Why Not Airdrop?

The Utility of Preplanned Airdrop to Resupply Land Forces in the Contemporary Operating Environment

A Monograph

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14. ABSTRACT

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A brief review of three historical airdrop cases helps identify parameters for employment of airdrop. Common lessons learned from Dien Bien Phu, Khe Sanh and Operation Enduring Freedom denote how and why airdrop succeeds or fails when commanders intentionally place forces into isolated battlespace. A critical evaluation of the accuracy, efficiency, complexity and responsiveness of airdrop--as opposed to ground convoy--further delineates when airdrop is suitable and when it is not. A class of supply analysis also evaluates whether airdrop can provide sufficient support to an example field artillery battalion in Iraq. Unfortunately, current doctrine, organizational structure and unit training is insufficient to maximize the potential of airdrop. Suggestions for improvement are identified, most importantly the need for a streamlined request procedure in joint doctrine and a planned airlift apportionment for airdrop, as well as incorporation of airdrop into the Army's combat training centers.

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Abstract

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The contemporary operating environment poses distinctly different challenges for military commanders and planners than traditional conflicts. Non-contiguous battlespace exposes lines of communication to enemy action, unlike the linear battlespace that much of current doctrine has been based upon. As convoys continue to face improvised roadside bombs and other insurgent attacks, ground commanders are committing additional combat forces to protect these lines of communication. One tool available to free combat power for its primary role is to use airdrop to circumvent the dangerous roadways. This methodology has borne fruit in Afghanistan, but it is curiously not employed by Army units in Iraq. Is airdrop suitable for use in Iraq?

A brief review of three historical airdrop cases helps identify parameters for employment of airdrop. Common lessons learned from Dien Bien Phu, Khe Sanh and Operation Enduring Freedom denote how and why airdrop succeeds or fails when commanders intentionally place forces into isolated battlespace. A critical evaluation of the accuracy, efficiency, complexity and responsiveness of airdrop--as opposed to ground convoy--further delineates when airdrop is suitable and when it is not. A class of supply analysis also evaluates whether airdrop can provide sufficient support to an example field artillery battalion in Iraq.

Unfortunately, current doctrine, organizational structure and unit training is insufficient to maximize the potential of airdrop. Suggestions for improvement are identified, most importantly the need for a streamlined request procedure in joint doctrine and a planned airlift apportionment for airdrop, as well as incorporation of airdrop into the Army's combat training centers.

ACKNOWLEDGEMENTS

The motivation to take on this topic stems from multiple professional conversations with peers over the course of my year at the US Army's Command and General Staff Officer's Course. During both classroom and staff exercise time, airdrop was consistently dismissed--without evaluation--as a means of supply. "It's too inefficient; it's unreliable; I can't get enough stuff forward; it's too complex. . . ." Not wanting to slow down the planning process, I placed the issue on my mental "back burner." SAMS has presented me with an opportunity to take an in-depth look into this joint capability; to determine how valid these critiques really are.

In pursuing this goal, a number of professionals from across the services have significantly contributed to my effort. Col Alsid (USAF), COL Solseth (USA), LTC Cabrey (USA), and LTC Lukaskiewicz (USA) personally shared their command and staff experiences in combat, helping me frame the problem of airdrop's utility. A number of my peers--MAJ Keith Fegler (USA), Maj Eric Mayhew (USAF), Maj Cory Peterson (USAF), and Maj Rod Simpson (USAF)--helped to focus the general direction of this paper and provided me recent examples of airdrop in action. Aerial delivery masters like CW2 Lautzenheiser (USA) and Gunnery Sergeant Bush (USMC) provided the technical knowledge and essential details of current airdrop operations and procedures. I also would like to thank the Marines at the USMC's Center for Lessons Learned for their unhindered candor in support of my paper.

Finally, to Vickie, Meghan, and Hannah who gave up their computer, one of the three rooms in our cramped Kickapoo home, and too much of our family's free time to this project: *je suis finis et je t'aime*.

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INTRODUCTION

The United States, alongside its international partners, is currently engaged in a prolonged struggle in multiple locations around the world. In an effort to spread democracy and root out international terrorism, coalition forces are engaged in campaigns against elusive enemies; enemies that exercise their own forms of warfare, attempting to attrite coalition forces and erode the national will of the supporting populations. It is the tactics of the enemy--the hit and run, and sometimes even suicide attacks--that have caused the lion's share of friendly causalities, not major force-on-force combat. As such, the United States can expect to face similar conflicts in the future, as these tactics demonstrate a potential chink in friendly armor.

A notable effect of this enemy approach is the division and organization of coalition battlespace.[1] Having advanced and seized ground, land forces must then hold the ground. In sparsely populated environments, it is unsuitable and unproductive to attempt to hold uninhabited space. Thus, there are vast expanses of land neither patrolled nor occupied by friendly forces. In order to sustain the forward troops, however, logisticians must deliver supplies through these unsecured areas. In order to safeguard these logistical efforts, commanders dedicate combat forces to security duties in order to protect the delivery convoys. Accordingly, the number of vehicles, and more importantly the number of operating personnel subject to attacks along the delivery routes, increases. Yet this is not a new phenomenon in the history of warfare.

Recorded military history is full of examples of land forces surrounded and isolated from their supply bases. Only in the last 100 years, however, has technology offered these forces a supply delivery mechanism other than ground convoy. Since the advent of the aircraft and its subsequent incorporation into military arsenals, airdrop has been used to deliver anything from

[1] Department of Defense, Joint Publication (JP) 1-02, *DOD Dictionary of Military and Associated Terms* (Washington, DC: Government Printing Office, 2001), 64. The dictionary defines battlespace as "the environment, factors, and conditions that must be understood to successfully apply combat power, protect the force, or complete the mission. This includes the air, land, sea, space, and the included enemy and friendly forces; facilities; weather; terrain . . ."

messages to combat troops to supplies. Yet today's military doctrine, and resulting logistical practices, view airdrop as a contingency supply method, not a useful pre-planned activity.

In order to make the case for airdrop as a suitable means of pre-planned resupply in the contemporary operating environment (COE), this paper will first introduce the COE itself. Part of this definition will be an examination of one Army battalion task force's situation during a recent deployment to Ar Ramadi, Iraq. To prevent development of a theory based on only one example, a brief historical review will examine three additional case studies--two cases where airdrop was successful and one where it was not. Having reviewed the historical precedence of airdrop, a theory will develop that identifies potential evaluation criteria for planners attempting to discern the suitability of airdrop. This paper will evaluate the theory against the historical case studies identified in the next chapter, as well as the introductory case of the Army battalion operating in Iraq. Finally, this paper will recommend potential changes to current military doctrine, organization, and training concerning airdrop resupply, in order to enable the force to utilize airdrop to its fullest potential.

The Contemporary Operating Environment (COE)

Since the terrorist attacks of 11 September 2001, the outlook of the nation's military has taken a decidedly more offensive focus. Led by President Bush in his 2002 National Security Strategy, the United States "will not hesitate to act alone, if necessary, to exercise our right of self defense by acting preemptively against such terrorists, to prevent them from doing harm against our people and our country."[2] Because of this new expeditionary posture, the military has found itself operating in environments unlike any it had deliberately prepared for.

With the end of the Cold War, United States military forces have become increasingly withdrawn from overseas installations, and increasingly reliant upon strategic and operational

[2] George W. Bush, *The National Security Strategy of the United States of America* (Washington, DC: Government Printing Office, 2002), 6.

reach for both maneuver and sustainment.[3] Current operations in Iraq and Afghanistan are no exception. In fact, as the "Global War on Terror" continues, one should expect additional operations in similarly distant environments.

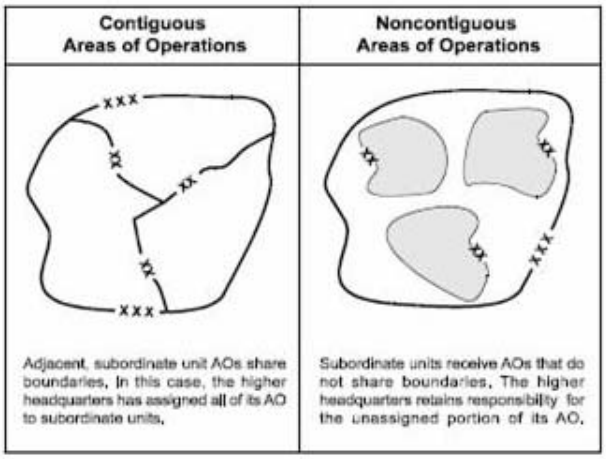

Figure 1. Contiguous and Noncontiguous Areas of Operations[4]

The distance from established basing, coupled with a need to maintain presence amongst populations surrounded by unsecured spaces has driven battlespace organization away from contiguous areas of operations (AOs) to noncontiguous configurations. Any number of reasons can drive a commander to select noncontiguous areas of operation--terrain as in the case of Afghanistan, population centers as in the case of Iraq, for example. How, then, do logisticians sustain the force in areas of operation that are not contiguous and through spaces not continuously secured?

During Operation Enduring Freedom (OEF) in the landlocked nation of Afghanistan, coalition forces faced an operating area without any mature ports of debarkation (Air and Sea PODs, also known as APODs and SPODs). Some of the world's most unforgiving terrain, coupled with winter weather, offered serious challenges to traditional ground-based logistics.

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[3] Gregory Fontenot et al., *On Point: The United States Army in Operation Iraqi Freedom* (Ft Leavenworth, KS: Combat Studies Institute Press, 2004), 406.

[4] Department of the Army, FM 3-0, *Operations* (Washington, DC: Government Printing Office, 2001), 4-20.

The terrain in Afghanistan serves as a natural divide between peoples, and accordingly had the same effect on combat operations in Afghanistan. United States Special Forces, operating alongside Afghani Northern Alliance tribesman, fought in isolated pockets--isolated from supply bases and isolated from each other. Unlike the linear or contiguous battlefields of previous campaigns, noncontiguous operations in Afghanistan required a logistical approach not reliant upon unsecurable, impassable ground lines of communication.

Logistics in Iraq differed from Afghanistan in that modern roadways did exist between major population centers; airfields with long, wide runways were distributed throughout the nation; and port facilities on the Persian Gulf allowed sea-based logistics to flow once the port was secured. Nonetheless, whether from Kuwaiti ports in the major combat phase of OIF, or Iraqi ports following the "end of hostilities" in April 2003, logisticians delivered supplies overland through unprotected battlespace. These lines of communication (LOCs) proved extremely vulnerable to enemy activity--whether coming forward from the theater rear area, or distributing between forward units and their subordinate unit AOs

Figure 2. Improvised Explosive Device (IED) Attacks on Coalition Forces in Iraq, by month, July 2003 to October 2005.[5]

In the Fall of 2003, an insurgency burgeoned in Iraq. Alongside attacks on troops and bases, insurgents targeted the unprotected in-between spaces, through which "soft" logistics

[5] Icasualties.org, Iraq Coalition Casualty Count, Available from http://icasualties.org, Internet, Accessed on 22 November 2005.

targets operated along the LOCs.[6] Figure 2 lays out total fatalities due to insurgent attacks on coalition forces using improvised explosive devices (IEDs) and clearly depicts the sustained upswing of insurgent violence starting in October and November of 2003. One of the repercussions of this increase in violence was the need to protect supply convoys as they traveled from supply bases to forward deployed troop locations.

