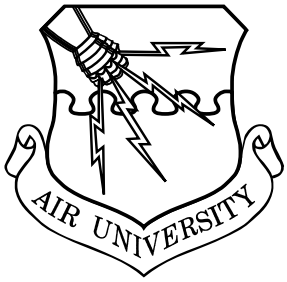

Lifeline from the Sky

The Doctrinal Implications of Supplying an Enclave from the Air

JOHN STEVEN BRUNHAVER
School of Advanced Airpower Studies

A THESIS PRESENTED TO THE FACULTY OF
THE SCHOOL OF ADVANCED AIRPOWER STUDIES,
MAXWELL AIR FORCE BASE, ALABAMA, FOR COMPLETION OF
GRADUATION REQUIREMENTS, ACADEMIC YEAR 1995–96.

Air University Press
Maxwell Air Force Base, Alabama

June 1996

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUN 1996	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Lifeline From the Sky: The Doctrinal Implications of Supplying an Enclave From the Air	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Air University Press Maxwell AFB, AL 36112-6615**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**54**	

Disclaimer

Contents

Abstract

This paper seeks to answer the following question: What are the doctrinal imperatives of providing effective airlift support to enclaves? Doctrinal imperatives are those necessary and sufficient propositions that describe the optimal way to employ airlift forces in support of an enclave. In short, this paper attempts to determine the best way to conduct airlift operations to support enclaves.

The primary conclusion of this paper is that four fundamental factors influence airlift operations: requirement to capability ratio, threat, support infrastructure, and weather. The second conclusion is that there are two basic methods to employ airlift forces: continuous flow and surge methods. The additional doctrinal imperatives contained in the conclusion relate to the interactions among the four factors affecting airlift operations to support enclaves and the ways in which they influence the two employment methods.

Evidence used to derive the doctrinal propositions came from the Luftwaffe's attempt to resupply the German Sixth Army at Stalingrad from the air, the Berlin Airlift, and the airlift to the Khe Sanh garrison in the Vietnam War.

About the Author

Maj John Steven Brunhaver graduated from the United States Air Force Academy in May 1981. After graduating from undergraduate pilot training in 1982, Major Brunhaver went on to fly C-130s as an instructor pilot and wing combat tactics and techniques officer. He was subsequently selected to fly the C-141 as special operations low level (SOLL) II standards and evaluation pilot. He was also the squadron's standards and evaluation division chief. Following that assignment he was assigned to the Checkmate division of the Air Staff in 1992. Major Brunhaver graduated from Air Command and Staff College in 1995 and the School of Advanced Airpower Studies in 1996. In July 1996, Major Brunhaver was assigned to US Transportation Command's Initiatives Team, Scott Air Force Base, Illinois.

Acknowledgments

I would like to thank everyone who helped me complete this project. First thanks go to Dr. Harold R. Winton for his help during the research phase and especially for patiently reading through multiple drafts of the thesis and correcting the numerous grammatical errors. I would also like to thank Lt Col Robert C. Owen, Dr. James S. Corum, and Dr. David R. Mets for their experience and guidance.

Most importantly, I want to express my sincere appreciation to my wife, Mary Jo, my sons, John and Brian, and my daughter, Kathrine, for their love, understanding, and patience during the months when I spent my days with my laptop and not my family. Their confidence in me was reassuring and made the difference in ensuring the work was completed.

Chapter 1

Introduction

Without supplies no army is brave.

—Fredrick the Great
Instructions for his Generals, 1747

In November 1993 a small group of US Air Force (USAF) officers were gathered in the basement of the Pentagon attempting to develop solutions to the troubles in Bosnia–Herzegovina for the chief of staff. This effort was given urgency not only by the deteriorating situation in the Balkans but also by the fact that President William J. Clinton had campaigned on a platform that advocated stronger American action in the region. After taking office, however, the Clinton administration quickly ruled out use of American ground forces and turned to airpower to provide humanitarian assistance to the civilian population of Bosnia–Herzegovina. That decision led to USAF C-130s dropping food and medical supplies to Bosnian government towns whose ground supply routes had been interdicted by the Bosnian Serb Army. This incident highlights the propensity of government leaders to use airpower, as opposed to surface forces, to achieve a desired political effect with minimum casualties. It also serves as an example of the utility of military forces in support of humanitarian missions. While these events in Bosnia illuminated the use of airpower to supply enclaves, the practice dates back to the very dawn of military airpower during the British Mesopotamian campaign of World War I.

In July 1915 the British army advanced northwest along the Tigris River to secure oil fields and pipelines in Mesopotamia. For years prior to the outbreak of war, Britain had exercised a protectorate over the sheikdoms of Kuwait and Mohammera. This influence became vital as the British became more dependent on oil.[1] While attempting to push the Turkish army out of the region, British forces met stiff resistance and were forced to withdraw to the town of Kut al Amara. The Turkish army quickly laid siege and constructed 31 miles of trenches surrounding the city. In order to support the beleaguered garrison and the civilian population, the Royal Air Service dropped 250-pound bags of flour and other foodstuffs to Kut. The officer commanding the aviation service in the theater determined that the best way to supply Kut would be to fly each aircraft over the town three times. Much of the flour and other foodstuffs dropped by British BE-2s landed in an unusable condition or in an inaccessible area, beyond the reach of British forces. In the end the resupply effort was not successful and the British commander was forced to surrender his garrison due to the lack of food. On 29 April 1916, Col Nizam Bey, a Turkish regimental commander, lead his unit into Kut to accept the

surrender of 13,300 British and Indian soldiers. Although the use of airpower to supply the Kut garrison clearly stretched the Royal Air Service beyond its capacity, this episode demonstrates the birth of an idea.

Both the Kut example and the more recent use of airpower to support Muslim enclaves in Bosnia–Herzegovina illustrate the point that the support of isolated garrisons is an important mission for the USAF. Because of this importance, it naturally follows that the doctrinal precepts to guide airlift operations supporting enclaves are worthy of serious investigation. This paper, therefore, seeks to answer the following question: What are the doctrinal imperatives of providing effective airlift support to enclaves? Doctrinal imperatives are those necessary and sufficient propositions that describe the optimal way to employ airlift forces in support of an enclave. In short, this paper attempts to determine the best way to conduct airlift operations to support enclaves.

Terms Used

In order to establish a lexicon for this paper, the following key words or phrases will be used as indicated:

1. The word *enclave* comes from the French word *enclaver,* which means to enclose. *Webster's* defines an *enclave* as a country or part of a country within the boundaries of another country, or a minority group preserving its own distinct culture while living within a larger group. Additionally, an enclave is a location that is completely surrounded by hostile forces. This location may be occupied by friendly forces, by noncombatants, or by both.
2. *Webster's* also defines *airlift* as a system of transporting troops or supplies by air, frequently when surface routes are obstructed or inaccessible. In this paper, airlift includes the use of both fixed and rotary winged aircraft and both airland and airdrop means of delivery.
3. The term *threat* includes multiple aspects of military force that can be applied against airlift forces. The threat from the air would include air-to-air fighters threatening airlift aircraft en route as well as bombers and fighter bombers attacking airlift bases and logistics centers. The threat from the ground would include antiaircraft artillery (AAA) and surface-to-air missiles (SAM) attacking airlift aircraft en route as well as enemy ground forces threatening airfields both in the enclave and in the rear areas.
4. The enclave's airlift *requirement* is the total amount of provisions that must be delivered by air for it to survive. It is usually expressed in tons per day.
5. The *requirement to capability ratio* is a term designed to relate the airlift requirement and airlift capability. In an attempt to treat these factors independently, this term is defined narrowly. The requirement is defined above, and the capability is the amount of provisions that can be delivered flying each airlift aircraft at its designed utilization rate. An example of a high requirement to capabilities ratio

is a case where the daily requirement is 300 tons per day and the airlift force structure can only transport 200 tons per day. An example of a low requirement to capabilities ratio is a case where the requirements is 200 tons per day and the airlift capability is 300 tons per day.

6. The *support infrastructure* includes all those support facilities and functions that ensure the transport aircraft are ready for operations and are loaded and off-loaded. This includes maintenance, supply, transportation, aerial port, billeting, messing, air traffic control (ATC), and command and control. The condition and effectiveness of these facilities and organizations directly affect the number of productive sorties flown each day.
7. *Weather* pertains to the conditions that influence the airlift effort in total. This includes not only the weather conditions at the airfields and en route that impinge upon the flight operations but also the conditions that affect the support infrastructure.
8. Methods of employing airlift forces fall into two categories: *surge operations and continuous flow operations*. The surge method of employing airlift force involves an effort to concentrate the arrival of the airlift forces into an objective area in a short period of time. This could be done at regular or irregular intervals throughout the day. This method is used to take advantage of breaks in the weather, fighter escort, or AAA/SAM suppression. Flying formations to multiple drop zones (DZ) or landing zones (LZ) with concentrated times on target (TOT) is an example of the surge method. On the other hand, the continuous flow method involves a flow of aircraft into the objective area at regular intervals. Aircraft arriving at an airfield every three minutes, 24 hours a day is an example of the continuous method. The continuous method promotes efficiency.

Evidence

This paper begins by investigating the Battle of Stalingrad during World War II. The focus of this case is the Luftwaffe's attempt to resupply the German Sixth Army while it was encircled by the Soviets. The Stalingrad case is characterized by a challenging requirement for supplies from Sixth Army and an equally challenging threat from the Soviet ground and air forces. Following the Battle of Stalingrad, this paper will assess one of the most important events of the Cold War, the Berlin Airlift. Here the Western Allies supplied the noncombatant occupants of West Berlin while the Allied surface corridors to the city were interdicted by the Soviets. The Berlin Airlift's most important characteristic was a very demanding daily requirement for tonnage to be delivered. The final case is an examination of the American resupply of US forces at Khe Sanh. Khe Sanh focuses on a high threat environment and the use of a robust airlift force structure to counter it. These examples were selected to present diverse threat environments, airlift capabilities, demands, and outcomes. They were also

selected to present a cross section of significant airlift efforts from modern aviation history.

The sources consulted for this study include a wide variety of primary accounts and secondary analyses. The primary evidence for the Stalingrad case study is centered on Gen Fritz Morzik's personal accounts of the Luftwaffe's airlift operations during World War II and *Generalleutnant* Herman Plocher's description of the Luftwaffe's operations, *The German Air Force Versus Russia, 1942*.[2] Generals Morzik and Plocher were both Luftwaffe commanders on the Eastern Front. Dr. Richard Muller's *The German Air War in Russia* and Von Hardesty's *Red Phoenix* round out the evidence for the Stalingrad case.[3] The evidence on Berlin Airlift operations is drawn from the Combined Airlift Task Force's preliminary report on Operation Vittles, the US Army Transportation Corps's report on Operation Vittles, Dudley Barker's *Berlin Air Lift: Special Study of Operation "Vittles,"* and Gen William H. Tunner's *Over the Hump*.[4] *Over the Hump* is a firsthand account that provides a detailed perspective of the operations from the task force commander. John Prados and Ray Stubbe's book, *Valley of Decision: The Siege of Khe Sanh* provides the background of that battle, but the primary evidence for this study is found in the Contemporary Historical Evaluation of Combat Operations (CHECO) reports, situation reports, interviews, and numerous unit histories of the airlift units that participated in the relief effort.[5]

Methodology and Analytical Criteria

This paper uses an inductive approach. The conclusion of each case will develop doctrinal imperatives for supplying enclaves by air. These imperatives are derived by studying several factors that contributed to the success or failure of the airlift operation in the context of the political and military situation in which it was executed. The four factors that influence how airlift resources are employed and the outcome of the airlift operation are the threat, the requirements to capabilities ratio, the support infrastructure, and the weather. Each factor includes explicit reference to the ground situation as well as the air situation. The factors are each related to operational decisions made by the airlift planners. One of those decisions is how to employ the airlift forces. There are two basic ways to employ airlift forces: the surge method and the continuous flow method. From the results of the decisions made, each case derives specific doctrinal propositions related to a situational analysis of the airlift support to the enclave. The propositions from each case are then synthesized to determine preliminary conclusions based on their general historical applicability. These preliminary conclusions are evaluated for their continuing validity in light of contemporary changes affecting airlift support to enclaves, leading to the final conclusion. From this conclusion, implications will be drawn for future doctrine regarding aerial support to enclaves. We

will now move to the frozen plains of Russia to analyze the first case: German airlift support to the beleaguered garrison at Stalingrad.

Notes

1. Ronold Miller, *Death of an Army* (Boston: Houghton Mifflin Co., 1970), 3.

2. Fritz Morzik, *German Air Force Airlift Operations*, USAF Historical Study 167 (Maxwell Air Force Base [AFB], Ala.: Air Force Historical Research Agency [AFHRA], 1961), file no. K101-167; and Hermann Plocher, *The German Air Force Versus Russia, 1942*, USAF Historical Study 154 (Maxwell AFB, Ala.: AFHRA, 1966), file no. K101-154.

3. Richard Mueller, *The German Air War in Russia* (Baltimore, Md.: Nautical & Aviation Pub. Co. of America, 1992); and D. Von Hardesty, *Red Phoenix: The Rise of Soviet Air Power, 1941–1945* (Washington, D.C.: Smithsonian Institution Press, 1982).

4. Combined Airlift Task Force, "Preliminary Analysis of Lessons Learned," Maxwell AFB, Ala.: AFHRA, June 1949, file no. 572.549-1; Col Donald C. Foote, United States Army Transportation Corps, "Operation Vittles—Tempelhof a Transportation Corps Milestone," Maxwell AFB, Ala.: AFHRA, June 1949, file no. 168.7053-209; Arthur Harris, *A Special Study of Operation "Vittles"* (New York: Conover-Mast Pub., 1949); and William H. Tunner, *Over the Hump* (1964; reprint, Washington, D.C.: Office of Air Force History, 1985).

5. John Prados and Ray Stubbe, *Valley of Decision: The Siege of Khe Sanh* (Boston: Houghton Mifflin, 1991); David R. Mets, Maj, USAF, "Tactical Airlift Operations," Headquarters Pacific Air Force, Project CHECO Report (Maxwell AFB, Ala.: AFHRA, 30 June 1969), file no. K717.041-2, 16; Warren A Trest, "Khe Sanh," HQ PACAF, Project CHECO Report (Maxwell AFB, Ala.: AFHRA, 13 September 1968), file no. K717.0414-2; Department of Defense, "Project CORONA HARVEST Final Report, USAF Airlift Activities in Support of Operations in Southeast Asia: 1 January 1965–31 March 1968" (Maxwell AFB, Ala.: AFHRA, March 1968), file no. K239.034-2; Seventh Air Force, "Situation Report for General Momyer, 18 February 1968, 1600 hrs" (Maxwell AFB, Ala.: AFHRA, February 1968), file no. K740.30811-2; Major Holland, "Tactical Airlift in Vietnam," Project CORONA HARVEST Working Paper (Maxwell AFB, Ala.: AFHRA, November 1969), file no. K239.046-52; Lt Col Emmett A. Niblack, transcript of oral history interview by Col Ray Bowers, 3 May 1972, 762, AFHRA, Maxwell AFB, Ala.; Maj Henery M. Davis, transcript of oral history interview, AFHRA, Maxwell AFB, Ala.; History, Pacific Air Forces, 463d Tactical Airlift Wing, January–March 1968, Maxwell AFB, Ala.: AFHRA, file no. K-WG-463-HI; and History, Pacific Air Forces, 834th Combat Control, 1968, Maxwell AFB, Ala.: AFHRA, file no. K-DIV-834-SO-RE.

