and lower risks.[6] While none of these assertions is groundbreaking, JP 3-17 makes an important point regarding the use of airlift for combat sustainment and notes that using aircraft in this role comes with significant capabilities *and* risks.[7] In fact, this same section cautions that a force "delivered to the target area . . . may be totally dependent upon subsequent airlift operations for sustainment, movement, withdrawal, or redeployment."[8] In this way, JP 3-17 seems to account generally for the potential risks brought out by the present study by providing a general caution regarding the risks airlift can create, especially when airlift provides a sole line of communication. These same cautions, however, do not appear in joint doctrine for the logistics-specific areas of distribution and sustainment.

JP 4-01.5, *Joint Terminal Operations*, includes, for example, a transportation planning checklist. This checklist reminds planners to consider whether

the commander's concept of operation and the logistics concept of support are supportable in terms of transportation. It further asks if the capabilities of all ports and lines of communication (LOC) have been analyzed.[9] While this checklist serves as an appropriate reminder regarding overall logistical supportability, it does not address the moral hazard associated with airlift. For instance, the checklist asks the planner to consider if there are any shortfalls, but it does not ask specifically if there are redundant LOCs or, if not, whether the single LOCs have been determined to be indefinitely supportable by a sole means. In this way, the publication falls short compared to JP 3-17, which at least acknowledges the possibility of a unit becoming solely dependent upon airlift and therefore indirectly addresses the potential for an agent to take additional risk in light of a principal's insurance. Similarly, JP 4-09, *Distribution Operations*, includes a "Commander' s Checklist for Distribution of Materiel and Movement of Forces" that asks the planner if the plan is "sufficiently robust that no single node is a point of failure for the operation."[10] It goes on to ask if planners considered the "implications of the loss of overflight rights, key ports, and ground LOCs."[11] It does not ask, however, whether any areas rely on a sole LOC or whether planners considered the loss of an air LOC. Therefore, much like JP 4-01.5, JP 4-09 falls short of adequately addressing the moral hazard of airlift.

While these publications cover the broad fields of air mobility and logistics, they do not specifically account for the types of COIN operations witnessed in Afghanistan and Iraq. JP 3-24, *Counterinsurgency Operations*, deals specifically with these types of operations. This publication obviously deals primarily with land-based issues due simply to the nature of counterinsurgencies but does include some useful information regarding airlift as well. In fact, JP 3-24 notes that airlift "is usually a small percentage of the overall transportation network during major combat operations; however, in particularly challenging situations, airlift may become the primary transportation mode for sustainment and repositioning."[12] The interesting thing in this case is that rather than caution against the additional risks airlift might enable, JP 3-24 seems to embrace them by acknowledging their possibility. This is likely because insurgencies require counterinsurgents to assume more risks than they would assume in conventional situations.[13] What this does not do, however, is include any mention of the risks associated with such an approach. Neither does this published doctrine match the present reality, as there is an obvious disconnect between the phrase "particularly challenging situations," which implies a few locations, and the 43 locations in Afghanistan that rely solely upon airlift. That such a disconnect exists is indicative of one of two things: the doctrine contains an inaccurate premise, or Afghanistan operations

misapply the doctrine. In this way, JP 3-24, like the joint logistics doctrine, does not fully capture the risks associated with the moral hazard of airlift. Similarly, this review shows that joint doctrine does not fully account for these risks. Despite a relatively solid foundation in JP 3-17, the other associated joint publications do not capture the risks inherent in airlift or the potential additive risks that stem from airlift operations and their necessary principal-agent relationships. If joint doctrine is foundational to service doctrine, the service-specific documents likely will not fare better. A comprehensive review is necessary all the same.