The insurgent tactic of using IEDs against supply convoys proved a difficult challenge to overcome. Insurgents blended in with civilians, and the large expanse of roadways traveled by coalition forces made identification of the enemy problematic. Simply put, the coalition was, and is, incapable of providing twenty-four-hour surveillance of every roadway used by friendly forces without serious disruption to the primary mission: counterinsurgency. Thus, no successful method of *preventing IED emplacement* is available in the near term. The ground commander's counter tactic then has been an attempt to provide each supply convoy with enough firepower and physical protection either to deter IED detonation or to clear the roadway in advance of convoy passage. Both choices require dedication of significant amounts of combat power, with the latter choice often resulting in the armed escort force absorbing the IED attack itself.[7]

In a counterinsurgency campaign, any combat power diverted from primary counterinsurgency operations and dedicated to convoy protection is counterproductive to the overall effort. As the insurgents expand their target sets to include Iraqi institutions and the citizens themselves, the need to keep coalition combat power patrolling the streets increases significantly. As the counterinsurgency veteran David Galula wrote in 1964, "the counterinsurgent cannot achieve much if the population is not, and does not feel, protected against the insurgent. The counterinsurgent needs, therefore, to step up his military activity, to

[6] The US Department of Defense does not publish trends, statistics or data regarding total casualties from on-going operations in Iraq or Afghanistan. The government does release individual fatality press statements, but not wounded information. The data referenced in this paper, as cited below, comes from unofficial sources, which have compiled Government press releases from separate occurrences.

multiply patrols and small-scale operations by day and ambushes by night."[8] Herein lies the commander's dilemma--how to protect sustainment efforts without detracting from the overall capability to accomplish the primary counterinsurgency mission?

This admittedly cursory review of the Iraqi COE is designed merely to give an appreciation of the environmental constraints faced by logisticians in subsequent phases of OIF. In order to evaluate the potential utility of airdrop resupply in today's COE--specifically resupply of units operating in noncontiguous AOs--a more detailed analysis of the current environment is needed.

An Example Case From Iraq

Such an analysis can be framed through the eyes and experiences of a recently deployed unit. LTC Richard M. Cabrey, the former commander of a United States Army field artillery battalion stationed in Ar Ramadi, Iraq, commanded his battalion and attached task force units in support of OIF I and II rotations.[9] Upon arrival in the Fall of 2003, his unit's primary mission was to conduct offensive operations to defeat insurgent efforts near Ar Ramadi.

Ar Ramadi, a city of about 400,000 people, sits at the southwest corner of the "Sunni triangle." One hundred kilometers west of Baghdad, Ar Ramadi is the capital of Al Anbar province. Since the beginning of OIF, the coalition assessed the city to be a major staging and training area for transnational extremists en route to Fallujah and Baghdad.10 Figure 3 depicts the spatial relationships and road network between Ar Ramadi, Baghdad, Fallujah, and Jordan.

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[7] Phillip G. Pattee, "Force Protection Lessons from Iraq," *Joint Force Quarterly* (2nd Quarter 2005): 69.

[8] David Galula, *Counterinsurgency Warfare: Theory and Practice* (Westport, CT: Greenwood Press, 1964), 119.

[9] Richard M. Cabrey, LTC, US Army, Interview by author, 13 October 2005, Ft Leavenworth KS. All details on locations and practices come from this interview; other names, units, capabilities, and limitations are left out for security purposes.

[10] Wikipedia, Ramadi, Available from http://en.wikipedia.org/wiki/Ramadi, Internet, Accessed on 10 November 2005.

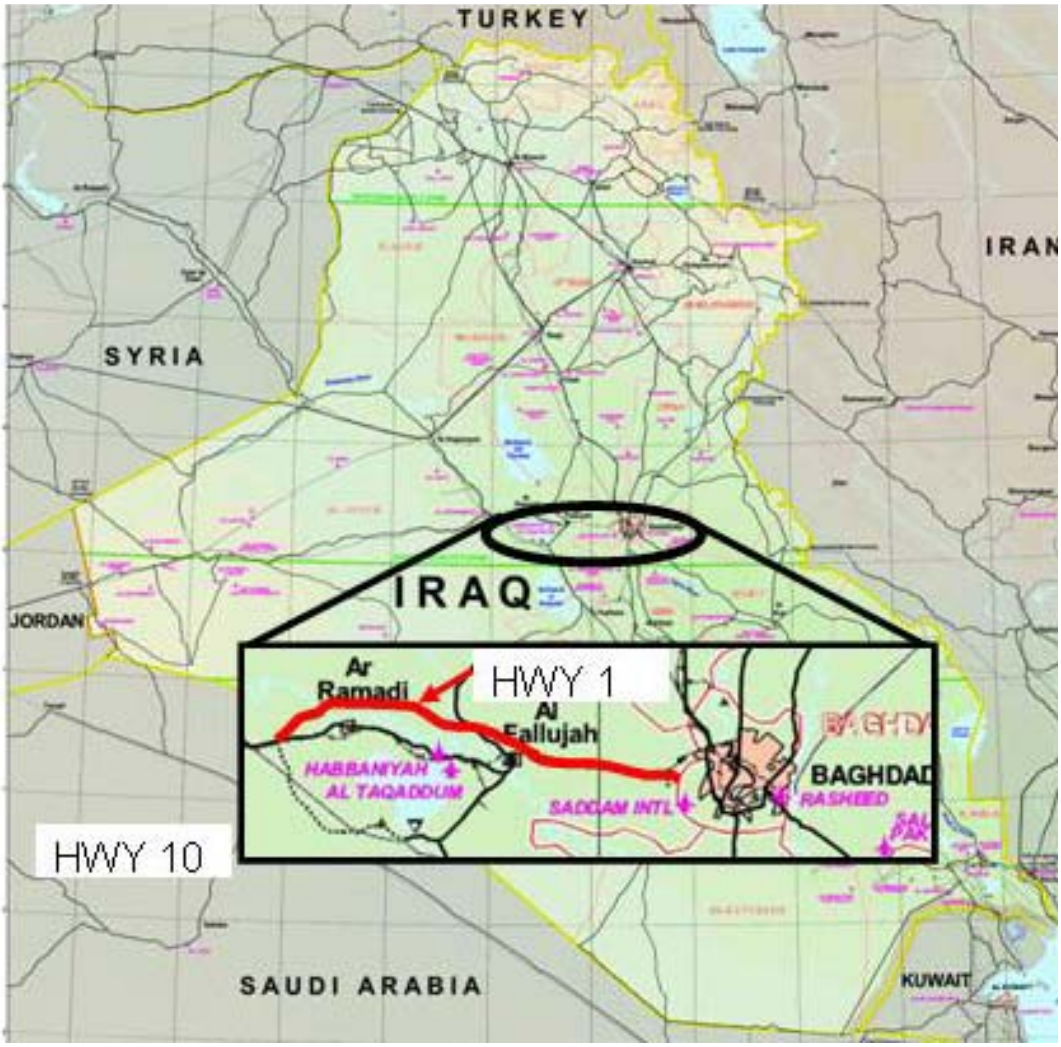


Figure 3. Map of Iraq, with inset depicting road structure between Ar Ramadi , Fallujah and Baghdad.[11]

[11] Graphics provided by author, with base map available on line at www.ndu.edu/, Internet, Accessed on 25 October 2005.

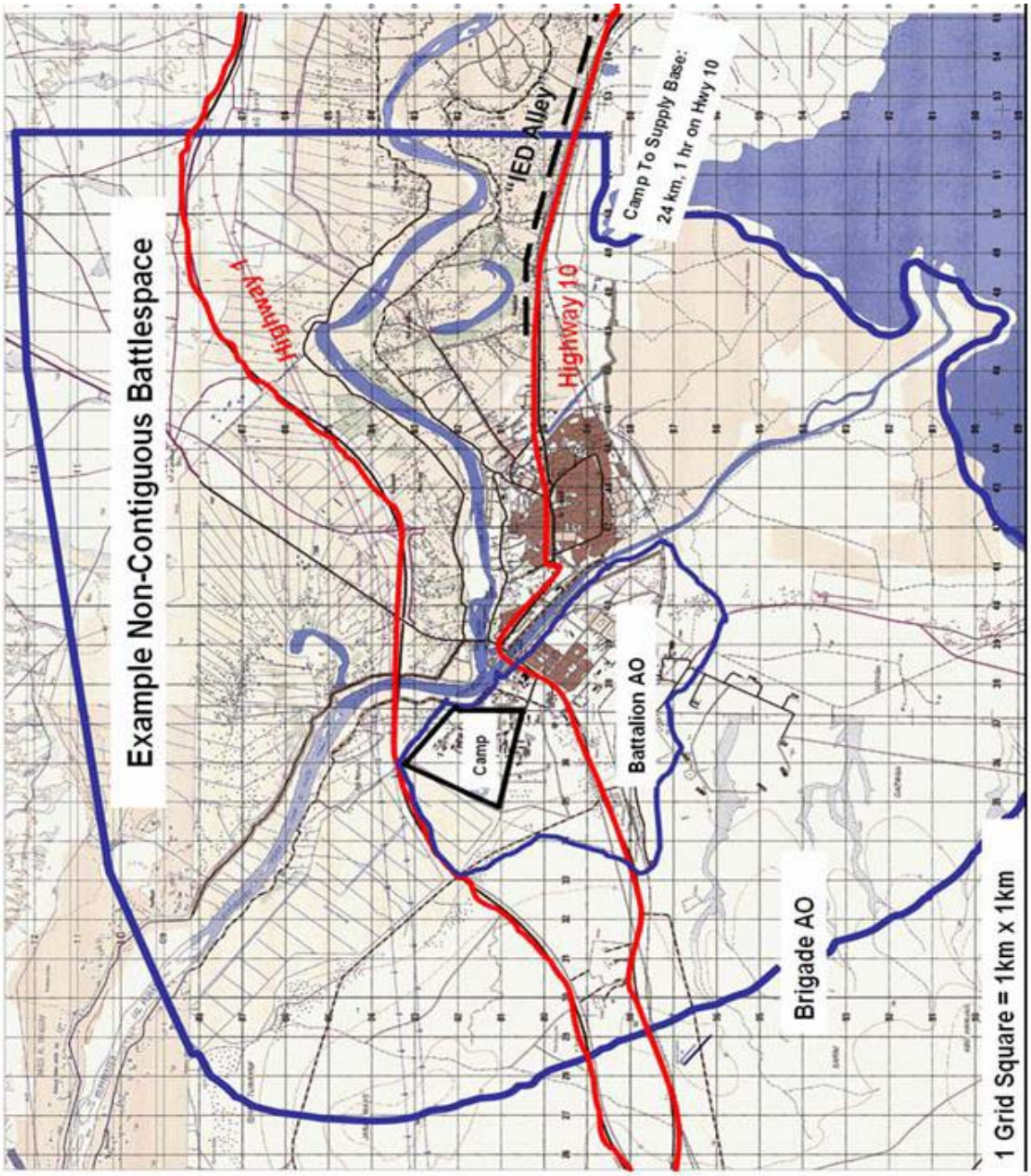


Figure 4. US area of operations in vicinity of Ar Ramadi, Iraq.[12]

[12] Diagram does not contain entire AO for parent brigade, only the space controlled by the infantry battalion, artillery battalion and Marine battalion task forces in Ar Ramadi. *Source*: Map data prepared and printed by the 148th Engineer Detachment (Topographic), 3rd Infantry Division (Mechanized), Fort Stewart, Georgia, May 2003, Available from http://www.humanitarian info.org, Internet, Accessed on 18 Sep 2005. Operational overlay graphics created by author.