Chapter 2

The Luftwaffe's Aerial Resupply of the Sixth Army at Stalingrad

When the aircraft do not land, it means the death of the army.
—*Generaloberst* Friedrich Paulus, 20 January 1943

Confronting fierce combat and the ravages of starvation and intense cold on the bitter steppes of Russia, soldiers of the German Sixth Army surrendered only after they had become too weak to carry their weapons and found themselves without ammunition against numerically superior enemy forces. Over 90,000 men fell into Soviet captivity in the Stalingrad battles, few of whom lived to return.[1] This chapter will attempt to determine what doctrinal imperatives regarding aerial resupply of enclaves can be learned from the tragedy at Stalingrad. The first part of the study will be devoted to a discovery of the facts. The analysis will then trace effects back to their causes in terms of factors that influenced the airlift effort. Finally, we will investigate and evaluate the means employed leading to a determination of the doctrinal precepts to be derived from this case.

Analysis of the Stalingrad airlift will focus on the Sixth Army's general situation, its requirements compared to the Luftwaffe's capabilities, the Soviet threat to the Luftwaffe's resupply efforts, the support infrastructure supporting the airlift operation, and the influence of weather on the operation.

Sixth Army's General Situation

In the Russian summer campaign of 1942, Adolf Hitler's objectives were governed chiefly by economic considerations. He therefore decided to advance in two different directions—toward the Caucasus to secure oil and toward Stalingrad to sever the Volga River.[2] Stalingrad and the isthmus between the Don River and the Volga were important to the Soviets as a center of war industry and as a line of communications to the south. The Caucuses presented Hitler with the source of much needed oil to fuel the German war machine.[3] Fuehrer Directive No. 45 assigned Army Group B the mission of capturing Stalingrad and establishing a defensive line along the Don River, with plans for the capture of Astrakhan to be worked out after the conquest of Stalingrad.[4] In pursuit of these objectives, Hitler decided to abandon the steady and methodical offensive of the two army groups in Combat Zone South and to concentrate, instead, upon two separate efforts, one against Stalingrad and the Volga and the other a thrust into the Caucasus.

The Sixth Army, Army Group B's lead unit, became encircled at Stalingrad in an effort to capture the city. On 23 August heavy Soviet counterattacks isolated the XIV Panzer Corps and a regiment of the 9th Flack Division in a narrow sector bounded by the Volga River. Tank fuel and ammunition were air-dropped to the surrounded panzer corps. After a few days, Sixth Army followed up the advance and relieved the isolated unit.[5] This was a precursor of things to come. During Sixth Army's advance, the Russian Army Don enticed the German forces into the area between Rostov and Kharkov. The Sixth Army advanced into Stalingrad but was unable to occupy it completely, thus halting the advance of the front along the Volga River.[6] The Soviet army opened the second phase of the Battle for Stalingrad on 19 November with a strong counteroffensive. Pincers from north and south of the city finally surrounded the Sixth Army on 22 November.[7] On that afternoon, the Sixth Army Commander, *General der Panzertruppe* Friedrich Paulus, sent the following message to Army Group B command post:

> Army completely encircled . . . ammunition situation critical; food supplies on hand for six days; the Army intends to hold the territory between Stalingrad and the Don River and has made necessary preparations. Success depends upon closing the gap on the southern front and on whether or not adequate food supplies can be delivered by air.[8]

The German Sixth Army became encircled for three main reasons: it had attacked beyond the point that it could conduct a credible defense, Army Group B had too many objectives, and the Russian plan to draw the Sixth Army into the pocket and surround it was well planned and executed.

The Sixth Army's troops and equipment were exhausted and in need of replacements, the army's fuel and ammunition were dangerously low, and only six days of food was on hand.[9] German forces committed to the seizure of the last Soviet bastions in Stalingrad were the same forces that had attacked in the previous large-scale offensive. These forces had been excessively used. Sixth Army had received an insufficient amount of supplies over a considerable period of time. Work on the security and stabilization of supply routes proceeded very slowly. One of the most pressing problems was the critical shortage of ammunition for artillery and heavy weapons.[10] German army artillery often ceased firing by noon because of ammunition shortages. In fact, it had become a standing joke in the Stalingrad area that "hundreds of batteries are in position before the city, but each of them has only one round of ammunition."[11] These ammunition shortages started even before the Sixth Army was cut off from its supply routes. In short, when the Sixth Army was surrounded in Stalingrad, its troops were exhausted, its equipment poorly maintained, and its supplies were critically low.

Several factors caused the Luftwaffe to attempt the resupply of Stalingrad by air. Hitler's desire to hold Stalingrad was the overriding reason. A few months earlier, Hitler had made the following assertion in a political speech: "Once the German soldier has taken up his position, there is no power in the world strong enough to dislodge him."[12] Hitler decided to

let events take their course, relying on the unfounded hope that things would turn out all right in the end. Hitler's order to hold Stalingrad was also partially based on a promise from Hermann Göring that the Luftwaffe could provide adequate supplies to the garrison.[13] The Demyansk operation, a successful aerial resupply of a thousand-man force earlier in the year, also influenced the decision to supply Stalingrad by air.[14] In the final analysis, however, it was Hitler's desire to hold Stalingrad and Göring's false optimism that drove the decision to stake the Sixth Army's survival on aerial resupply.

Fuel and ammunition shortages severely limited Sixth Army's ability to breakout. Realizing the that all of Sixth Army would be lost, Fritz Erich von Manstein assigned Fourth Panzer Army the task of advancing toward Stalingrad in an attempt to link up with or assist in the breakout of what remained of Sixth Army. On 20 December the Fourth Panzer Army's lead element, LVII Panzer Corps, crossed the Mishkova River and established a bridgehead 30 miles west of Stalingrad. From this point they were able to see the reflected glow from the firing around Stalingrad's perimeters. Accomplishment of the linkup seemed almost within grasp, but Sixth Army never attempted to breakout because fuel available in Stalingrad was enough for Sixth Army's armor to advance only 18 miles and Friedrich Paulus believed the break out attempt to be too risky.[15] With the Fourth Army unable to advance and the Sixth Army unable to break out, continued air resupply remained the only hope for Paulus's beleaguered troops.

The Fourth Air Fleet was the Luftwaffe unit responsible for effecting that resupply. This formation had two difficult missions to accomplish in the Battle for Stalingrad: first and most significant, airlifting supplies to Sixth Army; and second, supporting German ground forces fighting against the Soviet units advancing along both banks of the Don River. The success of each mission was contingent upon the satisfactory fulfillment of the other. The accomplishment of an airlift operation of even approximately the required scale required a defensive line along the Chirnaya River. Army Group B needed air support to hold this line, which had to be held if the supply airfields at Morozovskaya and Tatsinskaya were to be kept operational for the conduct of the airlift.[16] Both Army Group A and Army Group B were supported by Fourth Air Fleet. The Fourth Air Fleet had to resupply its comrades in Stalingrad but at the same time had to use its resources to stabilize the front. Obtaining and maintaining air superiority was necessary to the success of each mission. The scale of Sixth Army's requirements would make the Fourth Air Fleet's first mission very demanding.

Sixth Army's Requirements Compared to the Luftwaffe's Capabilities

The Luftwaffe airlift forces were under the command of the Fourth Air Fleet commander, Gen Wolfram von Richthofen. Assigned to the

Richthofen was the *Lufttransportfuhrer* (air transport commander), Col Hans Foerster (Foerster was later replaced by Colonel Morzik).[17] The *Lufttransportfuhrer* was an airlift expert assigned from the Air Transport Forces Command to the air fleet commander for special airlift operations. The *Lufttransportfuhrer* always retained command of the air transport forces, but he also assumed command of special employment units (bombers performing airlift) for large-scale air-supply undertakings.[18] Fourth Air Fleet had control of the Air Transport Chief (Crimea), Fourth Air Corps, Eighth Air Corps, and Twenty-Fifth Air Administrative Command. By mid-November, 10 additional Special Duty Bomber Groups were assigned to the Air Transport Officer for the Stalingrad resupply.[19] The Air Transport Officer was the single officer responsible for accomplishing this air resupply operation.

The Sixth Army required enough fuel, ammunition, and food to sustain defensive operations until the front could be restored to enable a linkup with German Army Group B. In order to supply 300,000 troops with enough supplies to sustain defensive operations, Sixth Army established the requirement of 750 tons per day. This was later reduced to 500 tons per day as a compromise between Göring and Gen Kurt Zeitzler, the chief of the General Staff of the Army. The Luftwaffe staff assumed 30 percent to 35 percent operational readiness rate and calculated that 10,050 Ju-52s were necessary to meet the requirement. The Luftwaffe, however, possessed only 750 Ju-52s at the time.[20] Freight gliders were considered as one more means to compensate for the shortfall in airlift capability.[21] Using bombers in an airlift role would have to make up the difference. In a conference on 23 November, Göring demanded 500 tons be delivered per day, even though Hans Jeschonnek, chief of the General Staff of the Luftwaffe, had stated that only 350 tons per day would be possible.[22] Thus, the rough estimates were that while Sixth Army required about 500–750 tons per day, the military leadership of the Luftwaffe believed that its capability was at best 350 tons per day. The question therefore arose as to how the Luftwaffe would employ its forces to supply the Stalingrad garrison.

The Luftwaffe employed its airlift forces in a method designed to provide maximum lift capability, while minimizing the Soviet threat in particular weather conditions. When good visibility and high ceilings were the prevailing weather conditions, the units flew in squadrons or in groups of five aircraft with a fighter escort. During periods of poor visibility and low ceilings, crews experienced in instrument flight flew in groups of five; and the remainder flew as single sorties or in a group of three aircraft at the most. Missions at night were flown as single sorties.[23] The Luftwaffe thus attempted to balance the weather with the threat to employ its forces as effectively as possible. The surge method, however, detracted from the most efficient utilization of the available force.

Soviet Threat to the Luftwaffe's Relief Efforts

The German armed forces were in a retreat all along the front in the Stalingrad area. The German and Rumanian front broke up along a length of over 50 miles in the north and 30 miles in the south. Into this breach, Georgy Konstantinovich Zhukov poured six armies.[24] While Manstein was gravely concerned for the Sixth Army in the pocket, he was also anxious about his extended Army Group Don. If Soviet units could drive through in force between the right flank of Army Group B and the left flank of Army Group Don in the direction of Rostov, they could interdict Manstein's logistical routes and isolate the greater part of Army Group Don.[25] On 12 December the operation for the freeing of the Sixth Army began. The drive was lead by the LVII Panzer Corps of the Fourth Panzer Army. Supporting VIII Air Corps units were given orders to give equal support to the combat operation on the ground and to the airlift into the pocket.[26] By midday of 23 December, Army Group Don was forced to withdraw a division from the Fourth Panzer Army to help the Rumanian III Corps and the XXXXVIII Panzer Corps establish a new front.[27] The Soviet ground threat was pushing the German lines farther west each day.

The Luftwaffe had two problems when it came to the security of its airfields not in the pocket. The first and most troublesome was the threat from Soviet ground forces; the second was the threat from Red air forces. Soviet army advances forced the Luftwaffe to evacuate the tactical airfields between the Don and Chir Rivers, from which German dive bombers, ground attack, and tactical reconnaissance units had been operating. In some cases the last aircraft left their bases when the first shells of Soviet tanks struck the fields.[28] Additionally, on 9 December the Tatsinskaya airfield was attacked twice by Soviet aircraft, which destroyed four JU-52's, 75 tons of fuel for the army, and 6,000 rounds of ammunition.[29] Later in the campaign, Fourth Panzer Army's failure to hold the front along the Manych River necessitated the evacuation of the Salsk airfield. By 15 January 1943, the lack of forward airfields was sorely felt. One relatively suitable site was found at Cherekovo, where an airfield was constructed in two days.[30] Every airfield lost to the Red Army significantly lessened the Luftwaffe's chances of completing its supply mission to the Sixth Army. Therefore, when Tatsinskaya was lost it was not difficult to predict the end.[31] Throughout the airlift operation, Luftwaffe airfields were either getting overrun by advancing Red Army forces, being bombed and strafed by Soviet air forces, or both. The problem of inadequate airfield defenses was exacerbated by problems en route.

En route to Stalingrad, Luftwaffe aircrews suffered losses at the hands of both Soviet fighters and Red Army antiaircraft gunners. In the area between the Fourth Panzer Army and the Sixth Army, the Russians soon deployed antiaircraft forces along the western and southwestern perimeters of the pocket and in the intermediate area.[32] At the same time, Soviet interceptor attacks became a more serious problem than antiaircraft fire,

especially for Ju-52 and Ju-86 aircraft.[33] The Luftwaffe and the critical supplies for the Sixth Army were significantly attrited on the way to Stalingrad. These losses were complicated by the difficult situation in the Stalingrad pocket.

The Luftwaffe airfields in the Stalingrad pocket were threatened day and night by the Red Army and the Soviet air force. On clear nights the airfields were under constant surveillance by Soviet pilots in U-2s, and incoming planes and moving targets on the field were frequently bombed.[34] On 15 January 1943, the southern perimeter of the pocket collapsed, allowing the Red Army to move in close to the Pitomnik airfield. The German failure to construct and outfit alternate airfields now restricted the entire airlift.[35] By 21 January most supplies were being delivered by airdrop, but many crews made landings despite heavy artillery fire and numerous shell and bomb craters on the strip. The Luftwaffe lost six transports in a single mission because the snow concealed the craters from the crews. The last Ju-52 to land arrived at 1220 hours on 22 January 1943. At this stage, however, no organized efforts were being made to recover supplies from wrecked aircraft.[36] Strong pressure from the Soviet army and air forces on the German airfields was continuous and increased in intensity as the campaign went on.

The Soviet armed forces attacked all aspects of the German resupply effort. The Red Army attacked and overran Luftwaffe airfields in the pocket and at the supply bases. The Soviet air forces attacked German transports at their home bases, en route, and on the ground at Stalingrad.

Stalingrad Airlift Operations Support Infrastructure

The examination of the support infrastructure will focus on five areas: the supply system to the transport bases, the condition of the transport bases, the condition of transport maintenance support, the condition of the airfields in the pocket, and the capability of the air traffic control and navigation systems.

The German supply depot at Tatsinskaya was the only source of supplies for the relief operation. Tatsinskaya was sustained by a single small-gauge rail line. Road transport was ineffective because of adverse road conditions and the limited supply of fuel and trucks. The areas of greatest concern to the German command were the important rail and supply depot of Tatsinskaya and the nearby airfield, which was of crucial importance for the continuation of the airlift to the Sixth Army.[37] Adding to the limitations of the German supply depot was the conditions of the German transport aircraft airfields.