USAF air mobility doctrine builds on JP 3-17 with Air Force Doctrine Document (AFDD) 3-17, *Air Mobility Operations*, which notes that "aerial delivery normally requires air superiority," and like its joint parent, it asserts that airland is the preferred method over airdrop.[14] Most notably, AFDD 3-17 includes a vignette from Khe Sanh, highlighting the flexibility and ability of airlift despite weather and enemy fire and the fact that airlift made the victory possible. Such vignettes are common in US doctrine documents and tend to capture the reader's eye. Typically, they are set off from the rest of the text in their own font and superimposed on a shaded background to make them stand out from the rest of the document. Because of this, they take on a visual importance whether intended or not. The Khe Sanh vignette in AFDD 3-17 is most notable for its location in the document. The vignette appropriately follows a description of airdrop and a summary of the advantages and constraints of that method of aerial delivery. While this is certainly appropriate, the fact that another airdrop *success* story immediately follows it seems to skew the evidence toward what aerial delivery is capable of while giving short shrift to its limitations. In this case, some evidence of the risks associated with airlift, like a vignette on the siege at Dien Bien Phu, would provide a nice counterbalance. This counterbalance is especially appropriate since, by definition, doctrine must be applied along with sound military judgment, and giving a decision maker multiple points of reference necessarily promotes the application of judgment. It is worth noting, however, that the lack of balance regarding the risks of airlift in this section does not imply that AFDD 3-17 understates risks as a whole. Actually, it goes so far as to assert that "both friendly and enemy forces view air mobility platforms as a high-value asset" and highlights the role of surface-to-air threats and weather in affecting airlift operations.[15] In this way, AFDD 3-17 does capture some of the lessons from the present study. It reaffirms the need for air superiority, which was a foundational requirement in each of the studies considered herein. It also broadly acknowledges the risks associated with airlift and considers airlift capabilities and advantages. What it does not do is present a balanced case for the advantages

and risks of airlift in its vignettes, which clearly favor successful airlift operations over unsuccessful ones. Because by definition doctrine must be applied with professional military judgment, balance in this area would better inform that judgment when it is made. With relatively sound, if not balanced, USAF doctrine in place, a final consideration is US Army doctrine.

The Army's foundational logistics doctrine is found in Army Field Manual (FM) 4-0, *Sustainment*.[16] This publication covers a broad swath of logistics fundamentals and, thanks to the ground centricity of Army operations, includes some details regarding LOCs that are absent from USAF doctrine. Relating to the present study, FM 4-0 asserts that "widely dispersed forces, longer LOCs, and congested road networks increase stress on transportation systems. . . . [Thus,] a combination of ground and aerial delivery maybe [*sic*] planned to accommodate the distribution."[17] In this manner, FM 4-0 accounts for the use of aerial delivery as a means of relieving pressure on ground LOCs, but conspicuously absent is any mention of using aerial delivery as a sole LOC. Furthermore, FM 4-0 states that aerial delivery "is a vital link in the distribution system and provides the capability of supplying the force *even when* land LOCs have been disrupted or terrain is too hostile, thus adding flexibility to the distribution system" (emphasis added).[18] Therefore, FM 4-0 clearly gives ground LOCs primacy and assumes that aerial delivery is secondary and that aerial delivery only provides a backup to land LOCs. This clearly implies that airlift, from an Army logistics viewpoint, is not a means of replacing ground LOCs outright. This bodes well in terms of the present study, because such doctrine should insulate the Army from the moral hazard risks identified herein—simply because treating airlift as an auxiliary means necessarily reduces the likelihood of relying solely upon it as an LOC. This insulation, however, does not transcend to the Army's COIN doctrine captured in FM 3-24, *Counterinsurgency*.