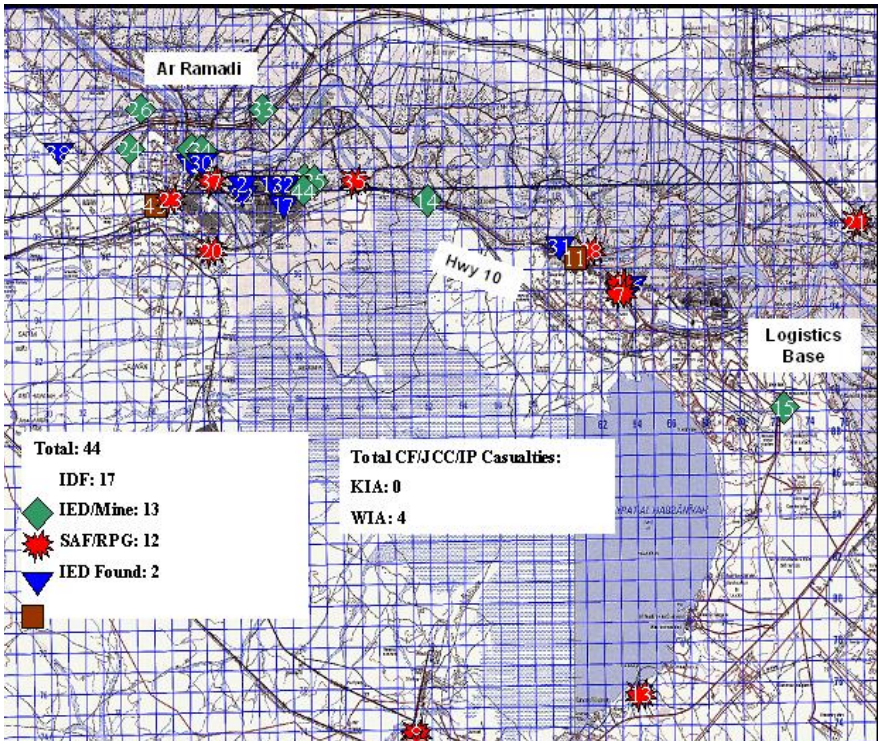


Figure 5. One week's enemy activity in the vicinity of Ar Ramadi.[13]

The coalition forces in Ar Ramadi, which included this field artillery battalion task force, as well as an Army infantry battalion task force and a Marine Corps infantry battalion task force, were responsible for an area approximately twenty-two by twenty-two kilometers in size, centered on the town of Ar Ramadi. This battlespace, while seamless internally, was externally noncontiguous. Isolated from the major supply point by twelve kilometers of unpatrolled space to the east and with no coalition units bordering the boundary to the west, the forces in Ar Ramadi were in essence operating in non-contiguous battlespace. As depicted in Figure 4, LTC Cabrey's battalion task force was primarily responsible for an area roughly four kilometers wide by ten kilometers long. The three battalion task forces, while not comprising the entire brigade combat team (BCT), did represent the primary mission set and area of responsibility of the

[13] Lukaskiewicz, LTC USA. Note the extensive activity north of the lake between Ar Ramadi and the logistics base (Hwy 10), and relative absence of activity south of the lake.

BCT.[14] Threading through LTC Cabrey's battalion AO were two east-west major supply routes, or MSRs. Highway 1 which traveled to the north of Ar Ramadi, and Highway 10, which cut directly through the battalion AO and the city itself en route to Habbaniyah, ten kilometers to the east. The highways converged at both ends of the city. In the west, they converged approximately ten kilometers west of Ar Ramadi, then continued on to the Jordanian border. In the east, the roads converged in Fallujah, well outside the brigade's AO, and half-way to Baghdad.

It was near Habbaniyah that the brigade located its primary supply base. Collocated with an airfield, this facility housed the brigade's logistical units, as well as logistic support units attached from the parent division and tasked to support this brigade. In order to keep the brigade in Ar Ramadi supplied, brigade combat units took turns making the supply run to Habbaniyah. A typical convoy would take forty-five minutes to one hour to make a one-way, twenty-four kilometer trip on Highway 10 between "Camp Ramadi." Since Highway 10 was the only road between Ar Ramadi and Habbaniyah, insurgents started to target vehicles moving along this "IED alley" (see Figure 5).

To mitigate this risk, planners and commanders in Ar Ramadi, like so many throughout Iraq, attached up-armored, armed escort vehicles--or "gun trucks"--to escort the supply convoys. While the specific number and type of vehicles, as well as the tactics used will not be discussed here, it is important to point out that these additional security forces were drawn from units already tasked to perform the brigade's primary mission: counterinsurgency. For every convoy needing escort, those escort troops and vehicles were unavailable to patrol streets, interact with local officials, train Iraqi security personnel, or any of the multitudinous tasks necessary to quell an insurgency.

[14] Other elements of the brigade were located to the east of Ramadi near Habaniyah. Specifically the armor battalion and logistics battalion operated from the airfield.

In a further attempt to protect the convoys, logistics planners identified an unimproved road that avoided "IED alley" (See inset map on Figure 3, note the dashed black line that swings south of the lake located between Fallujah and Ar Ramadi, eventually joining Highways 1 and 10 west of Ar Ramadi). While this road was less populated, and hence easier to clear in advance of a convoy, it necessitated a four and one-half hour one-way drive. As a result, one period of darkness was not enough time to complete one round trip between the Ar Ramadi camp and the supply base in Habbaniyah.[15]

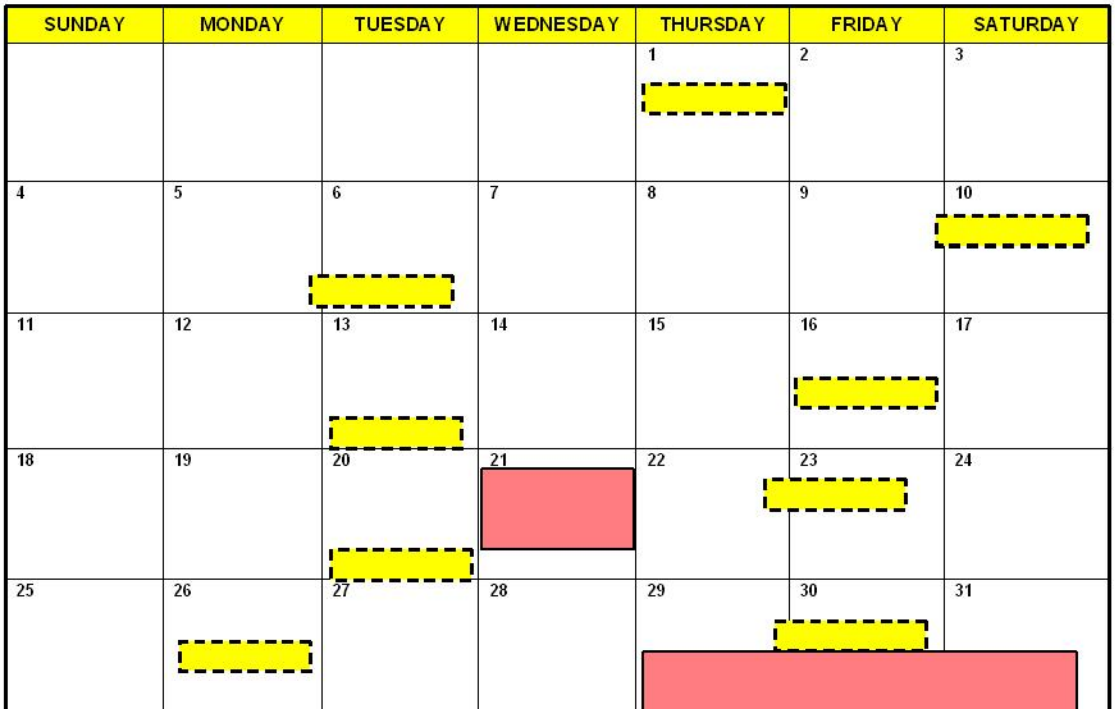


Figure 6. An example month of convoy operations in Ar Ramadi.[16]

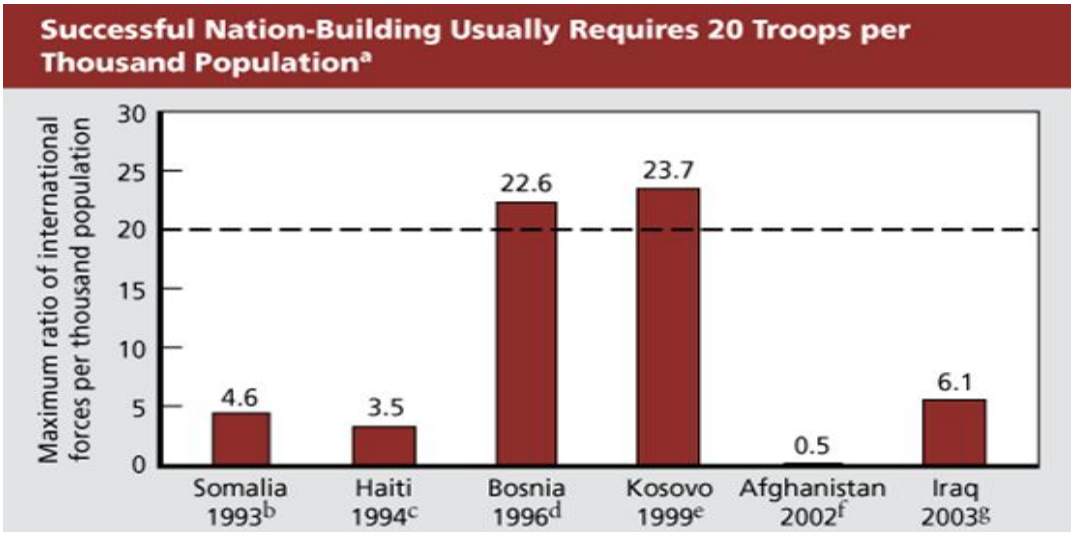
To compensate, a convoy would make a trip to the supply base one night and remain overnight. The next night, the convoy would return. Generally, the brigade would wait one or

[15] Operating during hours of darkness or reduced visibility is a technique the United States military exploits as a result of its technological advantage.

[16] Lukaskiewicz, LTC USA. Dashed yellow blocks indicate convoys sent from Ar Ramadi to logistics base (pull), and solid pink blocks indicate convoys sent from logistics base to Ar Ramadi (push).

two days between efforts, sending the next convoy forty-eight hours after the last one returned to camp. A seventy-two hour supply cycle evolved, keeping the escorting combat troops away from their primary mission for forty-eight hours at a time.[17] (See Figure 6) In short, the requirement to sustain the brigade directly detracted from the overall combat mission of counterinsurgency.

The portions of the brigade combat team stationed in Ar Ramadi--the Army and Marine infantry battalions (roughly 450 infantrymen each), LTC Cabrey's artillery battalion task force (of which roughly 100 Soldiers were available for COIN operations at any one time), and other support "slices"--had only 1,000 troops available to patrol the streets and conduct offensive operations in a city of 400,000. Historically, ratios of 20 soldiers per 1,000 civilians have proven to be successful, as depicted in Figure 7.[18] Based on this 20 per 1,000 ratio, the brigade should have had 8,000 Soldiers and Marines dedicated to Ar Ramadi. Instead, they had only 2.5 per 1,000 civilians. This paper does not consider the decision by national leaders to limit troop deployments to Iraq, but given the actual forces assigned, any further reduction in combat power due to the need to escort supply convoys was clearly undesirable.