The Luftwaffe transport airfields were hastily established and woefully underequipped. In Army Group B's advance toward Stalingrad, the Luftwaffe's logistical infrastructure had to set up quickly to continue air operations supporting Sixth Army's advance. These units suffered, as did the remainder of

the German armed forces, from inadequate winter supplies and equipment. The forward airfields were overcrowded and relied on radio and liaison aircraft for command and control.[38] The condition of the infrastructure deteriorated as the German front collapsed and the Red Army overran the Luftwaffe forward bases. Much material and highly valuable air equipment, sometimes even personnel, had to be abandoned in the wake of the Soviet pressure.[39] The last airfield to support the Stalingrad relief effort, Cherekovo, epitomized the condition of the infrastructure throughout the operation. Cherekovo was a cornfield without any kind of ground facilities and with very limited billeting. All loading and maintenance operations had to be conducted out in the open in subzero temperatures. In the first few days, ground equipment was lacking and everything had to be moved in under extremely difficult conditions.[40] In sum, the condition of the logistics infrastructure was inadequate to support the scope of the operation required to resupply Sixth Army, and this condition directly affected the maintenance and supply efforts.

The Luftwaffe maintenance and supply personnel worked in austere conditions with minimal equipment. The airfields, especially where Ju-52s were based, were overcrowded and underequipped. To alleviate the overcrowding, short-term maintenance was completed at the forward airfields and heavy maintenance completed at airfields in the rear area.[41] The minimal equipment that arrived at the forward bases in early November was often lost or destroyed as the Red Army advanced. Furthermore, by early December snow and ice had coated the airfields, the equipment, and the aircraft.[42] The Luftwaffe maintenance and supply effort was hampered by inadequate airfields, inadequate supplies and equipment, and severe weather conditions.

Within the Stalingrad perimeter, Sixth Army established and relied on only two airfields, Pitomnik and Bassargino, for a majority of its supplies. This was a major limitation throughout the operation. *Generalmajor* Pickert, 9th Antiaircraft Artillery Division commander, was in command of all Luftwaffe units in the pocket including—the airfield commands at Pitomnik. The 25th Air Administrative Command was responsible for developing the infrastructure in Stalingrad. These units were responsible for handling air-supply traffic in the pocket. Pitomnik was the only airfield in the pocket that could be used both day and night.[43] Initially, Pitomnik and Bassargino were the only bases suitable as logistical airheads in the pocket, but as security deteriorated, a new airfield was established at Gumrak. Before long it became obvious that the reception capacity of Pitomnik and Bassargino was inadequate. Additional airfields capable of 24-hour operations should have been constructed early in the airlift effort, as opposed to at the last minute. This would have enhanced the landing situation and permitted a much greater flow of air traffic to the pocket. The airfields in the pocket; were also hampered by Soviet artillery fire. On 15 January 1943, the southern perimeter of the Stalingrad pocket buckled, allowing the Red Army to move in close to the Pitomnik airfield. The ear-

lier lack of foresight in failing to construct and outfit alternate airfields now restricted the airlift.[44] The Sixth Army also lacked the equipment to off-load and move supplies quickly; loads had to be recovered and transported by hand. In short, the airlift support infrastructure within the pocket to accomplish an operation of this scale severely hampered the flow of supplies into the pocket. Equally vital to the airlift airfields was the air traffic control (ATC) and navigation systems.

The Luftwaffe established an adequate ATC and navigation system to get the transport crews into and out of the Stalingrad pocket. Communications channels and ATC facilities were able to meet the unusually high demands of the airlift. Two beacons at Tatsinskaya and Tsimlyanskiy and one strong beacon in the pocket rounded out the navigation aids. The Luftwaffe also made available an Elektra, a type of guiding set with many beams in a fixed field of operation.[45] The set at Zaporozhe was invaluable for night and bad weather. In short, air traffic control and navigation did not constrain the airlift. The Russian weather, however, was a serious problem.

Russian Weather Effects on the Airlift Operation

The severe Russian winter weather adversely affected all aspects of the operation. Weather predictions, particularly those pertaining to the target area, were a determining factor in establishing takeoff schedules and in planning the course of each day's missions.[46] By early December snow and ice had coated the airfields, equipment, and aircraft, which adversely affected ground operations. On 5 December, 36 JU-52s flew into Stalingrad, making completely blind takeoffs.[47] The 19th was encouraging for the airlift. Low-hanging clouds provided a sanctuary for the air transport operation, but they also hampered the Luftwaffe's ability to support ground operations on the front.[48] Between late November 1942 and February 1943, there was scarcely an entire day of clear weather with good visibility in the VIII Air Corps's operational area.[49] The harsh winter of the Russian steppes severely limited the Luftwaffe's ability to supply the Stalingrad garrison.

Results of the Stalingrad Airlift

The Sixth Army was ultimately forced to surrender because it no longer had the supplies required to sustain defensive operations. In an exchange between General Paulus and Major Thiel, a Luftwaffe *Gruppenkommandeur*, Paulus began with the following:

> When the aircraft do not land, it means the death of the army. Now it is in any case already too late. Every machine that lands saves the lives of 1,000 men. . . . Dropping the supplies does no good. Many supply canisters are not found, as we have no fuel with which to retrieve them. Today is the fourth day my people have had nothing to eat. We could not recover our heavy weapons, because we have no fuel. They are lost. Our last horses have been eaten. Can you picture the soldiers diving on an old horse cadaver, breaking open its head, and devouring its brains raw?[50]

Paulus's remarks indicate that the failed airlift effort definitely caused the death of the Sixth Army. There are many factors that contributed to the death of the Sixth Army; but an army that is starving to death, has no ammunition for its artillery, and has no fuel for its vehicles is an army that was affected by the airlift operation. Sixth Army had no choice but to surrender because it no longer had the means to resist.

The Luftwaffe never reached the established requirement of 500 tons per day. In fact, on only two occasions did they reach the possible goal of 350 tons per day. The Luftwaffe delivered a total of 8,250.2 tons and averaged 114.6 tons per day. One can see that the Luftwaffe never even got close to sustaining 350 tons per day let alone the required 500–700 tons per day required by Sixth Army.

Analysis

Analysis of the Stalingrad airlift will examine the overall results of the operation, the influence of the Soviet threat, the Russian winter, Sixth Army's requirement of 500 tons per day and the Luftwaffe's support infrastructure for the airlift. The surrender of Sixth Army clearly reflects the failure of the operation.

In assessing the Stalingrad campaign, one is forced to consider whether the Sixth Army could have survived even if the airlift operation had been successful. The answer is probably not. Even had the Luftwaffe been able to deliver 500 tons per day, the reduced and minimal figure deemed necessary for Sixth Army to hold out, and the strength of the Soviet forces surrounding the Germans would most likely have proven decisive. This conclusion is based on the proposition that no force can survive behind enemy lines indefinitely and the fact that by the spring of 1943 all hope for a ground relief of Stalingrad or the breakout of Sixth Panzer Army was obviated by the significant westward advance of the Red Army. Nevertheless, it is still useful to consider why the Luftwaffe was unable to sustain a delivery of even 350 tons per day, the figure its military leadership initially believed to be feasible.

What was the cause for the Luftwaffe's failure to airlift the required tonnage to Stalingrad? The combination of the strong Soviet threat and the harsh Russian winter prevented the Luftwaffe from flying enough sorties into the pocket to fill the requirement. The Soviet air forces forced the Luftwaffe to employ its airlift forces using the surge method to take advantage of fighter escorts. Despite the escorts, Red air forces destroyed many valuable transports and crews on the ground and in the air. To make matters worse, the Red Army overran the existing German infrastructure, capturing valuable personnel and equipment and forcing the Luftwaffe to operate from even more austere and distant locations. The subzero temperatures and deep snow impeded the ground crews' ability to maintain the aircraft and the aircrews' ability to operate the aircraft. Harsh weather combined with a makeshift infrastructure prevented the

Luftwaffe from meeting the operational readiness rates required to fly the needed sorties. Mutually reinforcing pressures from the Soviet threat and the Russian winter precluded the Luftwaffe from supplying Sixth Army with 350 tons per day, much less then the 500 tons per day stated requirement. General Paulus blamed the failed airlift effort for the demise of his army, but the task given Fourth Air Fleet was simply too demanding for the available resources and the conditions on the Eastern Front in late 1942.

The magnitude of the requirement was exacerbated by the paucity of the airlift capability. The adverse requirement to capability ratio dictated continuous airlift operations in order to squeeze the most effectiveness out of the austere infrastructure. However, a host of conditions prevented the conduct of continuous operations.

Soviet Air Forces and AAA batteries forced the Luftwaffe to employ its forces using the surge method to take advantage of the limited fighter escorts, thus degrading efficiency. The Soviet threat affected the Luftwaffe's airlift effort in two ways. First, the Red Army overran the German's forward airfields, destroying transport aircraft, thus reducing the capabilities of the Luftwaffe to generate airlift sorties into the pocket. The Red Army further decreased the Luftwaffe's ability to generate sorties by forcing the Germans to use airfields at greater distances from Stalingrad. Besides the distances involved, each suspension of the already insufficient air supply movement was a grievous concern for the Sixth Army; and each emergency transfer of air units meant a loss of equipment to the Luftwaffe.[51] Soviet AAA guns and fighters also destroyed transports as they attempted to reach Stalingrad. Luftwaffe flyers attempted to counter Soviet antiaircraft defenses by altering their flight routes, but this had the adverse effect of increasing the duration of the flights and, consequently, the total consumption of fuel.[52] Each lost aircraft denied to the beleaguered defenders of Stalingrad not only the supplies it was carrying, but also the future supplies they could have flown. Furthermore, while the Luftwaffe could replace the Ju-52s and He-111s lost in battle, it could not replace the crews that had flown them. In sum, overwhelming Soviet forces skillfully attacked the airlift operation from both the ground and the air.

The Russian winter affected the Luftwaffe's effort to resupply the Sixth Army in two ways. First, the winter weather hampered the flying operation. It made takeoffs, approaches, and landings all hazardous undertakings. According to Von Hardesty, "The attrition in transports as a result of accidents grew with the onset of severe winter weather."[53] Second, the Russian weather added to the decay of the Luftwaffe sortie generation capability. Ground crews at Pitomnik worked long hours against overwhelming obstacles: the runways had to be cleared repeatedly of drifting snow, hands froze to aircraft engine parts, and gas masks had to be worn to prevent frostbite.[54] While the Luftwaffe employed its airlift forces in surges to take advantage of breaks in the weather, the winter weather's

adverse influence on sortie generation prevented it from taking full advantage of the resources at hand.

The Luftwaffe's support infrastructure was also inadequate to support the surge method of employing the airlift forces. The inadequate infrastructure severely reduced the Luftwaffe's operational readiness rates. The initial operational readiness rate was only 35 to 40 percent, but it soon sank to 10 to 20 percent because of the intense cold, the lack of special equipment, and enemy action.[55] The reduced ability to produce sorties, coupled with the extended flying distance to Stalingrad brought about by Red Army advances made it difficult to take advantage of short periods of improved weather for an all-out transport effort.[56] In order to employ airlift forces in surges, the support infrastructure has to be able to generate high operational readiness rates in short periods of time. The Germans' inability to enhance their infrastructure severely degraded the Stalingrad airlift and helped lead to the collapse of the Sixth Army.

Doctrinal Propositions

What doctrinal propositions can be derived from the Luftwaffe's experience in attempting to supply Stalingrad by air?

Doctrinal Proposition:

1. When supplying an enclave by air, the planner must regularly attempt to balance competing planning factors.

Evidence to Support the Proposition from This Case:

The Stalingrad airlift presented numerous examples of the attempt to balance competing planning factors. Fourth Air Fleet had the mission to supply Sixth Army by air and support Army Group B's effort to stabilize the front. The bombers and fighters that were used in the resupply effort could have been used to stabilize the front. If the front could have been secured, perhaps the Luftwaffe support infrastructure could have maintained sufficiently high operational readiness rates to deliver more supplies with the existing Ju-52s. The Luftwaffe was unable to balance the high requirement to capabilities ratio with the strong Soviet threat.

Doctrinal Proposition:

2. A high requirement to capability ratio favors continuous flow operations in order to utilize existing resources most efficiently.

Evidence to Support the Proposition from This Case:

In this case the Luftwaffe had a limited airlift capability, and the Sixth Army required 500 tons per day. The Luftwaffe staff calculated that its force could deliver close to 350 tons per day if the operational readiness rate was 35 percent or higher. The Luftwaffe needed to use its resources in the most efficient method possible to achieve higher operational readiness rates. However, the Soviet threat and the weather would not permit a continuous flow method. Therefore, the operational readiness rates were not high enough to meet the requirement and the airlift failed.

Doctrinal Proposition:

3. An airlift effort facing a high threat environment and adverse weather conditions favors the employment of a surge operation to take advantage of threat suppression and breaks in the weather.

Evidence to Support the Proposition from This Case:

The Germans were faced with the Soviet fighter threat, so they escorted their transports into the pocket. Fourth Air Fleet had limited fighters, so the transports flew in surges to take advantage of the limited fighter cover. To make matters worse, the weather would often only permit operations for limited time periods throughout the day; the transports had to surge operations to take advantage of these periods of permissive weather. From the aspect of dealing with the threat and the weather, the surge method worked. The Luftwaffe could not, however, fly enough aircraft into the Stalingrad pocket during these surges to meet the requirement for 500 tons per day. The surge method of employing airlift forces works to minimize the effects of the threat and the weather, but the other factors must be conducive to this type of employment for the operation to succeed.

Doctrinal Proposition:

4. When an airlift operation is facing conflicting demands produced by a high requirement to capability ratio and a simultaneously high threat and adverse weather, the airlift effort must receive additional resources to enhance airlift capability or to diminish the threat.

Evidence to Support the Proposition from This Case:

The Germans' planner for the Stalingrad airlift faced this situation. The Luftwaffe did what it could to provide more resources, but the Luftwaffe was already spread thin; they also did what they could against the threat, but the force ratios greatly favored the Soviets. Because the German armed forces could not dedicate additional resources to this problem, the effort failed.

This chapter looked at a failed attempt to resupply an enclave by air. The next chapter will investigate a successful resupply, the Berlin Airlift.

Notes

1. Hermann Plocher, *The German Air Force Versus Russia, 1942,* USAF Historical Study 154 (Maxwell Air Force Base [AFB], Ala.: AF Historical Research Agency [AFHRA], 1966), 329.

2. Erich von Manstein, *Lost Victories: The Memoirs of Hitler's Most Brilliant General,* with a Foreword by B. H. Liddell Hart and Introduction by Martin Blumenson (1958; reprint, Novato, Calif.: Presidio, 1982), 291.

3. Alan Clark, *Barbarossa, the Russian–German Conflict, 1941–45* (1965; reprint with new introduction, New York: Quill, 1985), 190; and Plocher, 221.

4. Plocher, 219.

5. Ibid., 231.

6. Fritz Morzik, *German Air Force Airlift Operations*, USAF Historical Study 167 (Maxwell AFB, Ala.: AFHRA, 1961), 183.

7. D. Von Hardesty, *Red Phoenix: The Rise of Soviet Air Power, 1941–1945* (Washington, D.C.: Smithsonian Institution Press, 1982), 105.

8. Ibid., 184.

9. Morzik, 198.

10. Plocher, 237.

11. Ibid., 241.

12. Morzik, 181.

13. Göring's promise to Hitler was made during a heated debate with Hitler and General Zeitzler, chief of the General Staff of the army on November 21. Göring was losing favor with Hitler, and it is speculated that this promise was an attempt to get back in favor with the Fuehrer. When challenged by Zeitzler about what was entailed in the task of supplying Sixth Army, Göring did not know, but claimed his staff did. Clark, 184.