FM 3-24 somewhat refines the principles laid out in FM 4-0 and aptly notes that "wherever possible in COIN operations, planners should identify multiple LOCs between bases."[19] This is consistent with FM 4-0 in that here too Army doctrine establishes the importance of flexibility among LOCs. Notably, however, FM 3-24 later asserts that in COIN operations aerial resupply should be maximized because it reduces vulnerabilities on the ground. In fact, the manual includes a vignette titled "Air Delivery in Iraq: Maximizing Counterinsurgency Potential" that documents a successful account of supplying a unit solely by air in much the same way that AFDD 3-17 includes a vignette about Khe Sanh.[20] Finally, FM 3-24 notes that airlift provides COIN forces with an asymmetric advantage, saying that "in particularly challenging situations, airlift may become the primary transportation mode for sustainment and repo-

sitioning."[21] Therefore, while FM 3-24 builds on FM 4-0 in asserting the importance of flexibility among LOCs, it seems to counter this somewhat by allowing for a sole source of sustainment without a balanced consideration of the risks involved.

Overall, this review indicates that joint, USAF, and Army doctrine provide a mixed bag when accounting for the moral hazard of airlift operations. While JP 3-17 provides a relatively solid foundation and a general caution about sole reliance upon airlift, other joint doctrine fails to promote this trend and leaves important questions unasked in this regard. Similarly, USAF doctrine appropriately addresses many of the risks highlighted in the present study but, in the end, seems skewed in presenting cases that highlight the abilities of airlift rather than the risks involved therein. Finally, Army logistics doctrine provides a foundational insulation from airlift risks by clearly establishing airlift as an auxiliary means of support, but this insulation wanes in the COIN doctrine, which embraces air-only LOCs with an unbalanced view of the risks. Such a diverse mosaic would clearly benefit from efforts to refine and refocus it.

Doctrinal Recommendations

Refining and refocusing the previously reviewed doctrine is easier to do than it may otherwise appear. Given the hierarchy of joint and service doctrine, some basic additions to joint doctrine would provide a necessary corrective to account for the moral hazard of airlift. First, JP 3-17's caution regarding the fact that an inserted force may become totally dependent upon airlift should be expanded to include examples of historical successes and failures in this regard. Such a basic change might seem inconsequential, but doing so would further set the tone that airlift support for such situations comes with inherent risks. As this study has shown, these risks are often unaccounted for and, in fact, unseen. A minor edit to the foundational joint doctrine on air mobility will help to ensure that in the application of doctrine with military judgment, said judgment will be well informed. Secondly, JP 4-01.5 and JP 4-09 should be updated to include more specific questions regarding redundant LOCs. Each of these documents encourages a broad understanding of supportability but leaves the risks of air-only LOCs unaddressed. Third, while JP 3-24 and FM 3-24 each understandably embrace air-only LOCs as a means of countering insurgencies, both fail to spell out the risks involved when airlift becomes "the primary transportation mode for sustainment and repositioning."[22] An expansion on these risks would mean future decision makers would be better informed and thus help ensure that doctrine is applied with well-informed military judgment. Finally, AFDD 3-17's airlift vignettes should be expanded

to include a vignette on Dien Bien Phu. At a minimum, the French experience at Dien Bien Phu should be included in the existing vignettes as a point of contrast. Such a change will ensure balance in the doctrine and stimulate balanced judgment in the future. Notably, such a change could easily apply to any of the doctrine documents reviewed herein.

Although superficially basic solutions, such doctrinal changes informed by this study will foundationally address the moral hazard inherent in airlift operations. Surely, there are other approaches like the structural corrections considered earlier. The recommended doctrinal updates, however, have clear benefits over these in simplicity, value, and precision. They are simple in that they demand only minor changes to existing doctrine. They have great value because these minor changes will have untold savings in future blood and treasure—even if only to make decision makers aware of risks that might otherwise go unnoticed. They have precision in that they do not broadly target the problem nor do they unnecessarily limit airlift operations. In sum, they do not seek to reduce airlift capacity; they only seek to inform its application.

Notes

1. The author's own experience on a combined force commander's logistics staff included working with officers from three different services. Some of these officers came from operational backgrounds in their services, while others came from logistical backgrounds. In all cases, none of the officers attended the same career-field-specific training as their sister-service counterparts.