[17] Lukaskiewicz, LTC, USA, Interview by author, 13 February 2006, Ft Leavenworth, KS. The escort troops typically received a rest period before and after the convoy unless the security situation dictated otherwise.

Figure 7. Historical Examples of Troop-Civilian Ratios.[19]

Commanders in this case were aware of their environment, and executed everything within their organic capabilities to protect and sustain their troops while continuing the mission. While avoiding a classified discussion, it is important to take a moment and extrapolate the brigade's situation. Imagine how an upswing in insurgent violence, additional brigade taskings, or even training for a major offensive would impact sustainment efforts. Without regular replenishment of stocks, days of supply for each class of supply would reach critical levels. Until Iraqi security forces could be certified to operate independently, this dilemma would continue.

What, then, can commanders do differently to free combat power for its primary role? They could increase the number of troops available for convoy security duty. In fact, LTG McKiernan, Commander of the Joint Land Forces Component Command, during the major combat phase of OIF did just that. As Soldiers and Marines rapidly approached Baghdad during April 2003, he assigned the 2nd Armored Cavalry Regiment (2 ACR) the mission of LOC security between As Samawah and An Najaf.[20] According to the Army's history of the major combat phase of OIF, "[a]ttaching the 2nd ACR(L) to the 82nd [Airborne Division] gave the division enough combat power to control the whole LOC. . . . [I]t was when the 2nd Cavalry secured the lateral routes between the towns [nearly 100 kilometers] on 11 April that the LOCs could be said to be *reasonably safe*. That is arguably the right point at which to *declare the "LOC fight" over*."[21] While the timing of the decision is admirable, the definitive nature of the above statement paints an eerily false picture of things to come.

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[18] James T. Quinlivan, "Burden of Victory: The Painful Arithmetic of Stability Operations," *RAND Review* 27, no. 2 (Summer 2003): pg 28-29. Quinlavin also points out that the British Army has historically used 20 per 1000 ratios in Northern Ireland.

[19] Quinlivan, James T. "Burden of Victory: The Painful Arithmetic of Stability Operations," *RAND Review* 27, no.2 (Summer 2003). Available from http://www.rand.org. Internet. Accessed on 23 Oct 2005.

[20] Fontenot, 219.

[21] Ibid., 221. Emphasis added.

While an armored cavalry regiment is clearly more firepower than would suit the case study in Ar Ramadi, it lends some credence to the need to free combat power for its primary mission. Unfortunately, this method relies on more combat power to free current combat power. While tempting, the idea runs counter to the stated concept of reducing coalition presence in Iraq, and increasingly turning responsibility over to Iraqi forces.[22] This option does not work well in a political-military climate that is adverse to troop increases, or putting additional troops at risk.

Proposing A Solution

It is understandable that ground commanders should look within to solve any problem. Accordingly, ground-centric solutions have dominated the recent discussions on how to deliver supplies in non-contiguous battlespace.[23] Yet, if ground component commanders are indeed limited in their inherent options to solve this dilemma, perhaps the solution lies in joint interdependence. Beyond the recent tradition of joint interoperability, joint interdependence requires services and components to relinquish control of practices, processes, and capabilities to streamline activities and reduce redundancies. The June 2004 Draft version of the Defense Department's Joint Operating Concept for Major Combat Operations states "[i]nterdependence relies upon technical connectivity to be sure, but even more important it relies upon breaking down long-developed cultural positions and barriers, eliminating unnecessary redundancies, and better integrating joint force employment. . . . In so doing, this concept describes a profound transformation in the way we think about and conduct major combat operations."[24]

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[22] George W. Bush, President of the United States, *Press Conference Following the G8 Summit*, Savannah, Georgia, 10 June 2004. "There will be an Iraqi face on the security of Iraq. The Iraqis will secure their own country. And we are there to help them do so."

[23] Gregory Jacobsen, "Lines of Communication Security in the Contemporary Operational Environment" (Monograph, School of Advanced Military Studies, Ft Leavenworth, KS, 2004), iii. Maj Jacobsen highlights the need for improvements in "communication, convoy security, regional response forces, and route clearance and maintenance" as solutions. Yet he, like many others, does not consider the option of avoiding the ground LOC all together.

[24] Department of Defense, Draft Working Paper, *Major Combat Operations, Joint Operating Concept*, Version 1.10 (Washington, DC: Government Printing Office, 2004), v. The author acknowledges that this document is staged around hypothetical conflict in 2015.

Given this emerging concept, how can joint forces relieve pressure on ground units and keep them sustained? When the mission will suffer due to lack of sustainment, or the environment inhibits normal supply channels, what other mechanisms exist? One method that has some historical precedence is airdrop. But airdrop is typically perceived as an emergency resupply effort only. There are occasions throughout history, however, where airdrop was **preplanned** as a complementary or even primary supply means.

The final introductory thought for this paper, then, comes down to defining the "utility" of airdrop as a method of preplanned supply. Utility, or the "fitness for some purpose or worth to some end," as it applies to preplanned airdrop is an inherently subjective assessment.[25] In order for the paper to assess the "utility" of airdrop, it should provide planners with a framework of questions--and suitable answers--that apply to future situations. To help evaluate the general Iraqi COE and LTC Cabrey's situation in particular, three historical airdrop cases follow. An overview of these cases will reveal the "why, how long, to whom, how, and under what conditions" of a worthy preplanned airdrop effort.

Nonetheless, increasing emphasis on joint operations makes the point of joint interdependence relevant to this paper.

[25] Frederick Mish et al., Webster's Ninth New Collegiate Dictionary (Merriam-Webster Inc 1987), 1300.

THREE HISTORICAL AIRDROP CASES

Since the first attempt to use the airplane to deliver supplies from above, militaries have used airdrop resupply on more occasions than can be evaluated in this paper. In order to find precedence for airdrop in today's COE, examples should be limited to appropriate cases. Namely, support to military forces physically separated from other friendly forces and or higher echelons; humanitarian actions are outside the scope of this effort. The cases selected for study in this paper should help reveal "left and right limits" for the deliberate, pre-planned use of airdrop resupply.

World War II, and the political ramifications of the new bi-polar world, marked the first few attempts to use airlift en masse. During Germany's eastern offensive in 1942-1943, the Luftwaffe attempted to sustain over 200,000 German soldiers near Stalingrad using first airland, and then eventually airdrop. The effort was completely unsuccessful. The Stalingrad air effort does not suit this particular research for a number of reasons. First, unlike today's COE, the German forces at Stalingrad were overrun by the enemy not intentionally placed into isolation by their commanders. Second, these same unfortunate units were completely cut off from ground-based resupply. Convoying sustainment was not an option. Finally, the threat to the airlift fleet proved to be prohibitive; the Luftwaffe failed to achieve, let alone maintain, air superiority, and the objective areas inside the German perimeter (drop and landing zones) received constant harassing fires from enemy ground forces. One could also consider the Berlin Airlift as an air-only operation used to supply isolated personnel. The Berlin Airlift, however, was an exclusively airland operation--airdrop was not used. Due to the burgeoning Cold War in Europe, there were no land routes available to logisticians, so commanders had no opportunity to make a choice between airdrop and ground convoy.

The cases selected, then, are the French at Dien Bien Phu, 1953-1954; the United States at Khe Sanh, 1968; and finally, the United States in Afghanistan, 2001-2002. In all three cases, ground commanders deliberately positioned their forces in isolated battlespace, with an

understanding that they would call on airlift. In the first case, airdrop did not succeed in achieving the desired end state, whereas the last two were successful operations in which airdrop made a difference. Predictably, none of the three cases includes an effort where airdrop served as the sole means of resupply. This analysis seeks to understand the deliberate decision to use airdrop. Not only understand the criteria for employment of the method, but also the ramifications of that decision in terms of success or failure.

The French at Dien Bien Phu, Viet Nam, 1953-4

The siege at Dien Bien Phu was a reflection of change between two major political, social, and economic systems--the end of colonialism and the beginning of the Cold War. The simple fact that the French commander intentionally inserted troops into isolated battlespace, planning to use only air resupply to sustain their force, warrants the inclusion of Dien Bien Phu in this paper.

Following the devastation of World War II, France made a concerted effort to retain its colonies in order to bolster their economic recovery. At the same time, communism was gaining momentum in Asia--reflected in the "successes" of China and North Korea--and had infiltrated into Viet Nam. Known as the Viet Minh, the communist movement in Viet Nam received supplies from China through Laos and across the shared Vietnam-Chinese border. In an effort to disrupt the flow along this insurgent line of communication, French General Henri Navarre, the top military commander in Viet Nam, elected to create a forward operating base near the northern Laotian border to interdict Viet Minh supply lines.

Navarre selected Dien Bien Phu, a hamlet along the Laotian border in northwest Viet Nam, hoping to interdict Viet Minh supplies and force a decisive battle. Dien Bien Phu, however,

was too far from any existing French operating base to be supplied overland.[26] French doctrine of the day called for selecting bases in valley areas to allow for airstrip operation, consequently

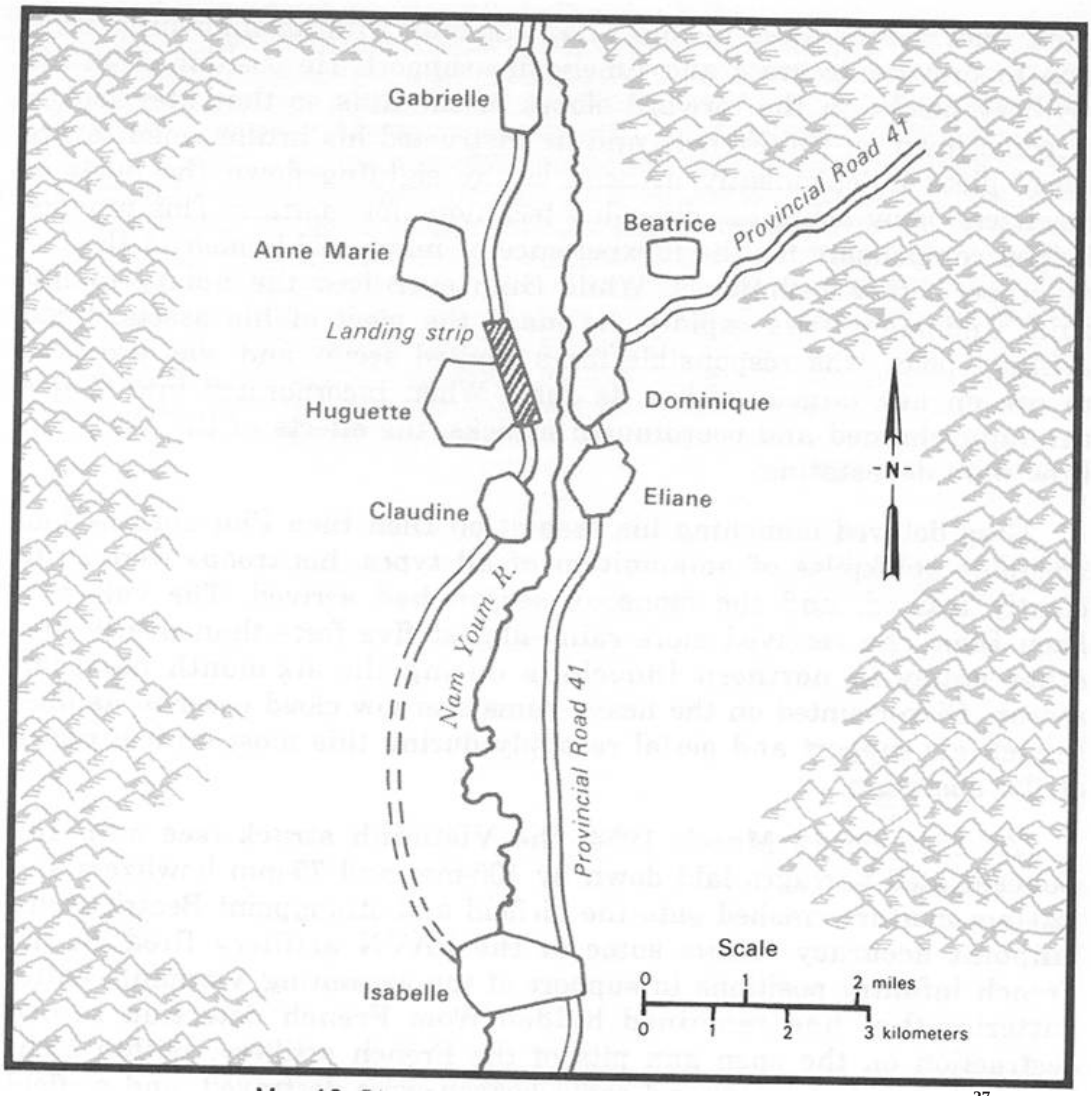

Figure 8. Dien Bien Phu Map that depicts hills surrounding the French encampments.[27]