14. Morzik, 179.

15. Plocher, 291–302.

16. Ibid., 280.

17. Clark, 186.

18. Morzik, 11

19. Ibid., 183.

20. Ibid., 185.

21. Ibid., 186.

22. Ibid., 185.

23. Ibid., 190.

24. Clark, 247.

25. Plocher, 286.

26. Ibid., 287.

27. Ibid., 292.

28. Ibid., 252.

29. Ibid., 285.

30. Ibid., 299.

31. Ibid., 295.

32. Ibid., 292.

33. Ibid.

34. Ibid., 318.

35. Ibid., 313.

36. Ibid., 324.

37. Ibid., 294.

38. Ibid., 281.

39. Ibid., 254.

40. Ibid., 299.

41. Morzik, 195–97; and Plocher, 282.

42. Plocher, 284.

43. Morzik, 195–96.

44. Plocher, 306–13.

45. Morzik, 197.

46. Ibid., 197.

47. Plocher, 284.

48. Ibid., 289.

49. Ibid., 293.

50. Richard Mueller, *The German Air War in Russia* (Baltimore: Nautical & Aviation Pub. Co. of America, 1992), 98–99.

51. Plocher, 297–98.

52. Ibid., 292.

53. Von Hardesty, 108.
54. Ibid., 109.
55. Plocher, 321.
56. Ibid., 298.

Chapter 3

The Berlin Airlift

Morale in all of Western Europe has been lifted to inspirational levels. The people see proof in the Airlift of our determination not to abandon them to totalitarian domination. The Airlift has become a symbol of hope.

—Lucius D. Clay, General
US Army Commander in Chief
European Command

The Berlin Airlift was an immense undertaking to furnish supplies, food, and fuel to the 2.5 million civilian and military inhabitants of West Berlin during the Soviet blockade of ground supply routes. The airlift lasted from 26 June 1948 to 1 August 1949. During that time, airlift forces flew 266,600 sorties and delivered more than 2,223,000 tons, demonstrating that airlift could be an effective instrument in international diplomacy.[1]

This chapter will examine what doctrinal imperatives can be gained from studying the Berlin Airlift. The first part of the chapter will be devoted to the discovery of the facts. The analysis will then trace effects back to their causes in terms of factors that influenced the airlift effort. Finally, we will investigate and evaluate the means employed leading to a determination of the doctrinal precepts derived from the Berlin Airlift.

Analysis of the evidence for the Berlin Airlift focuses on Berlin's general situation, the requirements to capabilities ratio, the Soviet threat to the Allied resupply efforts, the airlift operation's support infrastructure, and the weather's influences on the operation.

Berlin's General Situation

Intimidating West Berlin into relinquishing its freedom was the first step of the Soviet plan to gain control of Germany, which conflicted directly with the Allied objective to retain control of West Berlin and the three western zones of Germany. For the better part of 1947, the Russians gradually imposed a surface blockade of the western sectors of Berlin. On 24 June 1948, the Russian's last move in the series to blockade road and rail lines of communication was made and the surface blockade of western Berlin was complete.[2] The blockade of Berlin was a siege directed not only at the population's stomachs, but also at its minds. The Russian promise to feed the city was a lure to the people to surrender their freedom.[3] The Soviet actions showed that they intended to gain control of Berlin, and the blockade was the mechanism to accomplish this. The Allies, on the other hand, were facing an expanding Soviet threat and had to ensure a western-aligned Germany for their own security. The need to show the world the West could stand up to the Soviet Union was also important.

The Allies had several options to confront the Berlin blockade. They could attempt to open supply routes on the ground, or they could supply Berlin from the air. The first instinct of Gen Lucius D. Clay, United States military governor, was to suggest putting an American armored column on the road to Berlin instantly. In Washington, the joint chiefs of staff considered this proposition and approved it with the stipulation that the armored column would not attempt to fight its way through; if the Russians stood fast, the convoy would withdraw. Clay refused to proceed under those circumstances.[4] In light of the limited ground options, there was no recourse but to supply Berlin by air. Supplying the occupation forces would not present too much of a problem, but supplying the civilian population would be another matter entirely.

Berlin's Requirements Compared to the Allied Airlift Capabilities

A Combined Airlift Task Force (CALTF), organized under United States Air Forces Europe (USAFE), was responsible for the coalition effort to supply Berlin. The American effort began as an operational activity of Headquarters USAFE. However, the necessity for a single-mission organization was quickly apparent; and on 30 July 1948, the Airlift Task Force (Provisional) was formed. Coordination difficulties between the British and American efforts and new operational problems due to the rapidly increasing air traffic highlighted the requirement for another change in the organizational structure. After many discussions, the CALTF was established on 15 October 1948, as a subordinate command of both USAFE and British Air Forces of Occupation (BAFO).[5] Commander in Chief Europe, General Clay, directed the Army to be responsible for moving forward all supplies to the airfields. The commander of the Airlift Task Force was given operational control of those airways and air communications service (AACS) ATC centers that had jurisdiction over the airlift routes and airdrome traffic.[6] As the airlift progressed, the CALTF received more resources to accomplish the mission of delivering supplies to Berlin.

The Allied capability was limited in the beginning of the operation, but increased as time passed. On 2 July about one hundred C-47s of the European Air Transport Service were flying the shuttle to Berlin. By 20 July the USAF's aircraft contribution to the Berlin Airlift increased to 105 C-47s and 54 C-54s. The British added 40 Yorks and 50 C-47s. The combined daily capacity totaled 2,250 tons.[7] The aircraft and materials buildup was slow in coming. On 17 November, Military Air Transport Service (MATS) was informed that the USAF commitment to the Airlift Task Force was 225 C-54s.[8] But by 23 November, the Airlift Task Force only possessed 149 C-54s. The USAF eventually assembled 180 C-54s, to which the Royal Air Force (RAF) added 58 Dakotas and 40 Yorks.[9] The actual number of aircraft used during the operation varied due to maintenance depot work and changing aircraft types, but at one point there were 226 C-54s

assigned to the airlift. The Allies began in July with the capability to deliver over 2,000 tons per day and completed the operation with the capability to transport 6,000 to 7,000 tons per day.

Allied airlifters were required to supply Berlin with not only enough food and supplies for it to survive the blockade but enough food and supplies for it to prosper as a community. Before the blockade, the city imported 9,000 to 15,500 tons of supplies daily to meet its needs. When the blockade was put into effect, Berlin had adequate supplies on hand to last roughly 30 days. The minimum supplies necessary for survival were appraised at 4,000 tons per day. General Clay initially estimated that 700 tons per day as the maximum to be anticipated from even a "very big operation."[10] None of the leadership at the time expected the airlift would last very long. It was President Harry S. Truman's opinion that the airlift would serve only to stretch out the stockpile of rations in Berlin and thus secure time for negotiations. Even so in September when pressure was put on him to pull American troops out of Berlin, he said, "We're going to stay, period."[11] It was at this point it became evident that the blockade would continue, a re-evaluation of the situation showed that 4,500 tons of supplies were needed.[12] The minimum daily supply requirement for the city of Berlin was revised upward by the Office of Military Government, on 20 October from a total of 4,500 tons to 5,620 tons. This 5,620 tons per day included commodities ranging from baby food to bulldozers. The 5,620 tons were broken down as follows:

For the German Populace:	Tons
Food	1,435
Coal	3,084
Commerce and Industry Supplies	255
Newsprint	35
Liquid Fuel	16
Medical Supplies	2
Subtotal	4,827
US, British, and French Military:	763
Three C-54 Passenger Flights Daily (US and French)	30
Total	5,620[13]

At the same time, 14 October, the directive setting up the CALTF also assigned it to "deliver to Berlin the maximum tonnage possible."[14] The CALTF delivered 7,000 plus tons on several days. The requirement to deliver 5,620 tons per day was a daunting task that required the judicious use of available airlift resources. In sum, the Berlin Airlift began with a high requirement to capabilities ratio; but as the Allies gained resources, the operation became characterized by a medium (one to one) requirement to capabilities ratio.

The Airlift Task Force employed its resources using the continuous flow method in order to obtain maximum efficiency. To make this operation work, General Tunner had to integrate the aircraft into a continuous aircraft flow to Berlin. By the beginning of 1949, transport aircraft were operating from eight departure airfields into three arrival airfields. The narrow corridors into and out of Berlin, coupled with limited airspace over the city and finite ramp space on the three Berlin airfields, placed a requirement to use each slot.[15] The problem of properly channeling a dense volume of traffic from eight airfields into a restricted area with only three airfields, during all weather conditions, also required standard flight procedures. These procedures were written into a standard operating guide that was available to all crews, controllers, and other relevant personnel. General Tunner's continuous flow was based on a three-minute departure interval. This translated into 480 landings in a 24-hour day at each of the three Berlin airfields. The CALTF did not initially have enough aircraft to operate at this pace, but General Tunner wanted the procedures tested and practiced to give him the operational capability if he ever received the aircraft.[16] The success or failure of the entire project hinged upon the number of landings that can be made in Berlin. General Tunner and his staff needed the most efficient operation they could plan. A continuous flow operation gave them this efficiency. This continuous flow of airlift forces was, however, very vulnerable to a threat.

Soviet Threat to the Allied Airlift Operation

The Soviets threatened the airlift operation in two ways: harassment and sabotage. The first form of threat was Soviet harassment of airlifters in the corridors. According to the "Berlin Airlift Corridor Incidents Report," covering the period from 10 August 1948 to 5 August 1949, there were 733 incidents involving the Soviets and Allied airlift aircraft.[17] The Soviet harassment included buzzing, air-to-air firing in vicinity of airlift aircraft, firing AAA in vicinity of airlift aircraft, searchlights directed at the aircraft on departure and arrival, balloons in the corridors, and many other techniques. Most of the incidents occurred in March 1949.[18] According to General Tunner, "They were seen by the pilots and were sometimes close, but they were never more than a moral threat."[19] The other form of threat to the operation was sabotage. It was necessary to employ about 5,000 German personnel on the operation. Of the 27 cases of suspected sabotage at airlift bases, only four were proven to be sabotage and none of the saboteurs were caught.[20] Considering the harassment and the sabotage, the overall threat to the airlift effort was very low. Given a low threat, another important factor influencing the airlift was the condition of the support infrastructure.

Berlin Airlift's Support Infrastructure

The support infrastructure included the airlift bases, the supply system, the maintenance infrastructure, and the ATC and navigation infra-

structure. One of the critical links in the support infrastructure was the airlift bases.

At the beginning of the operation, the airlift bases were inadequate; however, as the airlift matured, the Allies were able to develop a robust basing complex. An efficient transport operation needs airfields that are concentrated and conveniently located near lines of communications, but the available airfields were dispersal type fields from World War II. Furthermore, a tremendous amount of work had to be done to modernize these facilities; and this modernization had to be done while planes were departing for and arriving from Berlin.[21] Runways and ramps had to be constructed to withstand the wear of large and heavily loaded aircraft. Fuel storage facilities were not available when operations started and had to be constructed. High-intensity approach and runway lights had to be installed. Living quarters, mess halls and dispensaries were all inadequate and had to be improved. Winterized tents were used to fill the void.[22] The runways, made of sod, were not able to take normal C-47 use, much less the pounding from C-54s. The initial runway in use, Rhein-Main, consisted of steel landing mats laid on a base of rubble. It had already begun to deteriorate when the operation began. The Allies had to build additional runways and resurface the existing runways on the airfields. The base support facilities and utilities had to be upgraded. By October the airfields began to have the sufficient infrastructure to meet the requirement. The supply functions on those airfields improved as well.

The off-load capability in Berlin kept pace with the growth of the operation. The Army Transportation Corps was responsible for delivering supplies to the aircraft loading and for off-loading in Berlin. The Transportation Corps's mission was to get the aircraft loaded and off-loaded in minimum turn time. Each aircraft load consisted of 180 to 200 bags. Using a 12 man team the plane could be off-loaded in six to 10 minutes.[23] During the hectic period from 1100 hours (hrs) to 1345 hrs on 16 April, or 165 minutes—901 planes landed at Tempelhof, a plane every 90 seconds. Yet off-loading at Tempelhof operated so efficiently that in less then three hours, 18 planes were off-loaded and waiting to return to Wiesbaden or Rhein-Main. In short, the trucks and off-load crews worked faster than aircraft could arrive.[24] The supply system kept pace with the airlift operation, but again it took time and effort to develop the system. As the operation progressed, the maintenance infrastructure did also.

The maintenance infrastructure that initially supported the airlift force was insufficient for the scope of the operation; however, over time the maintenance infrastructure expanded to meet the task. This maintenance infrastructure was initially deficient in two major areas. The first was personnel manning. Original groups used in Operation Vittles were organized under Troop Carrier (Medium) Table of Organization and Equipment (TO & E) at peacetime strength. Personnel authorizations for airlift units were obtained by reorganizing under war strength of the Troop Carrier (Heavy) TO & E.[25] Changing the manning levels was one thing, but actually getting the per-

sonnel working in theater is another. After receiving permission to hire German mechanics to fill the gaps, General Tunner suggested that personnel specialists find a former German air force maintenance officer who would, in turn, be able to locate mechanics for the airlift. They found Maj Gen Hans Detlev Von Rohden, who had served as an air transport commander during the war and was familiar with both the Allied problems and, fortunately, capable in English. The Airlift Task Force told him what it wanted, and he delivered excellent German mechanics. Von Rohden organized a translation section to render Air Force training manuals into German as the first step in an extensive training program. In the meantime, maintenance personnel who could speak German were assigned to serve as supervisors. The German mechanics proved to be so capable that eventually 85 of them were assigned to each squadron.[26] This solved the personnel problem.

The second deficiency was the inadequate supplies and facilities. The assigned equipment for a troop carrier squadron proved to be insufficient for around-the-clock operations.[27] Even with qualified personnel to perform the maintenance, the lack of special tools and heavy technical equipment was critical. To alleviate these problems, General Tunner took Sen. Stuart Symington to look at the facilities and talk to the troops. The following is General Tunner's account of one of those visits:

> "Relax," Symington said, for the hundredth time that day. "I'm Stu Symington. Just wanted to see how you're getting along with that engine."
>
> "Oh, I'm going to get it fixed all right, sir," the mechanic said, "but I could do it better if I had better tools."
>
> "What's the matter with your tools?" Symington asked.
> The mechanic held up a screw driver, a wrench, and a pair of pliers.
>
> "See these?" he asked. "Well, I bought 'em myself right here in Germany, and they're all I got, and I can't get any more, and they ain't worth a good go----n."[28]

In the beginning of the airlift operation, the facilities were also substandard. Makeshift stands were constructed to take care of the immediate maintenance problems. When material was available, wooden maintenance docks were constructed. The docks presented a fire hazard and cause of the loss of four aircraft.[29] After seeing all the problems, Symington was not pleased and worked on getting them fixed immediately. The response came very quickly. Orders came down to requisition improved housing, and construction began on emergency barracks. Burtonwood, an aircraft and engine overhaul facility, was shaken up from top to bottom, which significantly increased the number of periodic maintenance inspections. Long-needed supplies began flowing.[30] Although, the maintenance infrastructure got off to a slow start, its eventual ability to generate sorties got the supplies to Berlin.