2. For a sense of the expansive number of military regulations, consider that a search of the USAF publications website for the term "AFI," which is short for "Air Force instruction," returned 3,657 items. While this number includes a broad swath of topics that do not necessarily relate directly to airlift, it illustrates the scope of a service's regulations. Narrowing this down to just the operational AFIs yielded almost 300 results. This can be narrowed further to the few that deal with airlift operations but would have to be expanded to include logistics and training issues. At any rate, these would then have to be multiplied by the number of individual services and would have to include joint regulations as well.

3. Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 8 November 2010 (as amended through 15 August 2013), 83, http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf.

4. Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine, Organization, and Command*, 14 October 2011, 2.

5. JP 1-02, *DOD Dictionary of Military and Associated Terms*, 83.

6. JP 3-17, *Air Mobility Operations*, 30 September 2013, IV-13 and I-13, http://www.dtic.mil/doctrine/new_pubs/jp3_17.pdf.

7. Ibid., IV-5.

8. Ibid.

9. JP 4-01.5, *Joint Terminal Operations*, 6 April 2012, C-A-1–C-A-9, https://jdeis.js.mil/jdeis/new_pubs/jp4_01_5.pdf.

10. JP 4-09, *Distribution Operations*, 5 February 2010, C-2, https://jdeis.js.mil/jdeis/new_pubs/jp4_09.pdf.

11. Ibid.

12. JP 3-24, *Counterinsurgency Operations*, 5 October 2009, VII-5, https://jdeis.js.mil/jdeis/new_pubs/jp4_09.pdf.

13. US Army Field Manual (FM) 3-24, *Counterinsurgency*, 15 December 2006, ix, http://armypubs.army.mil/doctrine/DR_pubs/dr_a/pdf/fm3_24.pdf.

14. AFDD 3-17, *Air Mobility Operations*, 1 March 2006, incorporating changes through 28 July 2011, 37. While this publication has been superseded, the newer document continues in the same vein.

15. Ibid., 81–2. The newer document continues to fall short in this regard.

16. Army Doctrine Publication (ADP) 4-0, *Sustainment*, 31 July 2012, superseded this publication. The new publication continues to insulate Army operations from the risks associated with the moral hazard of airlift, taking an even broader approach than the previous publication. Additionally, ADP 4-0 addresses the need for survivability, redundancy, and endurance. In this way, ADP 4-0 builds positively upon FM 4-0 but continues to exhibit similar strengths on the whole.

17. US Army FM 4-0, *Sustainment*, 30 April 2009, 4-4 and 5-4.

18. Ibid., 5-4.

19. FM 3-24, *Counterinsurgency*, 8-5.

20. Ibid., 8-9. As mentioned previously, the historical narratives for Iraq and Afghanistan are still taking shape. When they coalesce, this case may provide a welcome addition to the present study.

21. Ibid., E-4.

22. Ibid.; JP 3-24, *Counterinsurgency Operations*, VII-5.

Abbreviations

ADP	Army doctrine publication
AFB	Air Force base
AFDD	Air Force doctrine document
AMC	Air Mobility Command
AOR	area of responsibility
ARVN	Army of the Republic of Vietnam
COIN	counterinsurgency
DMZ	demilitarized zone
FM	Army field manual
FOB	forward operating base
GCA	ground-controlled approach
GPES	ground proximity extraction system
IED	improvised explosive device
IMC	instrument meteorological conditions
IW	irregular warfare
JP	joint publication
JPADS	joint precision air drop system
KIA	killed in action
LAPES	low-altitude parachute extraction system
LOC	line of communication
NVA	North Vietnamese Army
OECD	Organization for Economic Cooperation and Development
SAASS	School of Advanced Air and Space Studies
USAF	United States Air Force
USAFCENT	US Air Forces Central
USMACV	United States Military Assistance Command, Vietnam
USMC	United States Marine Corps
USTRANSCOM	United States Transportation Command
WIA	wounded in action

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