[26] Bernard Fall, *Hell in a Very Small Place: The Siege of Dien Bien Phu* (New York, NY: Da Capo Press, 1966), 4-9. The air armada that inserted the initial force departed from two airfields near Hanoi, and took over two hours to reach the drop zones near Dien Bien Phu over twenty miles inland. The time and distance problem, coupled with a lack of airframes and crews, would haunt this operation.

[27] Department of the Army, Available from http://www-cgsc.army.mil/, Internet, Accessed on 4 November 2005. Note the distributed nature of the positions, and their considerable distances from the landing strip which was collocated with the primary drop zone.

giving away the surrounding highlands to the enemy.[28] The French believed their superior firepower would, in conjunction with poor infrastructure to support enemy movements, more than make up for geographical disadvantage.

From the outset, the French Air Force struggled to provide the necessary level of support to the operation. In order to insert the initial ground force, aircrews, and airframes were diverted from other offensive operations in the Indochina theater. Even staff officers were removed from their offices to fly the infiltration.[29] A second problem in supporting the outpost at Dien Bien Phu was the French reliance on firepower from the air. Of the 130 air-to-ground attack aircraft available throughout Indochina, the French air and naval forces could only maintain a 75 percent operational sortie rate. Dien Bien Phu was not the only operation these aircraft were supporting, either.

On 20 November 1953, the first wave of what would eventually amount to over 16,000 French soldiers parachuted into, and subsequently seized, Dien Bien Phu.[30] While not known for sure, it is reasonable to assume that Navarre's choice to conduct the operation in the fall was due to the rainy season in the spring and summer months. After successfully seizing the airstrip and clearing the 100-plus houses in the village, transport aircraft (mostly World War II-era C-47s) began delivering follow-on forces, supplies, and equipment. By mid-December, patrolling French troops encountered stiff resistance from the Viet Minh and withdrew to their base at Dien Bien Phu (see Figure 8) and the six non-mutually supporting defensive positions in the valley.[31]

From the time French ground forces ceased offensive operations, the Viet Minh spent nearly three months consolidating before attacking in mid-March. Political pressure to avoid the apparent failure of withdrawal forced the ill-fated decision to continue. The airlift would have to continue until ground forces succeeded, surrendered or were defeated.

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[28] Jules Roy, *The Battle of Dienbienphu* (New York, NY: Harper and Row, 1963), 36.
[29] Ibid., 2.
[30] Fall, 483.

Perhaps an unintended consequence of the parachute insertion was the ground component's inability to construct robust defenses at Dien Bien Phu. A light infantry force, supported by small airlift aircraft unable to deliver large construction vehicles via landing, was wholly incapable of transitioning from offensive patrol-type operations to fixed-base defense against a significantly larger enemy force. Fortunately for the French, C-119 "Flying Boxcars" (contributed by the United States) were capable of airdropping palletized heavy equipment, and did so with varying levels of success. Nonetheless, the requirement for construction materials, equipment, water purification, bridging materials, and electricity generation to support over 10,000 men was phenomenal.

Bernard Fall, having composed a thorough history of the Dien Bien Phu operation from French and Viet Minh sources alike, lays out a bleak picture of the French combat engineering needs:

> The chances for a successful defense of Dien Bien Phu under direct attack could be expressed in one frightening equation: 34,000 tons of engineering equipment represented the cargo loads of about 12,000 flights of C-47 transport aircraft. . . .About 80 aircraft were deployed on the daily run to Dien Bien Phu. At that rate, and assuming *nothing else* but engineering materials were [delivered], five months would have been required to make the forlorn valley into a defensible field position![32]

In addition to the seemingly insurmountable engineering logistic needs, the force itself estimated a daily supply delivery of 200 tons--ammunition, food, and basic supplies to sustain the force. Given the four and one half-ton capacity of the C-47, this need alone would dictate forty-five daily sorties.

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[31] John Tokar, "Provide by Parachute: Airdrop in Vietnam, 1954-1972" (Monograph, School of Advanced Military Studies, Ft Leavenworth, KS, 1999), 12.

[32] Fall, 89. [original emphasis] While Fall does not amplify his calculations, the 12,000 sortie number can be roughly divined. Each C-47 could carry 9,000 pounds, or 4.5 tons. Given the size and shape of much of the cargo, however (large wooden beams, and others), a given sortie may have filled the aircraft cargo compartment before it reached maximum weight. Today, this is known as "cubing out" before "weighing out," and still limits the airlift of large equipment and vehicles. Thus, 2.8 tons per sortie, especially to an unimproved airfield, is not unrealistic.

When the Viet Minh finally initiated their attack on 13 March, they had emplaced nearly 200 camouflaged artillery pieces throughout the hilltops surrounding Dien Bien Phu.[33] The next day, artillery barrages destroyed fourteen aircraft, two helicopters, the control tower, and radio beacon on the airfield at Dien Bien Phu.[34] By 17 March, monsoon rains ensured the dirt airstrip would no longer be usable. Now without an airstrip to precisely deliver supplies, the French faced a four-to-one firepower mismatch, and a lopsided ground combatant ratio of nearly five-to-one in favor of the Viet Minh.[35]

For the remainder of the fifty-five-day siege, the entire supply effort transitioned to airdrop in order to keep the French troops alive at Dien Bien Phu. Over the course of the operation, some 125 C-47s from France and the United States served as the workhorses of the airlift. While the C-47 was more capable in terms of cargo capacity than the Ju-52 used at Stalingrad, the C-47 still relied on a side-door exit, thus limiting the size, shape, and quantity of airdroppable material. New to the airlift, however, was the C-119. With a removable aft cargo door, this aircraft could deliver in one pass what took one C-47 ten passes over the drop zone to accomplish. The C-119 could also drop palletized cargo, as opposed to the C-47 that relied on pushing bundles out man-sized side entry doors.

The enemy easily negated the improved airdrop capability. As the Viet Minh cautiously and consistently placed artillery pieces in the hills surrounding Dien Bien Phu, so too did they install anti-aircraft artillery (AAA) pieces to deny over flight of the encampment. Faced with a robust, flexible, and seemingly inexhaustible enemy logistics system, French Air Force commanders elected to focus their offensive airpower on Viet Minh supply lines, at the expense of air defenses around Dien Bien Phu. As a result, AAA forced airdrop aircraft to drop from ever-increasing altitudes, which in turn reduced the accuracy of the drops themselves. In one

[33] Ibid., 127.

[34] David Vaughan, and James Donoho, "From Stalingrad to Khe Sanh: Factors in the Successful Use of Tactical Airlift to Support Isolated Land Battle Areas," *Air and Space Chronicles* (2000), 4.

demoralizing instance, French troops watched as thousands of pounds of 105-millimeter artillery rounds drifted safely into the hands of the Viet Minh. Ironically, the Viet Minh also had 105-millimeter artillery pieces, trained and ready to fire upon the French.[36]

Complicating the problem, Viet Minh ground forces gradually encroached on the French position, continually shrinking the available space for secure drop zones. Eventually, only one area within the garrison remained suitable as a drop zone--without any variation in targets, airdrop aircraft had to overfly a single spot only 2,000 yards in diameter. They proved an easy target for Viet Minh anti-aircraft gunners.[37] As if transiting the drop zone was not challenging enough for French and United States aircrews, the Viet Minh added insult to injury by interdicting the airlift at its origin. Guerilla attacks against French Air Force bases in Gia Lam and Cat Bi resulted in destruction or damage to seventy-eight aircraft.[38] Finally, the weather played an uneven hand to the French. Low ceilings, heavy rains, and persistent fog hampered airdrop efforts--both delivery and recovery--and perhaps more importantly, the ability for offensive airpower to harass Viet Minh firing positions, fielded forces, and logistics trains. For the Viet Minh, weather did not pose nearly such a debilitating influence. Having established positions months earlier, and sighted their guns in the first few days of the siege, accurate artillery fire no longer relied on visual assessment for feedback. Viet Minh artillery would rain down on French heads even when their resupply and air support could not.

Throughout the course of the airdrop effort, the French and United States made noteworthy strides in airdrop tactics, techniques, and procedures. French quartermaster units, assisted by United States counterparts, devised parachute rigging techniques that, while not a panacea for the conditions at Dien Bien Phu, allowed successful delivery of some supplies.

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[35] Fall, 133.
[36] Tokar, 18.
[37] Ibid., 17.
[38] Fall, 227.

Unbeknownst at the time, the techniques developed would stand the test of time--both at a later stage in Viet Nam and beyond.

Despite these advances, however, poor weather and enemy action affected aircrews to the point they were frequently unable to accomplish their mission. Over the fifty-six days where airdrop was the sole resupply means, aircrews dropped 7,000 tons of supplies of all classes. While the French estimated 200 tons per day were required to sustain the force (170 tons of which was ammunition alone), an average of only 120 tons per day were delivered, with only 100 tons per day being recoverable on average. Nearly 7,000 of the 16,500-man French force lost their lives, were wounded or reported missing by the fateful surrender on 8 May 1954.[39] In a sad final testament to the failure at Dien Bien Phu, post-combat investigations revealed that the French never conducted an estimate of actual logistics requirements prior to the initial insertion into Dien Bien Phu. Perhaps had the French conducted an honest estimate, and compared it to their failing fleet of available aircraft, the seeds of this disaster may never have been planted by Navarre.

The United States Military at Khe Sanh, Viet Nam, 1968

Following the ejection of the French in 1954, the Geneva Accords partitioned Viet Nam into two states, North and South along the 17th parallel. The North aligned itself under communist principles and ideologies, and the South was quickly recognized by both the United States and Great Britain. A communist insurgency in the south, supported by the north, gained momentum over the next decade, eventually reaching sufficient strength to cause the government of South Viet Nam to accept increased levels of American military assistance.