The Berlin corridors had adequate ATC and navigation capabilities for the operation, but aircraft spacing on arrival to and departure from the Berlin airfields was a limiting factor to traffic in the corridors. When the operation started, there were problems with inadequate range on the low-frequency beacons, shortages of fan-marker beacons, interference on the frequency

modulating (FM) radio ranges, inadequate power supply, and no back-up power sources.[31] The first day General Tunner was in the theater, there was so much chaos in the Berlin traffic patterns that he felt the need to intercede over the aircraft radio. Over the next nine months, the system improved to the point that during the maximum effort period from 1200 hrs 15 April to 1200 hrs 16 April, Tempelhof tower handled 519 incoming aircraft, Tegel Tower controlled 390 aircraft, and the ground control approach (GCA) unit handled 1,303 aircraft.[32] The ATC system's ability to handle the CALTF's record-setting day demonstrated its effectiveness at maturity. The chief limitation of the ATC system, however, was the number of aircraft that can be safely handled by the GCA controllers into the three Berlin airfields. General Tunner's decision to set the spacing interval at three minutes optimally balanced safety of the aircraft and crews with the capabilities of the ATC system and the requirements of the mission.

German Weather Effects on the Airlift Operation

Fog, low ceilings, and low visibility characterized the weather during the Berlin Airlift; however, the Allies used all the technology possible to minimize the effects of the weather. The Allies used the latest in weather measuring and reporting technologies. The Allied forecasters used the past 40 years of historical weather data and current reports. Various measuring devices were set up in theater. Weather stations in the United States, in the Arctic, and on ships at sea forwarded data for essential long-range forecast. American B-29s and British aircraft flew weather routes reporting weather conditions every 30 minutes. A radio operator was in every seventh aircraft flying in the operation to report weather conditions at critical points in the corridors.[33] The forecasters used the weather data to determine a long-range forecast and a forecast for day-to-day operations. Starting in the fall of 1948, the weather was the worst it had been in 40 years. Forecasts indicated that the weather would not be as bad in the northern and central corridors as it was in the southern corridor, so General Tunner shifted as much traffic as he could to the bases in those sectors.[34] The forecasts were used for planning and execution to get the most use out of the corridors and airfields in-theater.

Results of the Berlin Airlift

The Berlin Airlift not only fed the citizens of West Berlin but also demonstrated the potential for peaceful resolution of conflicts through the use of nonlethal airpower. The Chief of Staff of the Air Force, Gen Hoyt S. Vandenberg, offered this assessment:

> Above all, the Berlin Airlift has provided the United States Air Force an opportunity to demonstrate to the American people, whose instrument it is, and the world at large, what it can do and what it will continue to do to the best of its ability to make air power a true force for peace.[35]

A doctrinally and strategically important lesson established by the Berlin Airlift was that cargo and personnel in a low threat environment can be carried between any two points, despite geography or weather.[36] The Berlin Airlift delivered enough supplies for the city of West Berlin not only to survive but to prosper as a worldwide example of the Allied commitment to democracy. It was an airlift distinguished by statistics, for numbers have a way of representing, at least in this case, the enormity of the effort. Two point two hundred thirty-one million tons were lifted, of which 67 percent was coal. Eight hundred sixty-eight to 886 trips to Berlin per day were flown. There was an average of one takeoff or landing every 63 seconds. Airlift aircraft lodged 567,537 flying hours, which averaged out to 1,800 hours per day. The airlift cost 31 lives lost in 12 accidents. The end result of the airlift was a free and democratic Berlin.

Analysis

The Berlin Airlift secured the freedom of Berlin and possibly West Germany; it also showed the world that the West was capable of standing up to the Soviet Union. If the Allies had not been able to conduct the airlift successfully, they would have been forced into either confrontation or appeasement. President Truman's remark, "we're going to stay, period" ruled out the appeasement option; the Joint Chiefs of Staff's (JCS) treatment of General Clay's plan also displays the administration's feeling on confrontation.[37] Airlift was the correct option, and its success produced victory.

Even given a very substantial Allied Airlift capability, the 5,620 tons of supplies per day required by Berlin demanded that the airlift planners employ their forces using the continuous flow method. Based on the assumption that a C-54 could carry 10 tons, Berlin needed 562 sorties per day, or 188 landings at each airfield in Berlin, which translated into one landing every 7.6 minutes at each airfield in Berlin. The continuous flow method was the only way to conduct this operation. General Tunner elected to land an aircraft on one of three Berlin airfields every three minutes, which gave the system some latitude for the fog or friction of war. The Operation Vittles staff had to optimize the utilization of all the components in the airlift system; a continuous flow method of employment allowed them to do it. One of the key components in the system was the logistics infrastructure.

The logistics infrastructure was developed to ensure that sufficient sorties were generated to meet the supply requirement. Using the three-minute interval as a planning factor and the assumption that the aircraft are equally distributed among the eight German airfields, the logistics infrastructure had to produce a departure about every eight minutes. In order to accomplish this, maintenance needed to produce the operational aircraft; the Transportation Corps had to load the aircraft; the runways had to support the traffic; ATC had to handle aircraft; and the facilities had to answer the basic needs of the personnel. If any single part of the system had broken

down, the whole system would have failed. During the Berlin Airlift, the system was developed to generate sorties needed for the airlift. The result was the 5,620 required tons per day were actually delivered; and in some cases, this figure was exceeded.

The Allied planners could not manipulate the weather to facilitate a smooth operation, but they were able to minimize the weather's influence on the continuous flow of aircraft into Berlin. They did this in two ways: first, they planned around the bad weather using relatively accurate forecasts; and second, they used available technology to operate in relatively adverse weather. The weather's influence on the operation was thus ameliorated by the use of planning and technology.

The Soviet threat, which was at most morale, had a marginal influence on the airlift operation. No incident prevented an allied aircraft from delivering its load.[38] The threat was a distraction, but it influenced neither how the airlifters were employed nor the amount of cargo they delivered.

The extremely large requirement to deliver 5,620 tons per day to Berlin with an initially limited capability was the most significant factor that influenced how the Allied airpower was employed. During the Berlin Airlift, the Allies were challenged by adverse weather, an initially inadequate support infrastructure, and a staggering 5,620 tons per day requirement; they succeeded because they increased their airlift capability, improved the support infrastructure, and minimized the impact of adverse weather. The requirement to supply 5,620 tons to Berlin demanded that the Allies employ their forces using a continuous flow, even when they had the resources to exceed the requirement. The Airlift Task Force staff evaluated the threat and assessed that it would remain low; they inspected the support infrastructure and concluded that if this operation was going to work, the infrastructure had to improve; and finally, they studied the weather patterns and decided that the adverse weather effects would have to be minimized. Operation Vittles was a success because the Allies had the resources and capability to influence these three factors to more favorable conditions. More importantly, the Allies had the will and intelligence to use their combined resources effectively to ensure that Operation Vittles was a success.

Doctrinal Propositions

What doctrinal propositions can be derived from the Allied experience in supplying Berlin by air?

Doctrinal Proposition:

1. When an enclave presents a high or medium requirement to capability ratio, the planner should use a continuous flow method of employing airlift forces in order to use the limited resources most efficiently.

Corollaries:

a. The continuous flow method demands that the infrastructure be developed sufficiently to generate the sorties in the quantity and for the duration required.

b. The continuous flow method also demands that planners examine the weather and determine what can be done to minimize the effects of any adverse weather.

Evidence to Support This Proposition and Its Corollaries from This Case:

The planner needs to appraise the support infrastructure to guarantee that the required sorties are generated and used effectively. General Tunner and his staff determined that the limiting factor was the airspace into and out of Berlin and developed the airlift system to maximize the use of that airspace. As part of this system, General Tunner decided that an aircraft would land at each Berlin airfield at three-minute intervals. This decision required a departure from one of the eight West German airfields about every eight minutes. The president decided that American forces were not leaving Berlin. This decision established a requirement for an indefinite operation. The support infrastructure was developed to meet both these requirements. If the infrastructure had not been developed to meet these needs, the operation may have failed. The Allies used navigation and approach technology, standard operating procedures, weather forecasting, and adverse weather planning to minimize the effects of the weather. General Tunner decided to move USAF airlift resources into the central and northern sectors because the forecast indicated that the weather conditions would be better in those two sectors than it would be in the southern sector. This action minimized the effects of the great fog in November. If they did not possess the means nor the will to address the infrastructure and weather, then they had to address attempting to lower the requirement. The CALTF posed the means and the will to be successful in supplying the population of Berlin by air.

Doctrinal Proposition:

2. A benign threat environment permits the use of the continuous flow method; however, a benign threat must be constantly evaluated to ensure that it remains so. For if it changes, a reevaluation of the whole operation may be required.

Evidence to Support This Proposition from This Case:

During the Berlin Airlift, the Soviets did not seem to have the will to threaten the airlift seriously. However, if they had, they would have significantly disrupted General Tunner's operation.

Doctrinal Proposition:

3. When an enclave resupply effort takes place in adverse weather, the continuous flow method is susceptible to disruption. Therefore, the planner must use technological developments and judicious planning to mitigate the effects of the adverse weather.

Evidence to Support This Proposition from This Case:

Technological developments include devices that permit aircraft to operate despite the weather. In the case of the Berlin Airlift, the GCA radar approaches were part of that technology. The Allies also used the latest

advances in navigation aids to include high-power beacons and high-intensity approach lights. During the Berlin Airlift, historical weather data, North American reports, Atlantic reports, and European reports all were collated to form forecasts to aid in the effort to utilize the airfields and corridors to the maximum extent possible.

This paper has now examined two high-requirements case studies, one a failure and one a success. There are also doctrinal implications that can be derived by examining a case with lower requirements. With that in mind, this study moves to the year 1968 and the jungles of the Republic of Vietnam in Southeast Asia.

Notes

1. Charles E. Miller, *Airlift Doctrine* (Maxwell Air Force Base [AFB], Ala.: Air University Press, 1988), 175.
2. Dudley Barker, *Berlin Air Lift: An Account of the British Contribution* (London: His Majesty's Stationery Office, 1949), 7.
3. Ibid., 55.
4. William H. Tunner, *Over the Hump* (1964; reprint, Washington, D.C.: Office of Air Force History, 1985), 158.
5. Combined Airlift Task Force, "Preliminary Analysis of Lessons Learned" (Maxwell AFB, Ala.: Air Force Historical Research Agency [AFHRA], June 1949), file no. 572.549-1, 5.
6. Ibid., 15.
7. History, Military Air Transport Service, 1948, Maxwell AFB, Ala.: AFHRA, file no. 4520-A1, 155.
8. Ibid., 191.
9. Arthur Harris, *A Special Study of Operation "Vittles"* (New York: Conover-Mast Pub., 1949), 8.
10. Tunner, 159.
11. Ibid.
12. Maj Richard Holmes, "Determination of Transport Aircraft Requirements from a Study of the Berlin Airlift," Research Paper file no. 239.043449A-206 (Maxwell AFB, Ala.: AFHRA, Air Command and Staff School, 1949), 3.
13. Tunner, 207.
14. Ibid., 187.
15. Miller, 178. Note: A slot was a one minute block departure time that enabled the aircraft flying standard procedures, to arrive in the corridors and land in Berlin at the correct time. This was set up to maximize the use of approach airspace into Berlin.
16. Tunner, 173.
17. United States Air Forces Europe, "Berlin Airlift Incidents Report: 10 August 1948 to 5 August 1949," Maxwell AFB, Ala.: AFHRA, file no. 572.601A, passim.
18. Ibid., 1.
19. Tunner, 185.
20. Combined Airlift Task Force, "Preliminary Analysis of Lessons Learned," 22.
21. Harris, 53.
22. Combined Airlift Task Force, "Preliminary Analysis of Lessons Learned," 43–45.
23. Col Donald C. Foote, United States Army Transportation Corps, "Operation Vittles—Tempelhof a Transportation Corps Milestone," Maxwell AFB, Ala.: AFHRA, June 1949, file no. 168.7053-209, 1–6.
24. Ibid., 15.
25. Combined Airlift Task Force, "Preliminary Analysis of Lessons Learned," 11.

26. Tunner, 183.
27. Combined Airlift Task Force, “Preliminary Analysis of Lessons Learned,” 40.
28. Tunner, 196.
29. Combined Airlift Task Force, “Preliminary Analysis of Lessons Learned,” 43.
30. Tunner, 193.
31. Combined Airlift Task Force, “Preliminary Analysis of Lessons Learned,” 24–25.
32. History, Airways and Air Communications Service, April 1949, Maxwell AFB, Ala.: AFHRA, 10 May 1949, file no. 380.01, 3.
33. Harris, 47.
34. Tunner, 209.
35. Harris, 5.
36. Maj Gen William H. Tunner, commander in chief, Combined Airlift Task Force, “A Report on the Airlift Berlin Mission: The Operational and Internal Aspects of the Advanced Elements” (Maxwell AFB, Ala.: AFHRA, 30 August 1949), file no. 572.1013.
37. Ibid., 159.
38. United States Air Forces Europe, “Berlin Airlift Incidents Report: 10 August 1948 to 5 August 1949,” passim.

Chapter 4

Khe Sanh, the American Aerial Resupply of the US Marines

There would have been no Khe Sanh Combat Base—no "set-piece" strategy—without one of the biggest aerial resupply efforts in history.

—Eric Hammel
Khe Sanh, Siege in the Clouds

Located on a remote mountain plateau, Khe Sanh provided a base for US intelligence and interdiction operations. Surrounded by North Vietnamese Army (NVA) tunnels and fortifications, the camp could only be supplied by air. The aerial resupply enabled the garrison to defend successfully the fortifications at Khe Sanh. This chapter will examine what doctrinal imperatives can be gained from studying the resupply of the Marines at Khe Sanh. The first part of this chapter will be devoted to the discovery of the facts. The analysis will trace effects back to their causes in terms of factors that influenced the airlift effort. Finally, we will investigate and evaluate the means employed, leading to a determination of the doctrinal precepts to be derived from this study.

Analysis of the evidence for Khe Sanh will focus on the general situation, the supply requirements compared to the American airlift capabilities (requirement to capabilities ratio), the North Vietnamese threat to the resupply effort, the support infrastructure for the airlift operation, and the weather's influences on the operation.

Khe Sanh's General Situation

Although there is some speculation about the North Vietnamese using Khe Sanh as a deception plan to set up the Tet offensive, both Gen William C. Westmoreland, chief of Military Assistance Command, Vietnam (MACV), and Gen Vo Nguyen Giap, North Vietnam (NVN) defense minister, saw Khe Sanh as an opportunity to win a propaganda victory.[1] The political goals of General Giap's campaign against the Marine base might have been similar to those he had at Dien Bien Phu.[2] The defeat of the Marines at Khe Sanh would certainly have amplified the shock to US public opinion as a result of the Tet offensive and would have made the administration's problems more difficult than they already were.[3] The goal of the Marines occupying Khe Sanh was to impede the flow of men and materiel from North Vietnam southward.[4] General Westmoreland used Khe Sanh as a "set-piece" operation to entice the North Vietnamese to fight conventionally in a battle of attrition that Westmoreland thought he could win. As part of the Tet offensive, the

North Vietnamese apparently expected to control by military action portions of the two northern provinces and set up a "Liberation Government."[5] Khe Sanh was a part of this plan and was obviously an initial objective of the NVA. This provided Westmoreland opportunity to fight a conventional battle against the NVA. The important point is that Khe Sanh was important to both Westmoreland and Giap for political and military reasons. This importance led to the US Marines' encirclement at Khe Sanh.