The United States began gradually increased military assistance to help stem the growing threat from North Vietnam--a threat consisting of both conventional forces (the North Vietnamese Army (NVA)), and insurgents (Viet Cong operating inside the southern republic). In 1966,

President Johnson abandoned gradual increase and deployed 500,000 service members to Viet Nam. What had been a "by, with, and through" campaign conducted by Army Special Forces and other American advisors quickly became all-out compound warfare.

Timed in conjunction with the Vietnamese New Year--or "Tet"--the NVA and Viet Cong launched a massive offensive with the hope of capitalizing on growing popular discontent in South Viet Nam. The United States Marine Corps' combat base at Khe Sanh (see Figure 9) became a focal point for northern forces during the Tet Offensive of 1968--the 6,000-plus Marines and Vietnamese Rangers faced nearly 20,000 NVA from two divisions, with a third division capable of reinforcing from only 25 kilometers away.[40] Given the advanced warning, commanders elected to retain and sustain Khe Sanh, despite the overwhelming odds.

While similar to Dien Bien Phu at first glance, the fighting at Khe Sanh differed significantly in a number of ways. Like Dien Bien Phu, Khe Sanh was created from scratch in order to attrite the flow of enemy supplies along a major line of communication--the "Ho Chi Minh Trail." It differed, however, in that unlike Dien Bien Phu, Khe Sanh lay within range of American field artillery 20 kilometers away at Camp Carroll. Khe Sanh also lay alongside Highway 9--a major supply route linking the combat base to outside support.[41]

Operations at Khe Sanh benefited from pre-hostility planning; both in terms of logistics and firepower. As intelligence increasingly pointed to an enemy offensive against allied outposts near the 17th parallel, joint forces endeavored to prepare for the coming battle. Troops occupied key hilltops surrounding Khe Sanh, extra artillery pieces were flown into the base, reconnaissance patrols probed for enemy formations and troop reinforcements prepared to deploy to Khe Sanh. Navy Seabees (Construction Battalion engineers) stationed at Khe Sanh, equipped with heavy machinery for runway and revetment repair, consolidated their supplies and readied for the attack.

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[39] Ibid., 483.

[40] Bernard C.Nalty, *Air Power and the Fight for Khe Sanh* (Washington, DC, Office of Air Force History: Government Printing Office, 1973), 14.

[41] Ibid., 4.

Simply stated, the forces at Khe Sanh, with an opportunity to create established defenses, secure significant terrain and stockpile supplies and ammunition, actually stood a chance at the outset--Dien Bien Phu did not. Additionally, logisticians estimated a need for 235 tons per day, which helped focus the airlift planning effort both in terms of scope and method.[42]

The attack came in full force on 21 January 1968. Initial NVA artillery barrages destroyed 98 percent of stored ammunition and damaged the 3,900-foot-long runway. The Seabees quickly returned 2,000 feet of the runway to service--allowing United States Air Force C-123 airlifters to land and take off from the besieged base. By the end of the next day, twenty-six C-123 sorties had replenished 130 tons of ammunition. Cargo aircraft continued to land at Khe Sanh through intensifying enemy fire, until 10 February when one C-130 was destroyed on the ground and another badly damaged. From 12 February onward, only the 5-ton-capable C-123s were allowed to land at Khe Sanh.[43]

[42] Vaughan and Donaho, 5.
[43] Nalty, 26-38.

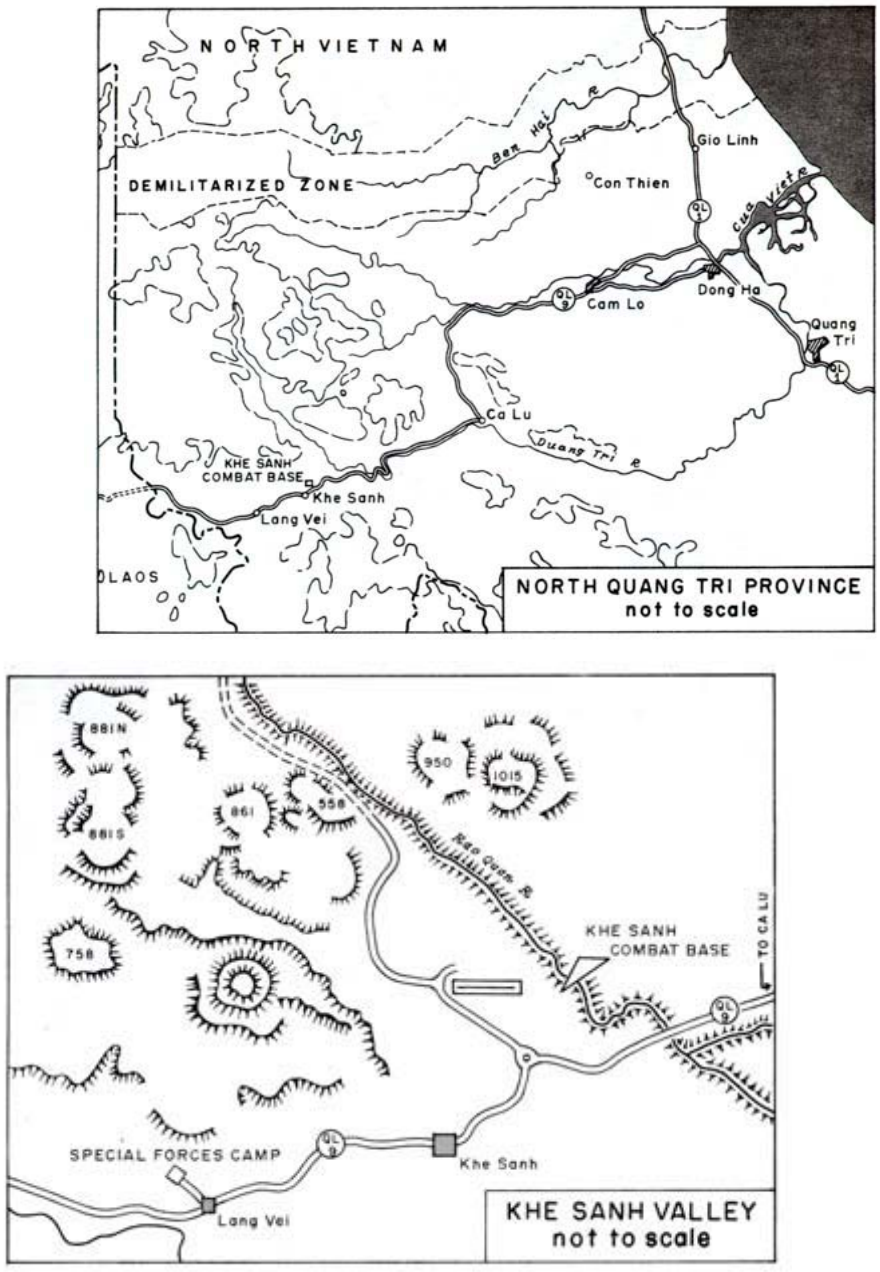

Figure 9. Khe Sanh region and camp layout.[44]

[44] Department of the Army, *Field Artillery 1954-1973*, Chapter 5: "The Hot War" (1968-October 1969), Available from http://www.army.mil/, Internet, Accessed on 4 November 2005. Top map depicts location of Khe Sanh Combat Base and its proximity to the DMZ, Laotian border, and Ca Lu, from where the eventual rescue mission was launched. Bottom map depicts Khe Sanh combat base, runway and relevant high terrain. Unlike the French at Dien Bien Phu, US forces at Khe Sanh made a concerted effort to retain this terrain. The same terrain also necessitated a one-way approach to land (East to West) and reverse departure path. This restricted arrival/departure corridor placed airland missions at greater risk, and contributed to the eventual transition to an airdrop supply system.

Unable to land, C-130 crews employed two aerial delivery techniques new to the Viet Nam war. Both variations on a similar theme, the Low Altitude Parachute Extraction System (LAPES) and the Ground Proximity Extraction System (GPES) allowed precise cargo delivery without requiring the aircraft to land, stop, and then offload. LAPES required aircrews to fly five to ten feet above the runway and jettison an extraction parachute out the cargo door. This small chute would inflate, and then pull the palletized load free of the aircraft. After roughly 750 feet, the pallet would skid to a stop on the runway surface and be recovered by ground crews. GPES required crews to touch down on the runway, but instead of decelerating the airplane, a ground hook would contact the load and extract it from the cargo compartment. Although significantly more dangerous and difficult than landing or airdrop, extraction systems were used throughout the ten-week siege. While more accurate than airdrop, extraction systems delivered significantly less cargo than airdrop or normal landing per attempt, and still relied upon the pilot having clear sight of the runway. In bad weather, they were useless tactics.[45]

Unlike Dien Bien Phu or Stalingrad, airdrop aircraft employed a singular technology to defeat the adverse effects of bad weather: radar. Positioned at the base camp for the purpose of directing air strikes, the radar sets could direct the airdrop crew to a known location near the drop zone, allowing the crew to use basic dead reckoning (heading and timing) to determine the release point--all without ever seeing the airfield or drop zone itself. Over the course of 17 and 18 February, the weather was so bad that "the only planes in the air over Khe Sanh were the . . . transports which delivered 279 tons of supplies in 18 drops. . . . This method was accurate, with a circular error average of 83 yards . . .[46] Such accuracy was not only fortunate, but also required as the drop zone was only 300 yards long.[47]

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[45] Nalty., 51-53.

[46] Ibid., 47 and 50.

[47] Ibid., 47. To understand how small 300 yards is for an airdrop, consider that a C-123 or C-130, traveling at drop airspeed of 130 knots, covers roughly 75 yards every second. An error in timing of more than two seconds in either direction would result in the load landing long or short of the secured drop zone.

Where French airdrop crews suffered at the hands of Viet Minh AAA, United States airlifters at Khe Sanh "enjoyed" having to fly through only small arms-caliber defenses. This was due in large part to the firepower available--over 100,000 tons of bombs and over 150,000 artillery shells were expended on NVA positions around Khe Sanh.[48] General Momyer, commander of 7th Air Force, and eventual single commander of the air effort in support of Khe Sanh after 21 March, had at his disposal three B-52 wings, six Viet Nam-based fighter wings, four Thailand-based fighter wings, one air commando wing, the 1st Marine Air Wing, and the airlifters from the 834th Air Division.[49] Alongside the fighters, B-52s conducted air strikes within 1,000 meters of friendly forces at Khe Sanh--an incredible feat for the times.

Also contributing to the success of the airlift was the use of helicopters. At Khe Sanh, logisticians used helos to evacuate wounded, backhaul logistical supplies (pallets, rigging, and others) and distribute supplies from the combat base to outposts on nearby hilltops. This vertical lift capability prevented airdrops at smaller, less defensible locations--in short, the supplies had a better chance of getting to those who needed them. Aerial bombardment, coupled with surface-to surface fires, ensured the Marines at Khe Sanh, and the airlifters that supplied them, were well supported.

Compared to Dien Bien Phu,

> The magnitude of the Khe Sanh airlift was staggering. The number of supply drops made there by 15 March exceeded the total for all of Vietnam before that time. . . .8,120 tons of cargo were parachuted to the defenders in 601 individual sorties.[50]

Only 460 sorties landed at Khe Sanh, delivering 4,310 tons of cargo and 2,676 passengers. On 30 March, elements of the 26th Marines and 1st Cavalry Division attacked along Highway 9 with the goal of ending the siege at Khe Sanh. The next day, the Marines at Khe Sanh aided themselves by conducting offensive operations for the first time since the siege began. By

[48] Tokar, 22.

[49] In terms of firepower, by today's standards, this equates to 60 B-52s; ten wings of 54 fighters each; and one Marine wing of 108 fighters, plus additional Marine helicopters and KC-130 transports.

6 April, an air cavalry element arrived at Khe Sanh, and two days later United States forces conducted the official relief in place.

In total, 199 Americans died during the siege of Khe Sanh; 1,600 were wounded, of which 845 were evacuated for treatment. Official estimates of enemy casualties hovered near 10,000--nearly one-quarter of all enemy casualties during the Tet offensive.[51]

The ultimate outcome of Khe Sanh could be labeled a draw. The NVA failed to gain territory or a significant victory at any point during Tet. Westmoreland, however, failed to disrupt enemy logistics along the Ho Chi Minh Trail. If anything, the United States may have come up short, losing the information campaign back home with the "defend at all costs" approach to Khe Sanh. Nonetheless, airdrop had a significant impact on the successful outcome at Khe Sanh. Airdrop delivered the lion's share of supplies--in fair and foul weather--with a remarkable average accuracy of 110 yards in good weather and 133 yards in bad weather.[52] Supportive firepower, inventive tactics, improved technologies, and steadfast servicemen made the historically improbable defense of Khe Sanh a military reality.

US Special Forces and the Northern Alliance in Afghanistan, 2001-2002

Having identified the perpetrators of the 11 September 2001 attacks, the Bush administration set in motion a plan to retaliate against international terrorism in general, and Al Qaeda specifically. The initial phases of the operation called for CIA and special operations forces to join with tribal leaders in northern Afghanistan and attempt to build an army capable of overthrowing the Taliban and ousting Al Qaeda.

Afghanistan, a mountainous and landlocked nation, posed serious logistical problems for planners. At the time, the United States did not possess or operate out of any base in or around Afghanistan, a nation roughly the size of Texas. Without a railroad system and with only 1,500

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[50] Nalty, 58.
[51] Ibid., 103.

miles of paved road (see Figure 10), the weather and combat-savvy Mujahideen fighters were sure to bring any ground supply network to a screeching halt. The logistical lessons learned from the Soviet experience in Afghanistan were clear.[53]

Thanks to relationships forged during a recent exercise in neighboring Uzbekistan, however, an intermediate staging base was quickly established at Karshi-Kanabad (known as K2 by American forces) during the first week of October 2001.[54] K2, separated from Afghanistan by mountains towering over 10,000 feet above sea level, would serve as the only support base for the initial Northern Alliance push until a permanent base could be opened in Pakistan and Afghanistan later in 2001.

The terrain, coupled with routinely bad weather during the winter months, would limit the range and payload of rotary wing assets. MH-47s and MH-60s from the United States Special Operations Command performed the initial infiltration missions of the special operations teams tasked to link-up with northern alliance tribal leaders, but these helicopters would not be able to sustain the teams for any significant period of time, nor in any significant quantity. The ground teams, aware of the limitation during pre-mission planning, requested periodic resupply by airdrop to fill the capability gap.

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[52] Ibid., 50.

[53] Charles Russo, LTC, US Army, "Soviet Logistics in the Afghanistan War" (Student Paper, US Army War College, Carlisle Barracks, PA, 1991), 2.

[54] Charles H. Briscoe et al., *Weapon of Choice: US Army Special Operations Forces in Afghanistan* (Ft Leavenworth, KS: Combat Studies Institute Press, 2003), 67.

Figure 10. Afghanistan road map.[55]

Ideally, the airdrop operation would have been conducted from the closest base possible--K2. The capacity of the small, Soviet-made airbase however, was already overwhelmed. Between the Army helicopters, an Air Force search and rescue fleet, and the daily airlift flow, there was not enough physical space to station airdrop aircraft at K2.[56] The closest airbase with sufficient security, ramp space, and cargo handling facilities to support an airdrop fleet of aircraft was Incirlik Air Base, Turkey.

On 17 October 2001, four United States Air Force MC-130H aircraft and supporting personnel from Royal Air Force Mildenhall, United Kingdom deployed to Incirlik to support Operation Enduring Freedom, two days before the first Army special forces team was inserted

[55] USACGSC, Map available from http://fmso.leavenworth.army.mil/, Internet, Accessed on 4 Nov 2005. . Note the limited number of navigable roads, considering Afghanistan is the size of Texas. Logistics facilities refer to Soviet operations in the 1980s, NOT US operations in 2001-present.

[56] Briscoe, 72.

into Afghanistan.[57] Army liaison officers from Special Operations Command Europe (SOCEUR) and riggers from the 10th Special Forces Group, embedded with the Air Force special operations forces, formed the core of the special operations element in Turkey.[58]

The command and control structure was challenging to say the least, given the distances and lead times required. To request additional supply missions, teams on the ground would relay their needs to their parent headquarters at K2--the Joint Special Operations Task Force-North, or JSOTF-N. From K2, JSOTF-N sent the requests to SOCEUR's logistics planners, who worked closely with the 21st Theater Support Command in Germany to fill the supply requests. With the supplies in hand, riggers from the 5th Quartermaster Company (an Army Reserve unit from Georgia mobilized to serve in Germany) packed the airdrop bundles and rigged the parachutes. Strategic airlift C-5 or C-17 aircraft then delivered the bundles to Incirlik for transload onto the MC-130s.

Concurrently with each transmission to SOCEUR headquarters in Germany, JSOTF-N sent an air support request to the MC-130 force at Incirlik AB. Typically with only twenty-four hours notice--a significant departure from the doctrinally advertised SOF ninety-six-hour planning cycle--aircrews planned their routes. Air Force special operations leaders at Incirlik positioned an experienced navigator liaison officer at JSOTF-N in K2. This officer provided an initial "sanity check" on drop zone location, and helped interpret the needs of the ground team into useful data for the aircrews. On multiple occasions, the fast moving ground war outpaced airdrop missions, and drop zones were retasked in-flight, providing a great challenge to aircrews. Here, too, the liaison from Incirlik proved his weight in gold, working with the ground teams to select drop zones that would ensure success despite less-than-minimal planning.[59]

Competing mission needs between the ground teams caused missions or loads to be "bumped" in priority to a later date. One such occasion occurred early in the war, when a special

[57] Mark Alsid, Col, USAF, E-mail correspondence with author, 15 November 2005.
[58] Briscoe et al., 130.

forces team infiltrated to solicit the support of General Dostrum needed to prove their value. Although this team was not scheduled for a resupply mission for many days hence, JSOTF-N reprioritized this mission to 1st priority given the political-military implications of failing to recruit Dostrum as an ally. The next night, two MC-130H aircrews delivered thirty-two bundles of blankets, food, horse fodder and weapons, dropping the bundles in Dostrum's back yard.[60] At the leading edge of the mission, the Army Special Forces liaisons ensured the proper bundles were bumped or pushed--at the trailing edge, habitual training relationships provided peace of mind for the ground teams that the Air Force Special Operations aircrews would deliver with "bulls-eye accuracy."[61]

The teams on the ground had identified (during pre-infiltration planning) over 256 supply bundles to be assembled and delivered over six-months.[62] Most would arrive one or two bundles per drop, with one aircraft servicing one drop zone for each sortie. This apparently reduced flow is standard for a Special Forces team living off the land, and with support from indigenous forces. Planners had not accounted for, however, the quantity and variety of unexpected items that would prove crucial to cementing relations with the northern alliance leaders.

At the beginning of the operation, the 200th Material Management Center--the United States Army logistics unit from the 21st Theater Support Command in Germany responsible for acquiring the supplied to be dropped--had only 200 parachutes on hand within Germany. As

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[59] Alsid.

[60] Cory M. Peterson, Major, USAF, interview by author, 21 October 2005, Ft Leavenworth, KS.

[61] Briscoe et al., 128. Not only was accuracy impressive, missions were hailed by SF soldiers after the operation as "nothin' but net" as crews dropped bundles "onto drop zones no bigger than a tennis court."

[62] Basic math would imply that planners had predicted 281 STONs over 180 days, for an average of 1.56 STONs per day, assuming 2,200 pounds per bundle.

requests for horse saddles, blankets, ammunition, weapons, and red wheat[63] poured in from JSOTF-N, estimates for parachutes quickly reached 600-800.[64]

Delivering the bundles from Turkey required a sixteen-hour mission, with an aerial refueling mission each way, climaxing with one hour of low-level in terrain that out-climbed the aircraft's terrain following system.[65] The Taliban possessed no competent air fleet, and after the first night of bombing, no air force at all. Surface to air threats posed the main military hazard, consisting of impossible-to-destroy small arms, light caliber AAA, and shoulder-fired infrared guided missiles.[66] Despite a few engagements, surprise, defensive countermeasures, and the cover of darkness proved enough to defend the airdropping aircraft. Perhaps the most significant technical aspect of airdrop missions during OEF was the use of the global positioning system, or GPS. The navigational accuracy of GPS not only ensured an accurate airdrop, but it enabled the low-altitude airdrops by providing confidence to the aircrews on their location in the featureless, yet extreme mountainous terrain. GPS, along with terrain following radar, made night combat airdrop missions in foul weather possible.

By mid-November 2001, the airdrop flow slowed to a trickle--from two or three missions per night to one mission per night--due mostly to the establishment of an airbase inside Afghanistan. On 10 January 2002, the Air Force special operations element in Turkey redeployed home after completing 135 combat missions, delivering 1.8 million pounds of supplies in 1,347 containers over 73 days.[67] The support in Turkey, Germany, and the United States--both supply

[63] Briscoe et al., 130. The red wheat and blankets were delivered for two weeks, up to the point the ground offensive began against the Taliban. The Red Wheat came from Texas and Montana, and most closely resembled the wheat used by Afghans in their cooking.

[64] Dennis Steele, "Unconventional Logistics," *Army Magazine* 52, no. 11 (November 2002), pg 58.

[65] Peterson.

[66] Ibid.

[67] Briscoe et al., 254. Again, basic math calculates an average of 12.3 STONs per day.

and maintenance personnel--delivered a 99 percent mission success rate.[68] The aircrews at Incirlik "serviced" fifty-four different drop zones in Afghanistan (see Appendix 7), the breadth of which is indicative of why ground and rotary wing resupply were inadequate to the task.[69] In total, airdrop supported not only 316 American soldiers in Afghanistan with supplies, ammo, and arms but also provided food, blankets, and animal fodder arms and ammunition for some 3,000 Afghani Northern Alliance fighters.[70]

Not only did tactical airlift airdrop supplies to coalition ground forces, but "strategic airframes" were involved as well. In order to facilitate Hamid Karzai and his 200 Afghani volunteers in their planned attack on Kandahar, Karzai's Special Forces advisor team created an ad hoc basic training school. On 1 December 2001, they received an airdrop of enough arms, munitions, food, and humanitarian aid to train the ad hoc force and support the local populace. By 7 December, Kandahar had fallen, and the rest of Afghanistan was not far behind.[71]

Lessons Learned

There are a number of lessons that can be drawn from these case studies. First, air superiority is absolutely crucial to effective airdrop resupply. During all three cases, aircrews were not constrained by enemy fighter activity when it came to route selection, time of day, or employment altitude. While not reviewed in this chapter, the Luftwaffe at Stalingrad did not enjoy air superiority and suffered mightily as a result. Second, without superior fire suppression, any advantage gained from air superiority is negated. If the enemy can target "at will" the drop zone personnel or the aircraft themselves, the airdrop effort will fail. The lack of suitable drop

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[68] Alsid. Only one planned mission did not complete on time. It returned to base due to a hydraulic system failure. The load was placed on a spare aircraft, and the crew dropped it later that night.