The Marines did not, however, become encircled at Khe Sanh unknowingly. Intelligence reports tracked the movement of the NVA divisions into the region, but General Westmoreland was determined to defend Khe Sanh and General Giap was determined to relive his victory at Dien Bien Phu.[6] Since late 1967, there were indications of extensive buildup below the western part of the DMZ, signaling a possible NVA offensive.[7] During the northern monsoon and beginning of the Christmas truce, enemy activities increased in all parts of the Republic. Northern I Corps area and Khe Sanh, a strategic point on a vital North Vietnamese infiltration route appeared to be key targets. In early January an estimated two NVA Divisions, 15 to 20 thousand troops, were reported in the Khe Sanh area.[8] Several units airlifted into Khe Sanh to counteract the threat were the 1st Battalion, 13th Marines, a South Vietnamese battalion, and two brigades of the 101st Airborne Division (Air Assault).[9] The garrison was reinforced to a strength of 6,000 troops. On 21 January a rocket and mortar attack destroyed the Khe Sanh ammunition storage area, scattering shrapnel over one-half of the runway and preventing C-130s from landing. Six C-123s were diverted from their scheduled missions, loaded with 26 tons of ammunition, and flown to Khe Sanh. They landed on the potholed runway, by the light of artillery flares, under heavy automatic weapons and mortar fire. Thus began the siege of Khe Sanh, which eventually ran into 78 days of aerial resupply.[10] The amount of supplies on hand in Khe Sanh was an important consideration for the airlift.

The Marines could have maintained a defensive posture in Khe Sanh for about 30 days without air resupply, as soon as the initial emergency demand for ammunition was met. When the siege began, Khe Sanh's main ammunition dump was destroyed in a rocket and mortar attack. The resulting shortage of ammunition was quickly relieved by C-123s that same day. Two days prior, 19 January, stocks of rations, fuel, and munitions on hand at Khe Sanh were sufficient to meet the consumption demands for 30 days.[11] Additionally, Lt Gen William W. Momyer, commander of Seventh Air Force, and his staff planned to ensure that a 20-day level of supplies would be maintained at Khe Sanh.[12] The garrison was well stocked as the siege began but would need significant resupply to continue operations.

Khe Sanh's Requirements Compared to the Allied Capability

Khe Sanh's requirement to capability ratio; the ground force requirements (tons per day); airlift forces' organization, composition, and capability; and

airlift forces employment method will now be examined. To keep this examination in context, prior to, during, and after Khe Sanh, USAF C-130 and C-123 aircraft were delivering an average of 2,500 tons of cargo per day throughout Vietnam. The 185 tons per day delivered to Khe Sanh account for about 8 percent of the total for the country.[13]

The tonnage per day required by the Marines changed throughout the siege of Khe Sanh. Ideal airlift planning and response requires early determination by the ground commander of firm supply requirements. Firm requirements at Khe Sanh were not provided to 834th Air Division planners until two weeks after the airlift effort began.[14] However, the MACV logistics chief informed General Westmoreland on the 20th that the 185-ton daily supply requirement could be accomplished by 15 C-130 sorties and that 75 additional sorties would be needed if the stocks were to be built up to a 35-day level for an expanded force.[15] Survival at Khe Sanh required the Marines to go underground for protection against rocket and mortar attacks. Due to the lack of bunkering material, the Marines required a large amount of bulky lumber.[16] The III Marine Amphibious Force (MAF) reaffirmed a daily supply requirement of 235 tons (18 tons for consumption and the remainder for stock buildup) on 19 February.[17] Changing troop levels, questionable reserve supply quantity, and emergency need for ammunition and bunkering material kept the "daily requirement" in flux; however, the average requirement should have been between 185 and 235 tons per day.

The 834th Air Division, which controlled the airlift forces, reported to Seventh Air Force, which also directed close air support of the Khe Sanh garrison. For the battle for Khe Sanh, General Westmoreland appointed his deputy for Air Operations, General Momyer, as the single manager for tactical aviation throughout South Vietnam.[18] The Air Force had long wanted centralized control, and the concentration in the skies above Khe Sanh made the move seem necessary from the Air Force point of view. The 834th Air Division, commanded by Brig Gen Burl W. McLaughlin, was responsible for the lifeline to Khe Sanh. The C-7 and C-123 squadrons in South Vietnam were assigned to the 834th Air Division, unlike the C-130 squadrons that were in South Vietnam on temporary duty from the 315th Air Division.[19] The 834th Air Division had control of about 226 tactical airlift aircraft to conduct airlift for Southeast Asia.[20] Less then 10 percent of the available tactical airlift aircraft were required to meet the daily requirement. Additionally, General Westmoreland made Khe Sanh a priority operation to ensure the planner had the flexibility to make the required aircraft available to resupply the garrison. The Seventh Air Force was the single coordinator for tactical air forces involved in Khe Sanh, and the 834th Air Division was responsible for the airlift operation.

The 834th Air Division employed its forces to take advantage of limited load recovery capability, adequate weather, and limited runway availability. Initially, most of the supplies were delivered by C-130 and C-123 aircraft landing at Khe Sanh. On 12 February, General Momyer directed that no fur-

ther C-130 landings would be made at Khe Sanh because of the intense barrage of mortars, rockets, and small arms fire.[21] Landings at Khe Sanh were restricted to C-123Ks. Because of the extremely precarious ground situation and monsoon weather conditions, 834th Air Division officials advised the III MAF that air-drop methods would have to supplement ground off-loading if the required tonnage was to be delivered at Khe Sanh. Three air-drop methods would be used: the Ground Proximity Extraction System (GPES), the Container Delivery System (CDS), and the Low Altitude Parachute Extraction System (LAPES).[22] CDS drops constituted the main method of airdrop operations, accounting for 498 sorties.[23] Normally, five or six planes made drops to coincide with morning strikes, releasing their loads at intervals of about 25 minutes each. The drops ceased for several hours while the loads were recovered and resumed again in the afternoon until the Marine "shore party" officer halted them. Because the drop zone (DZ) was abandoned every night, it was critical to recover all the loads before dark.[24] The Seventh Air Force commander also directed that fighter aircraft would escort all airlift aircraft into Khe Sanh.[25] Because of morning weather, threat, and load recovery limitations, the 834th Air Division was forced to employ its aircraft in a surge method.

North Vietnamese Army and Vietcong Threat to the Airlift Operation

The North Vietnamese Army or Vietcong (VC) could threaten airlift forces in three areas: at the airlift bases, en route, and at Khe Sanh.

Sappers, snipers, and sporadic mortar and rocket attacks constituted the threat to the airlift bases in Vietnam. On 30 January 1968, the VC attacked the crew facilities and airfield at Tan Son Nhut Air Base (AB). Six 463d Tactical Airlift Wing crew members were trapped in the crew facilities, and C-130 operations and the rebel ramp were menaced by sniper fire.[26] On 18 February, one C-130 was destroyed and six damaged by a VC rocket attack.[27] These two incidents are representative of the threat against allied air bases. The VC frequently attacked air bases with mortar, rocket, and small arms fire. When the bases came under rocket and mortar attack, it was necessary to evacuate the airlift force. The C-130s were moved to Phan Rang and Cam Ranh Bay, and this separation from their source of cargo and maintenance further strained the system. Thus, while the ground attacks and rocket fire were not especially damaging in the number of aircraft destroyed, they did impose a loss of cargo-moving capacity because of the waste involved in evacuation.[28] The VC threat to the airlift bases was significant and did influence airlift operations, but they did not influence how airlift forces were employed.

En route to Khe Sanh, the airlift forces were exposed to little threat from the enemy. Airlift aircraft were safe at high altitudes because the North Vietnamese surface-to-air missiles, were used as point defense for valued

facilities in the north had not yet made their way to the south. Nor was there any threat from MiGs. However, airlift aircraft were vulnerable to AAA and small arms fire flying at lower altitudes. Tactics developed for Khe Sanh included maximum performance descent/ascent procedures to reduced aircraft vulnerability to AAA and small arms fire at low altitudes. In sum, airlift aircraft flying en route at higher altitudes, out of AAA and small arms range, were not threatened by the enemy.

Upon arrival in the Khe Sanh area, C-130 and C-123 crews could expect an intense array of small and large caliber AAA, mortar, artillery, and small arms fire. In reply to the allied reliance on the air bridge, the NVA, well dug in and hidden in the hills encircling the base, set up automatic weapons and AAA to attack the incoming transports. The enemy also shelled the landing zone, cratering the air strip on several occasions and littering the field with fragments. Crews responded by staying in the clouds as long as possible, flying steep, tight approach patterns, and minimizing their time on the ground.[29] General Momyer also directed fighter aircraft to escort all tactical airlift aircraft into Khe Sanh when the weather permitted. The fighters were to lay smoke screens, suppress AAA and small arms fire, and attack AAA and artillery positions.[30] Lt Col Emmett A. Niblack, a C-123 crew member from the 311th Tactical Airlift Squadron (TAS), made the following statement about the threat:

> Ground to air fire was generally nullified by the weather, which protected the crews until breaking out, often as low as 200 feet, leaving a few seconds for exposure. Evasive action in the air was not needed. After the three losses in early March, serious efforts were taken, it appeared, to coordinate artillery fire and FACs with the inbound transport aircraft. When ceiling permitted, fighters would make passes before the landing.[31]

The losses in March that Lt Col Niblack mentioned were three C-123s destroyed on the ground at Khe Sanh in early March.[32]

Because night operations would present the NVA with too easily discernible targets and the drop zone was much too vulnerable on night operations, airlift supply activities were limited to daylight hours.[33] Load recovery on the drop zone was often harassed by NVA shelling and recoilless rifle fire. The drop zone soon gained the reputation as being the most dangerous place at Khe Sanh.[34] Because of Khe Sanh's restricted runway approach, incoming aircraft were vulnerable to antiaircraft weapons that could actually be fired downward at them when they were approaching or departing.[35] The threat affected Khe Sanh in three different ways: first, AAA and small arms fire threatened aircraft on arrival and departure from Khe Sanh; second, mortar, rocket, and artillery fire threatened the aircraft on the runway and the supporting infrastructure; and finally, mortar, rocket, artillery, and small arms fire threatened the load recovery teams on the drop zone.

In comparing the threat at the airlift bases, en route, and at Khe Sanh, the threat at Khe Sanh presented the greatest challenge to the airlifters.

The results of this challenge were three USAF airlift aircraft lost and four Air Force crew members killed in action.[36]

Support Infrastructure Supporting the Khe Sanh Resupply

Analysis of the support infrastructure will include an examination of the airlift bases, maintenance infrastructure, supply system, Khe Sanh's support functions, and the ATC and navigation support.

The USAF airlift bases supporting countrywide airlift forces were more than adequate for the job at hand. Both the location and the condition of these bases were important. The geographical relationship of Khe Sanh to the location of the C-130 aircraft bed-down bases (Tan Son Nhut, Cam Ranh Bay, Tuy Hoa, and Nha Trang) where the major supply bases (Da Nang and Hue) decreased the overall capability of the airlift system.[37] The location of airlift forces at other than major supply bases reduced airlift responsiveness and effectiveness. The inability of air bases at major cargo generation points, such as Tan Son Nhut, Cam Ranh Bay, and Da Nang, to support all airlift aircraft in Southeast Asia (SEA) resulted in the bed down of some tactical airlift resources at other locations. Ideally, the planner wants aircraft bed-down bases and supply bases collocated at bases close to the enclave; the aircraft basing in Vietnam was not ideal.

The bases themselves were adequate for the job but were challenged by the number of aircraft they had to support. Tan Son Nhut AB was especially important to the airlift system. It was the location of the 834th Headquarters and Command Post. One-third of the C-130s and one-fourth of the C-123s were then based there. The largest aerial port in the world was also located there.[38] The director of operations' letter to General McLaughlin, dated 23 January 1968, stated that when the construction of the west ramp at Cam Ranh Bay and Charlie Row at Tan Son Nhut were completed, the combined capacity of those two bases alone would be 111 C-130s.[39] In sum, despite the inefficiencies caused by poorly located bases, the support to Khe Sanh was adequate and did not constrain the tonnage delivered or the employment method used.

Most major maintenance as well as periodic phase inspections continued to be performed at the different wings' main support bases, which enabled the maintenance complexes at the temporary duty bed-down bases to concentrate on the maintenance necessary for quick aircraft turnaround. For example, the 463d Tactical Airlift Wing (TAW) for the period of 1 January to 31 March, 67.4 percent of its aircraft at Tan Son Nhut were operationally ready as opposed to 53.4 percent at Mactan, the 463d's main base.[40] Additionally, the Air Force Logistics Command continued to support rapid area maintenance teams at Tan Son Nhut to repair those aircraft that received heavy battle damage.[41] To increase maintenance reliability at major supply bases, action was taken in several areas. Da Nang

AB, the primary staging base for the operation, was principally a fighter base, with no maintenance capability for C-130s and only limited capability for C-123s. To reduce maintenance delays Pacific Air Forces sent 19-man maintenance teams with limited amounts of equipment and supplies to Da Nang.[42] One can see from the following figures that the Khe Sanh airlift was not hampered by nonavailability of aircraft:

Date	Assigned AC	Missions Scheduled	Missions per AC
10 Feb	72	73	101%
11–28 Feb	88	83	94%
29 Feb–11 Apr	96	91	95%

In short, the aircraft were operationally ready to fly when they were needed to resupply the Khe Sanh garrison. Thus, aircraft maintenance was not a limiting factor to the airlift effort.[43]

The central Marine supply depot at Da Nang was well equipped and performed exceptionally well during the airlift. There were three ports of entry for supplies into the five northern provinces known as I Corps—the 8,000 man naval support activity at Da Nang and the small ports at Hue and Cue Viet.[44] Da Nang was the main supply base for the Khe Sanh operation. Aircraft could be refueled and reloaded for Khe Sanh in 40 minutes.[45] The supply system at Da Nang worked, and the aircraft were ready and loaded to fly their missions. However, problems at Khe Sanh often caused the aircraft to return with full loads.

Khe Sanh was plagued by the limited capability to recover loads from the drop zone and the limited through-put capacity (the ability to move cargo through an airhead) of the landing zone. Because the DZ was outside the base perimeter it was unguarded overnight, requiring sweep operations each morning to secure the area. The DZ had to also be cleared prior to withdrawal in the evening, which combined with the morning sweep limited the daily time period to drop and recover loads. The Marines reported that each load took 45 minutes to recover.[46] One of General McLaughlin's lessons learned for the Khe Sanh airlift was maintaining adequate recovery capability; K-loaders and fork lifts are highly important. The airlift delivery rate was not based on air-drop capability but on the ground forces' capability to clear the DZ.[47] Additionally, the 834th commander also pointed out that the layout of a base should include space for a DZ.[48] On the airfield, the Air Force aerial port teams were responsible for off-loading the airlifters. The aircraft could be off-loaded and airborne in as short as two minutes. A journalist who accompanied a C-123 into Khe Sanh describes the aircraft's off-load: "Even before we had turned off the runway, the ground level tower operator said 'Dump and you're cleared for takeoff.' We dumped and Moody (the pilot) gunned the engines to full power. Our stay in Khe Sanh lasted two minutes."[49] The airfield could accommodate only one aircraft on the ground at a time. The runway was often not available due to the debris or damage from a mor-

tar or rocket attacks. The inadequate load recovery capability and runway availability limited the amount of supplies the 834th Air Division could deliver and influenced the method airlift forces employed.

During the Khe Sanh operation, traffic in Northern I Corps was controlled by a single radar unit and was insufficient to handle traffic into the five airfields in the area, causing excessive holding delays of airlift aircraft.[50] This problem was not the major factor that influenced the employment method used and the tonnage delivered. In addition, the weather added to the complexity of the problem.

Vietnamese Weather Effects on the Airlift Operation

One of the major operational considerations governing the operation was weather. Khe Sanh's dense fog combined with the NVA threat limited airlift operations to three to four hours per day. The spring monsoons brought heavy fog and rain to the northwestern Quang Tri Province. Fog usually kept the runway at Khe Sanh below approach minimums through midmorning. The combination of the surrounding mountains and a ravine off the runway's east end created a perpetual "fog factory."[51] This perpetual fog factory accounted for relatively short periods of GCA minimum visibility conditions during the monsoon season, December through March.

Results of the Khe Sanh Airlift

Unlike the French experience at Dien Bien Phu 14 years earlier, American airpower kept the Marines at Khe Sanh supplied with all the fuel, bunkering material, ammunition, and food they needed to defeat their attackers. American airpower also played a big part in destroying Giap's forces as they laid siege to Khe Sanh. Day after day, Giap's forces were being destroyed by US airpower while the American garrison remained dug in, well equipped, well supplied, and alert. Prisoners picked up at the end of the siege by the Marines reported that their rice ration had been cut to one-sixth of an ounce per day instead of the normal two pounds.[52] An enemy unit reported it started on a patrol with a strength of 270 and was attacked by B-52s near the town of Ba Lia, with only 60 surviving the attack. Marines found numerous abandoned crew-served weapons and ammunition,[53] which indicates that the NVA withdrawal may have been less than orderly. General Westmoreland's Systems Analysis Office estimated between 9,800 and 13,000 North Vietnamese troops were killed.[54] At the onset of the operation, both commanders had set out to win propaganda victories; and the Americans won that victory. In a press meeting at Camp David, Maryland, on 9 April, Ambassador Ellsworth Bunker, the US Ambassador to the Republic of Vietnam said:

> I may say that Khe Sanh has not turned into another Dien Bien Phu. The news, as you know, has come in that the siege has been lifted. This will certainly have

> a very dramatic and favorable impact throughout South Vietnam. So, I think the Government is much more self-confident than before Tet and there is much greater unity in the country today than we have ever seen before.[55]

The North Vietnamese thus lost both the propaganda battle and the military battle at Khe Sanh.

By the time the ground resupply routes had been reopened almost three months after the siege began, the 834th Air Division had delivered over 12,400 tons of supplies to the forces at Khe Sanh. The airlift averaged just under 160 tons per day for 78 days. The garrison's artillery tubes never stopped firing for want of ammunition. The besieged soldiers had food and ammunition to sustain themselves. Every wounded soldier also knew that if needed, he would be evacuated out of Khe Sanh back to safety. The supply effort was successful in sustaining the 6,000 Marines encircled at Khe Sanh.

Analysis

The successful resupply effort of Khe Sanh was one of the key reasons the battle was won. While airlift sustained the garrison during the siege, the total impact of airpower was instrumental in lifting the siege. Bomber and fighter-bomber aircraft were critical to destroying Giap's forces that threatened Khe Sanh. Reports of diminished supplies to NVA solders are evidence of a successful interdiction effort. Caved in tunnels, destroyed gun emplacements, mangled trenches, abandoned weapons and supplies, and reports of decimated enemy units all show the effectiveness of airpower against Giap's stationary siege forces. The combined effect of airpower's punishment against the NVA and its replenishment of the garrison proved too much for the NVA.

The USAF in Vietnam had more than enough airlift capability to meet the Marines' requirements at Khe Sanh; therefore, the 834th Air Division could employ its forces using either method depending on the threat, support infrastructure, or weather conditions. The Marines "daily requirement" was about 180 tons per day. Twelve to 15 C-130s could meet this requirement; the 834th Air Division had access to about 10 times this number of tactical airlift aircraft to handle the theater-wide airlift requirements. Khe Sanh was the theater's priority mission; therefore, the required aircraft were available. The support infrastructure had to support theater-wide missions as well as Khe Sanh missions, so surge or continuous flow method of employment had little impact on the support infrastructure. The excess airlift capability gave the planner the ability to adapt to the Khe Sanh infrastructure problems, weather, and threat.

The threat to the airlift forces conducting operations into Khe Sanh was lethal but manageable using combat tactics that coordinated air and artillery strikes. The 834th Air Division flew 1,124 airlift sorties into Khe Sanh during the siege.[56] The NVA hit 53 airlift aircraft with ground fire; of

these, 18 were extensively damaged, and three were destroyed.[57] To put these figures in perspective, the NVA only hit 4.7 percent of the airlift aircraft, damaged 1.6 percent, and destroyed .2 percent. These are very low loss rates when one considers the Germans lost close to 50 percent of the airlift resupplying Stalingrad. Nevertheless, the threat influenced how the airlift forces were employed. The threat was one of the factors that affected the 834th Air Division and 7th Air Force's decision to employ its airlift forces in surges.

The 834th Air Division employed its forces using a surge method primarily because of the limited availability of the runway and drop zone. Fog and the time required by the Marines to secure the DZ precluded landings and drops in the early morning hours. Operations normally began in the late morning when fog had risen and the DZ was secure. At midday the runway could continue to operate, but the DZ normally halted airdrop operations to give the load recovery teams time to gather in the late morning drops. In early afternoon, the DZ would continue airdrop operations again, and the runway remained operational. In the late afternoon, the DZ stopped airdrop operations to ensure all the loads could be recovered before nightfall. Neither the runway nor the DZ were operational at night because of the threat. Because air-dropped supplies accounted for 65 percent of the total that Khe Sanh received, the availability of the DZ was significant. If both the runway and the DZ had been capable of 24-hour operations, the airlift planners would have had much more flexibility. In short, the Khe Sanh delivery reception capacity was the most significant factor influencing the operation.

The weather at Khe Sanh limited airlift operations to the latter part of the day, thus requiring surge employment; however, the same weather that made it difficult to land or drop supplies also obscured the airlift aircraft from the eyes of the NVA gunners. The limiting weather at Khe Sanh was the early morning fog that prevented the airlifters from landing on the runway. The low clouds also reduced the effectiveness of fighter and fighter-bomber aircraft in their suppression fire. It was only on relatively clear days that the fighters could provide the airlifters suppression fire. The weather was a contributing factor to the employment method used by the airlift planners, but it was not a limiting factor influencing the amount of supplies that arrived in Khe Sanh.

The support infrastructure at Khe Sanh, combined with the troublesome influences from the threat and the weather, affected how the 834th Air Division employed its forces into Khe Sanh and how those forces did. There are several doctrinal lessons that airlift planners can learn from this case study.

Doctrinal Propositions

Doctrinal Proposition:

1. When considering the resupply of an enclave by air, the planner must regularly attempt to balance competing planning factors.

Evidence to Support This Proposition from This Case:

The Khe Sanh airlift presented numerous examples of this. To sustain a larger airlift effort, the drop zone would have had to remain operational for longer periods each day. Because this would have put Marines at risk, the drop zone availability was limited to periods in the morning and the afternoon. The fact that some factors will influence the airlift effort more than others requires judicious behavior. Had the airlift requirement been greater, the ground and air planners would have had to reevaluate the likelihood of increased casualties in light of this requirement.

Doctrinal Proposition:

2. An airlift effort conducted in a high threat environment and adverse weather conditions favors the employment of a surge operation to take advantage of threat suppression and breaks in the weather.

Evidence to Support This Proposition from This Case:

Khe Sanh's nearly perpetual fog and the intense AAA, artillery, and small arms fire presented the American planners with a significant problem. In this case, the airlift surges were flown to take advantage of mid-morning weather improvements and at the same time exploit suppression from the air strikes. Marine artillery was also coordinated to suppress enemy fire for the airlift. The time spent in the early morning waiting for the fog to rise also gave the Marines the opportunity to secure the DZ. The American support infrastructure was sufficiently robust to support surges into Khe Sanh. The surge method of employing airlift forces is an effective way to minimize the effects of the threat and the weather, but the other factors must be conducive to this type of employment.

Doctrinal Proposition:

3. An inadequate support infrastructure in the enclave will limit the tonnage delivered.

Evidence to Support This Proposition from This Case:

Khe Sanh's limited availability of the drop zone and runway was the limiting factor in the amount of tonnage delivered. The drop zone had to be secured every morning before operations could begin and all the loads recovered before nightfall. This, coupled with the insufficient load recover equipment, limited the amount of supplies that could be delivered by air-drop. The lack of all-weather landing aids and a secure runway also limited the amount of supplies delivered. Fortunately, the infrastructure was barely adequate for the amount of supplies required.

Notes

1. David R. Mets, Maj, USAF, "Tactical Airlift Operations," Headquarters Pacific Air Forces (PACAF), Project CHECO Report (Maxwell Air Force Base [AFB], Ala.: AF Historical Research Agency [AFHRA], 30 June 1969), file no. K717.041-2, 16.

2. Ibid.

3. Allan R. Scholin, "An Airpower Lesson for Giap," *Air Force/Space Digest,* June 1968, 90.

4. Mets, 15–16.

5. John J. Toloson, *Airmobility: 1961–1971* (Washington, D.C.: Department of the Army, 1973), 165.

6. Burl W. McLaughlin, "Khe Sanh: Keeping an Outpost Alive, an Appraisal," *Air University Review* 20, no. 1 (November–December 1968): 58.

7. Ibid.

8. Ibid.

9. Bernard C. Nalty, *Air Power and the Fight for Khe Sanh* (Washington, D.C.: Office of Air Force History, 1986), 15; and McLaughlin, 58.

10. McLaughlin, 58.

11. Ray L. Bowers, *The United States Air Force in Southeast Asia: Tactical Airlift* (Washington, D.C.: Office of Air Force History, 1983), 296.

12. Scholin, 92.

13. Bowers, 675–82.

14. Warren A. Trest, "Khe Sanh," Headquarters PACAF, Project CHECO Report, (Maxwell AFB, Ala.: AFHRA, 13 September 1968), file no. K717.0414-2, 77.

15. Bowers, 297.

16. McLaughlin, 63–64.

17. Bowers, 303.

18. Nalty, 68; and Air Force Policy Letter for Commanders, from Office of the Secretary of the Air Force, Washington, D.C., 1 May 1968.

19. Nalty, 12.

20. Major Holland, "Tactical Airlift in Vietnam," Project CORONA HARVEST working paper (Maxwell AFB, Ala.: AFHRA, November 1969), file no. K239.046-52.

21. History, 463d Tactical Airlift Wing, Pacific Air Forces, January–March 1968, Maxwell AFB, Ala., AFHRA, file no. K-WG-463-HI, 9.

22. Trest, 75.

23. History, 834th Combat Control, Pacific Air Forces, 1968, Maxwell AFB, Ala, AFHRA, file no. K-DIV-834-SO-RE.

24. Bowers, 306.

25. Trest, 76.

26. History, 463d Tactical Airlift Wing, January–March 1968, 9.

27. Seventh Air Force, "Situation Report for General Momyer, 18 February 1968, 1600 hrs," Maxwell AFB, Ala.: AFHRA, file no. K740.30811-2.

28. Mets, 25–26.

29. Charles E. Miller, *Airlift Doctrine* (Maxwell AFB, Ala.: Air University Press, 1988), 319–20.

30. Trest, 76.

31. Lt Col Emmett A. Niblack, transcript of oral history interview by Col Ray Bowers, 3 May 1972, Maxwell AFB, Ala.: AFHRA, interview 762.

32. Nalty, 58.

33. Trest, 77.

34. Bowers, 306.

35. William W. Momyer, *Air Power in Three Wars: (WWII, Korea, Vietnam)* (Washington, D.C.: Air Force History Office, 1978), 306.

36. Nalty, 58.

37. McLaughlin, 68.

38. Mets, 25.

39. Ibid., 31.

40. History, 463d Tactical Airlift Wing, January–March 1968, 15.

41. Ibid., 16.

42. McLaughlin, 69.

43. Ibid.
44. "Red Defeat at Khe Sanh," *Washington News,* 6 May 1968.
45. Bowers, 306.
46. Trest, 76.
47. McLaughlin, 77.
48. Mets, 22.
49. Jack Foisie, "Resupply Planes Zip In, Out of Khe Sanh," *Los Angeles Times*, 13 February 1968.
50. Department of Defense, "Project CORONA HARVEST Final Report, USAF Airlift Activities in Support of Operations in Southeast Asia: 1 January 1965–31 March 1968" (Maxwell AFB, Ala.: AFHRA, March 1968), file no. K 239.034-2, D-6.
51. McLaughlin, 59.
52. Scholin, 94.
53. "Red Defeat at Khe Sanh."
54. Nalty, 102.
55. From the Office of the Secretary of the Air Force, Washington, D.C., Air Force Policy Letter for the Commander, 1 May 1968, Maxwell AFB, Ala.: AFHRA, file no. 168.952-3.
56. Trest, 129.
57. McLaughlin, 67.

Chapter 5

Conclusions and Implications for the Future

Generals and admirals stress the central importance of "doctrine." Military doctrine is the "logic" of their professional behavior. As such, it is a synthesis of scientific knowledge and experience on the one hand, and of traditions and political assumptions on the other.

—Morris Janowitz
The Professional Soldier, 1960

This chapter will state the doctrinal propositions that form the conclusion of this study and the implications those propositions may have for the future. To determine the doctrinal imperatives for aerial resupply of an enclave, the propositions from each individual case study were synthesized and tested for general applicability. This resulted in a preliminary conclusion, which was further examined in light of contemporary changes and led to the final conclusion.

This study investigated the Battle of Stalingrad, the Berlin Airlift, and the siege at Khe Sanh. Stalingrad represented a case with a challenging requirement to capabilities ratio, an equally challenging threat from the Soviet ground and air forces, and adverse weather. The Berlin Airlift's most important characteristics were an initially demanding requirement to capabilities ratio which was ameliorated by additional resources and a low threat. Khe Sanh featured a challenging threat and weather environment but a low requirements to capabilities ratio. These cases were selected to present diverse employment methods, threat environments, requirement to capability ratios, support infrastructures, weather, and outcomes. The Berlin Airlift and Khe Sanh were successes, while Stalingrad represented a clear airlift failure.

Doctrinal Propositions

The propositions listed below are those that emerge from the three case studies as being generally applicable. They are presented in order from the most general to the most specific.

Doctrinal Proposition:

1. There are four factors that influence airlift operations. These are the requirement to capability ratio, the threat, the support infrastructure, and the weather.

Corollary:

These factors often conflict with and influence each other. The success of the operation depends on the ability of the planner to minimize the ef-

fects of those that detract from mission accomplishment and to exploit those that favor it.

Discussion:

Each of the above factors influences both the employment method and the tonnage delivered to the enclave. Of the four, the requirement to capability ratio is probably the most telling. It is central to the choice of employment method. A high to medium requirement to capability ratio dictates the continuous flow method in order to gain maximum efficiency from the airlift system. The requirement to capabilities ratio is also very sensitive to the other factors. The threat may diminish the airlift capability, attrit supplies bound for the enclave, and degrade the support infrastructure. Attrition of transport during all phases of the resupply detracts from the airlifter's capability. The fewer number of Ju-52s the Germans had, the smaller the tonnage delivered to Stalingrad. Enemy attacks on the support infrastructure diminish the infrastructure's ability to generate productive airlift sorties. Sapper, sniper, rocket, and mortar attacks against Tan Son Nhut AB disrupted operation at that base for part of a day, decreasing sorties into Khe Sanh on 18 February. The threat may also dictate the surge method of employment. The Ju-52s flew in surges to take advantage of limited fighter escorts into Stalingrad. A high requirements to capability ratio requires a robust support infrastructure to ensure success. An inadequate support infrastructure reduces the ability to generate or to receive airlift sorties. An inadequate air traffic control system during the Berlin Airlift would have limited the number of aircraft in the corridors; thus, the number of aircraft that were prepared by maintenance and loaded would not matter if they could not fly to Berlin.

Doctrinal Proposition:

2. There are two basic methods to employ airlift forces: the continuous flow method and the surge method.

Discussion:

The two basic methods to employ airlift forces to resupply an enclave are surge operations and continuous flow operations. An enclave requires a given amount of supplies to be delivered each day. An airlift aircraft can carry a given portion of the requirement in a single sortie. To meet the requirement, the airlift forces must fly a given number of sorties into the enclave. These sorties can be flow in groups during blocks of time in the day (surge method) or they can be flown continuously throughout the day (continuous flow method). There are some variations on these basic methods, but each operation can be basically described by one of these two methods.

Doctrinal Proposition:

3. The continuous flow method is the most efficient method of employing airlift forces. This method should be used in situations that have a medium to high requirement to capability ratio.

Corollaries:

a. The continuous flow method requires the support infrastructure to be developed sufficiently to generate the productive sorties in the quantity and for the duration required.
b. In a benign threat environment, the continuous flow method is permissible; however, the threat must ceaselessly be evaluated to ensure it remains benign. If it changes, a reevaluation of the whole operation is required.

Discussion:

The continuous flow method is a method of employing airlift aircraft in a continuous stream to and from the enclave. The continuous flow method allows the planners to optimize the use of available resources. During the Berlin Airlift, airspace in the corridors and over Berlin was the most significant limiting factor. General Tunner and his staff developed a system that optimized the use of that airspace. In the battle for Stalingrad, the Germans were compelled by the threat and the weather to employ their airlifting surges. If they could have used a continuous flow method, they could have optimized the use of resources such as deicing equipment to generate more sorties. Because the maintenance infrastructure had to generate the required sorties in blocks of time during the day, instead of continuously throughout the day, its use was not optimal. These two examples illustrate the efficiency of the continuous flow method. However, for it to work the threat must remain benign in the area of operations.

Single aircraft arriving at somewhat regular intervals to the enclave make predictable targets for the enemy. The aircraft can deviate en route and on arrival to some extent but must eventually end up on a predictable final approach or DZ run in. Because transport aircraft have little or no defensive capability, they present easy targets for the enemy. During the Berlin Airlift the Soviets did not have the capability nor the will to threaten Allied airlift aircraft, which permitted the continuous flow method. However, if the planner is obliged to adapt the surge method, the efficiencies of the continuous flow method are lost. The end result may be decreased tonnage delivered to the enclave and possibly a failed operation.

Doctrinal Proposition:

4. An airlift effort conducted in a high threat environment and adverse weather conditions demands the employment of a surge operation to take advantage of threat suppression and breaks in the weather.

Corollary:

The surge method of employment requires the support infrastructure be developed sufficiently to overcome inefficiencies associated with this method.

Discussion:

It was pointed out previously that airlift aircraft employed in a continuous flow are vulnerable to both air and surface attacks. This is the case because the continuous flow method allows little opportunity for mutual support,

while it also allows the enemy forces time to detect and attack the vulnerable transport aircraft. On the other hand, surge operations maximize the ability of air defense forces to protect airlift forces. Surge operations usually reduce movements in time and space, thus also reducing their vulnerability to detection and attack. Airlift aircraft in formation also gain some benefit from mutual support. The suppression of enemy air defenses (SEAD) assets required are also diminished because of reduced exposure time of airlift forces during surge operations. On the other hand, surge operations are less efficient. Aircraft waiting to depart with the rest of the aircraft in the surge are not being used the most efficiently. Similar inefficiencies in the support infrastructure occur in surge operations. Therefore, the support infrastructure must be more robust to compensate for these inefficiencies. The Americans in Vietnam had a very robust support infrastructure and were thus able to overcome the inefficiencies of surge operations.

D*octrinal Proposition*:

5. When supplying an enclave by air, the planner must regularly balance competing planning factors and their influence on the employment methods.

Discussion:

The Germans were forced to use the surge method to take advantage of fighter escorts and breaks in the weather. If the weather was bad enough to preclude the Soviet fighters from flying, yet good enough for the transports to fly, the airlift forces used a continuous flow method for the applicable period of time. The weather in essence lowered the threat for the airlifters, so the employment method changed. The Luftwaffe also had to balance resources (bombers) between improving the requirements to capability ratio or diminishing the threat.

Doctrinal Proposition:

6. When an airlift operation is facing conflicting demands produced by a high requirement to capability ratio and a simultaneously high threat and adverse weather, the airlift effort must receive additional resources to enhance airlift capability or to diminish the threat.

Discussion:

The Germans' planner for the Stalingrad airlift faced this situation. The Luftwaffe did what it could to provide more resources, but the Luftwaffe was already spread thin; they also did what they could against the threat, but the force ratios greatly favored the Soviets. Because the German armed forces could not dedicate additional resources to this problem, the effort failed.

Continuing Validity Test

The most recent case studied occurred in 1969. Over the past 27 years the world has seen transformations in technology, international affairs, and domestic politics. The technological advances have been made in computing power, microcircuitry, propulsion, materials, sensors, and

communications. In the sphere of international politics, the most notable change is the end of the Cold War. Several other international trends may also influence airlift operation: the growing disparity in the distribution of wealth, the shift from identity with a nation-state to a tribe or culture, and the increased involvement of the United Nations in world affairs. In domestic politics there is the ever present instantaneous media coverage. There is also the pressure to cash in on the peace dividend; and finally, there is a trend to attempt to please all voters, thus none of the hard decisions are made. All the changes in these three categories may influence the validity of the historically derived propositions.

Doctrinal Proposition:

1. There are four factors that influence airlift operations. These are the requirement to capability ratio, the threat, the support infrastructure, and the weather.

Corollary:

These factors often conflict with and influence each other. The success of the operation depends on the ability of the planner to minimize the effects of those that detract from mission accomplishment and to exploit those that favor it.

Analysis of Continuing Validity:

The proposition is still valid, with one exception. The increased emphasis on operations other than war may accentuate the political nature of aerial resupply operations. Although the four basic factors remain operative, the post–Cold War environment may cause political concerns to intrude more directly into airlift support to enclaves. Political concerns may even compel the planner to be less concerned with the requirement to capability ratio because the only political concern may be to be seen doing something about the situation. This was the case in Bosnia where the C-130s dropping supply into Moslem enclaves did not adequately feed the populations but at least created the image of American involvement.

Doctrinal Proposition:

2. There are two basic methods to employ airlift forces: the continuous flow method and the surge method.

Analysis of Continuing Validity:

This continues to be a valid proposition. Neither technology nor politics has negated either method or created a new one. Although, technological advancements that bring about increases in aircraft tonnage capacity may blur the distinction between the two methods. It remains useful to continue to think in terms of two employment options.

Doctrinal Proposition:

3. The continuous flow method is the most efficient method of employing airlift forces. This method should be used in situations that have a high requirements to capability ratio.

Corollaries:

a. The continuous flow method requires the support infrastructure to be developed sufficiently to generate the productive sorties in the quantity and for the duration required.

b. In a benign threat environment, the continuous flow method is permissible; however, the threat must ceaselessly be evaluated to ensure it remains benign. If it changes, a reevaluation of the whole operation is required.

Analysis of Continuing Validity:

The major proposition remains valid. Technology has increased the capability of airlift aircraft, but at the same time there are fewer number of airlift aircraft available. Technology will reduce somewhat the airlift aircraft's reliance on infrastructure and defensive support. Support infrastructure remains important, but it may be reduced by the increasing reliability of airlift systems. Today's airlift aircraft are equipped with missile defensive systems, and the future airlift aircraft should have improved capability to defend it self. The requirement to maintain a benign threat environment for the continuous flow method decreases the more airlift aircraft can defend themselves. In sum, technology will tend to diminish the importance of the corollaries, but the main proposition will remain valid.

Doctrinal Proposition:

4. An airlift effort conducted in a high threat environment and adverse weather conditions, demands the employment of a surge operation to take advantage of threat suppression and breaks in the weather.

Corollary:

The surge method of employment requires the support infrastructure be developed sufficiently to overcome inefficiencies associated with this method.

Analysis of Continuing Validity:

This proposition remains valid today; however, technology and political concerns may decrease its importance. Today's aircraft may soon be equipped with existing technologies that permit operations in almost all weather conditions. Technology may also decrease the need for any defensive support. In operations other than war, political concerns may prohibit threat suppression in certain environments (urban). Also, technology will slowly decrease the influence of the support infrastructure. But as it stands today, this proposition is still well founded.

Doctrinal Proposition:

5. When supplying an enclave by air, the planner must regularly balance competing planning factors and their influence on the employment methods.

Analysis of Continuing Validity:

This proposition is even more applicable today than it was in 1969. The increased political concerns and the corresponding increase in the ability to influence the different factors forces the planner continually to balance

them. The effort to supply the Kurds in Iraq illustrates this point. Air supply there required support infrastructure in Turkey; however, long-term Turkish support for this base is tenuous because of the Turks' historical animosity toward the Kurds.

Doctrinal Proposition:

5. When an airlift operation is facing conflicting demands produced by a high requirement to capability ratio and a simultaneously high threat and adverse weather, the airlift effort must receive additional resources to enhance airlift capability or to diminish the threat.

Analysis of Continuing Validity:

This proposition also remains valid. The main emphasis of the proposition is binding as stated, but the influences of the threat and the weather will tend to decrease with advances in technology. Political concerns may allow only limited objectives with corresponding limited resources, thus the ability to receive additional resources may be limited by political concerns.

With several exceptions the historically derived propositions remain valid—the major exception being the possible addition of political concerns as a fifth factor that influences airlift operation. A less significant exception concerns the possibly reduced significance of the support infrastructure in light of technology's more reliable aircraft.

Implications for the Future

This section will address implications from the developed propositions for the future in the areas of doctrine and technology. For the purpose of this study, the future will be considered the beginning of the twenty-first century. The doctrine section will focus on changes or additions to current US Air Force and joint doctrine. The technology section emphasizes the focus technology should take to enhance the doctrine.

Airlift doctrine in the future should account for the strength of American armed forces' ability to change or influence the factors that affect how our forces are employed. This section will examine the current joint and Air Force doctrine as it relates to resupply enclaves from the air. The sources for current doctrine are Joint Publication (Joint Pub) 3-17, *Joint Tactics, Techniques, and Procedures for Theater Airlift Operations;* Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force,* vol. 2; and Air Force Doctrine Document (AFDD) 30, *Airlift Operations*. AFM 1-1, vol. 2, only mentions airlift's ability to resupply enclaves as an afterthought in a paragraph concerning the theater commanders' responsibility to have adequate theater airlift to prosecute their campaign plans.[1] AFDD 30 does address airlift capability to resupply enclaves as a "Combat Delivery Option" and as one of several "Non-lethal Applications of Air Power."[2] AFDD 30 does not address different methods of employing airlift forces, but it does discuss different forms of requirements. "Airlift

requirements originate on either a predictable, recurrent basis or a surge operation basis."[3] Joint Pub 3-17 does not address this issue, but it does discuss the parameters affecting choice of airlift delivery method: airland or aerial delivery. This discussion does list the following: the nature of the theater airlift operation (e.g., deployment, employment), user requirements, the capabilities of available airlift forces, the types of airlift terminals available, and the threat parameters.[4] The joint publication did not discuss resupplying an enclave, and the parameters it listed were not complete. Joint Pub 3-17 discusses two categories of scheduling: recurrent operations and surge operations.[5] These terms apply to total theater airlift operations but do not differentiate between scheduling and a method to conduct the operation itself.

Current doctrine does a good job of addressing how to employ airlift forces to run the day-to-day logistics of supplying the theater. The three doctrinal publications listed all mention the task or possibility of resupplying an enclave. The two air-lift specific documents address in one form or another the differences between surge operations or recurrent operations (continuous flow operations). On the whole, however, factors that influence airlift operations and employment methods are not addressed adequately in the current doctrinal publications.

Doctrinal publications need to address more fully the enclave resupply issue. This is because it is an increasingly important mission. Joint Pub 3-17, AFM 1-1, and AFDD 30 should all include the factors that influence airlift operations and the two methods of employing airlift forces to resupply an enclave. The two air-lift specific doctrine publications should add sections on aerial resupply of enclaves and incorporate the propositions listed above.

Future technology should be aimed at enhancing the ability of our forces and planners to affect the factors that influence airlift operations. Some of the key technologies for the future include: aircraft capability; wideband worldwide information networks, design systems; engine materials; low-cost airframe composites, lasers, sensors; short take-off and landing (STOL) capabilities, low observables, and guidance mechanisms. Wideband worldwide information network technologies, design system technologies, engine material technologies, low-cost airframe composite technologies, and guidance technologies would aim toward an airlift aircraft that can deliver increasing tons per day. Again wideband worldwide information network technologies, design system technologies; engine material technologies; low-cost airframe composite technologies, laser technologies, sensor technologies; STOL technologies, low observable technologies, and guidance technologies would all contribute toward a more survivable airlift aircraft, thereby decreasing the influence of the threat. The increase capability and survivability would also decrease reliance on support infrastructure. Finally, sensor technologies and guidance technologies will increase the self-contained all-weather landing and

drop systems. These technologies were all mentioned with the aim to increase the airlifter's ability to influence the four factors in his favor.

Notes

1. Air Force Manual 1-1, *Basic Aerospace Doctrine of the United States Air Force,* vol. 2, March 1992, 189.
2. Air Force Doctrine Document 30, *Airlift Operations,* 1 October 1995, 4.
3. Ibid., 18.
4. Joint Publication 3-17, *Joint Tactics, Techniques, and Procedures for Theater Airlift Operations,* 18 July 1995, I-11.
5. Ibid., I-6.