[69] 7th Special Operations Squadron History, 2004.

[70] Sean Naylor, *Not a Good Day to Die:The Untold Story of Operation Anaconda* (New York: Berkley Books 2005), 14 cites 316 as the number of SF soldiers, (The US Army Special Operations Command will not release the total number of Special Forces in country at the time). Briscoe et al., 125, 167, 174. Briscoe cites Northern Alliance forces as 200 under Karzai (174), 800 under Sherzai (167) and 2,000 under Dostum (125).

zones (more than one specifically) can directly improve the enemy's ability to target both ground forces and aircraft. Without dominant fire suppression, recovery of supplies from a single drop zone will be more than problematic. Third, airdrop cannot deliver the entire supply requirement, whether in quantity or by class of supply. The airlift effort at Khe Sanh, even after transitioning to airdrop, relied on airland from C-123s to deliver replacement personnel and fragile equipment and supplies. Finally, it is clear that airdrop must only be considered a temporary fix. If relied upon as a "do or die" last resort, the probability of success and survival drops dramatically. When planning and conducting an airdrop effort, commanders must vigorously pursue avenues that will re-open ground and/or airland means of supply.

	Dien Bien Phu	**Khe Sanh**	**Enduring Freedom**
Why?	Intentional isolation	Intentional isolation	Intentional isolation
Duration in days?	56	77	73
To Whom?	Light Forces	Light Forces	Light Forces
# of Forces?	16,500	6,000	316+3000^^
How?	Last resort	Airland & airlift	Mixed Effort^
Required STONs/day	200	235	1.56
Avg STONs/Day	120	220	12
Air Superiority?	Yes	Yes	Yes
Dominant Fires?	No	Yes	Yes
DZ suitability?	Poor	Poor	Good*
Ground Routes Available?	No	Yes	Yes**
Notes:			
* Certain areas of AFG were too mountainous to establish a DZ. Many areas, however, were flat enough to receive CDS bundles. Foliage was not an issue.			
** Ground routes existed, but the quality of the roads, weather, terrain and the distances involved combined to negate surface transportation.			
^ The early phase of OEF relied on mostly airdrop to support SF soldiers, but alos used helicopter airlift in a limited fashion.			
^^ Airdrop supplied not only 316 SF soldiers, but some Northern Alliance needs as well. Certainly, it must be acknowledged that some SF needs were accomodated by their Northern Alliance counterparts.			

Figure 11. Summary of Case Study Conditions.

[71] Briscoe et al., 173-179.

THE MYTHS SURROUNDING AIRDROP IN TODAY'S COE

With a brief review of these three cases complete, the big "so what" of this project looms directly ahead. Is airdrop useful in today's COE? If so, why, when, how, and in support of whom should commanders use airdrop to resupply? This chapter will offer some basic parameters for planners to consider when determining if airdrop is appropriate for use in today's COE. Addressing some common reasons for dismissing airdrop as a method of supplying forces operating in noncontiguous battlespace will assist in defining considerations for airdrop's use.

Inaccuracy

The last thing any commander needs to worry about is whether the delivered supplies will fall into the wrong hands. Alternatively, and just as demoralizing, the supplies arrive on scene only to be rendered useless by falling into inaccessible territory like a river or a minefield. During the Dien Bien Phu campaign, such maladies contributed to the eventual failure of the entire operation. At Khe Sanh and in Afghanistan, however, airdrop efforts achieved a greater level of accuracy due largely to improved technology.

At Khe Sanh, the use of ground-based radars and navigational beacons contributed to improved airdrop accuracy. Such luxuries are attributable to Khe Sanh itself serving as an airbase, as well as a combat base. Given the battlespace environment of today's conflicts, it is wholly unreasonable to expect each AO to be fitted with such devices, even though they do still exist. In Afghanistan, the greatest contributing technology to airdrop accuracy was what is now commonplace--integrated GPS navigation, operated and augmented by skilled, trained aircrew. Not reliant on any ground-based navigation aid, aircrews can navigate to the drop zone, and use either visual recognition of pre-arranged signals, or airborne radar verification of GPS accuracy to ensure the aircraft is at the appropriate release point. GPS is now an inherent part of the navigation suite of both tactical airlift aircraft in the inventory--C-130 and C-17.

Even if a ground component customer is not satisfied with the technological advances of today's airdrop aircraft, there are two measures within the control of the airdrop customer to remedy the apparent accuracy issue: The first is drop zone selection. While it may be a restatement of the obvious, the bigger the drop zone, the better the chances of the airdropped load landing within the confines of the drop zone. This is problematic for the customer, however. The bigger the drop zone, the greater the area that needs to be secured; more importantly, the greater the number of people that must be pulled away from primary duties for drop zone security. As airdrop is a temporary, surge-style operation, troops do not need to be dedicated to hold the drop zone. In fact, the troops that would otherwise be driving the roads or escorting convoys could ideally serve the drop zone security function. The amount of time required to secure a drop zone would be significantly less than time required to convoy supplies out and back, lessening the impact on the receiving unit's mission.

In Iraq and Afghanistan today, the availability of space suitable for drop zone usage is nearly unrestricted.[72] Such is the nature of desert environments. For any commander operating in and around an urban area, virtually the entire space outside the inhabited communities is available, open, non-arable land suitable for drop zones. Different environments--especially jungle--may not be as suitable.

Alternatively, when the customer cannot expand the size of the drop zone, the location could be moved. Areas in mountainous terrain are particularly challenging, as steep terrain detracts from airdrop load recoverability and survivability. Simply put, the flatter, the better. Teams in Afghanistan learned this lesson early on; moving their drop zones in coordination with the aircrews to flatter, more open areas in the valley floors.

When the drop zone size or location is not at the customer's discretion, the customer has a second alternative. Ground customers are no longer completely at the mercy of the weather, the

delivering aircraft, and the aircrew for accuracy. In the last five years, GPS-guided parachute platforms have been developed, tested, and fielded. Conceptually, the system (known as the "Sherpa") relies on a steerable parachute attached to a standard container delivery system bundle, steered by a GPS kit. The aircrew flies to a pre-determined release point, typically at an altitude much higher than standard delivery methods.[73] Flying at a higher altitude mitigates many surface-to-air threats and allows the GPS kit to steer the parachute and fly a pre-programmed approach to the desired impact point, adjusting for winds during the descent. For safety purposes, the aerial delivery, rigging unit can program a path to avoid built-up areas, potential threat areas, or unrecoverable areas such as wetlands or minefields. The customer can also choose to utilize a remote hand controller. Essentially a joystick, the remote control allows the ground customer to "fly" the chute and its load to a new location once released by the aircraft, or to override an incorrect parachute flight path. Most significantly, this is not just some unfunded developmental system. The Marine Corps has been employing it in Iraq since May 2004, with an average drop score of 69.25 meters from the target, vice 327 meters for conventional ballistic delivery.[74]

The "Sherpa" aside, the accuracy of today's conventional delivery system, using aircraft GPS to overfly the desired release point, has improved dramatically since the days of Stalingrad and Dien Bien Phu. Had GPS been commonplace for aircraft during Dien Bien Phu, for example, the 2,000-yard radius drop zone would have been more than sufficient for airdrop resupply.

Inefficiency

Clearly, there is a demonstrated inefficiency in airdrop, or else it would ***be*** the preferred method of supply delivery today. While this section is not designed to argue otherwise, an

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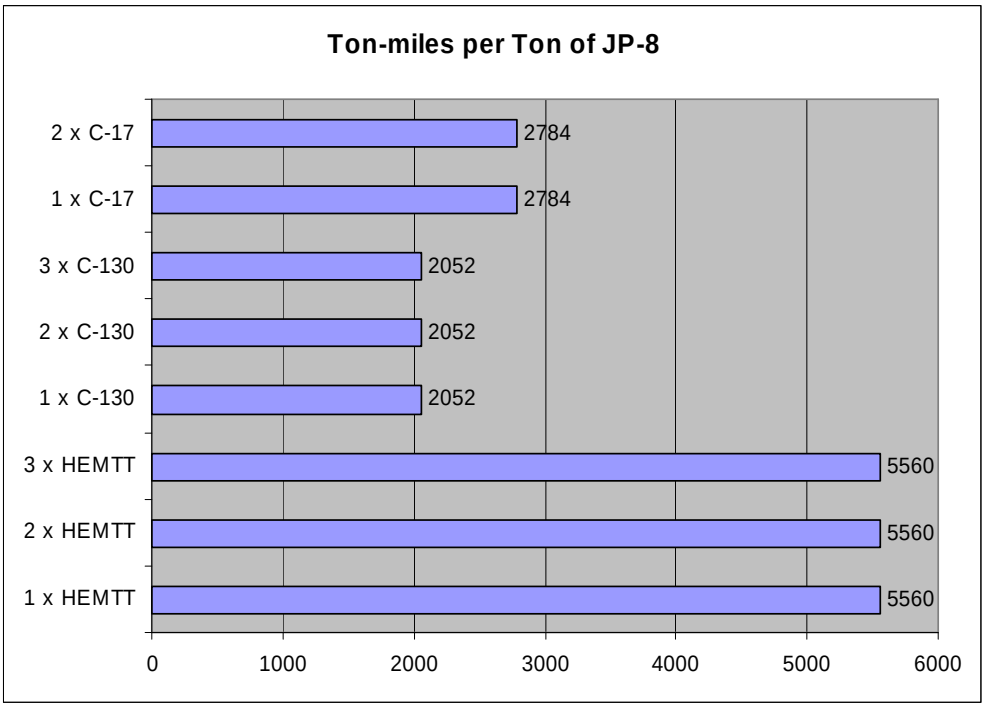
[72] With the notable exception of units embedded in urban terrain. While the solution here may not be airdrop, urban areas are likely collocated with airfields, and thus long-haul supply convoys are substituted with airland delivery.

[73] Currently, most manually initiated, ballistically free-falling systems are delivered from an altitude of 400' to 2000' above ground level (AGL). A lower altitude decreases the time in which winds can unpredictably affect the fall of the load, and therefore increases accuracy.

understanding of the efficiencies at work is necessary to put in perspective the effectiveness of saving lives by removing troops from supply convoy duty.

An objective formula useful for contemplating such efficiencies is the ton-miles per tons of fuel formula. Taken from Dr. Christopher Gabel's paper on Civil War generalship, the formula multiplies tons carried by miles traveled on a ton of fuel. Comparative results for a C-130, C-17 and the Army's Heavy Expanded Mobility Tactical Truck (HEMTT) family of vehicles are presented in Figure 12, with amplifying data available in Appendix 2.[75] In terms of strict efficiency, the HEMTT is more efficient than a C-17 by a factor of nearly two, and is 2.7 times more efficient than a C-130. Note that despite expected economies of scale in using multiple platforms per effort, the efficiency rating does not change. There are hidden savings, however.



[74] Kevin Brown, Lt Col, USMC, United States Marine Corps Center for Lessons Learned (MCCLL), Interview by author, 1 February 2006, Ft Leavenworth, KS.

[75] Assumptions for Figure 4: 1 gal JP-8 = 7 lbs; 1 x C-130 airdrop load of 36,000 lbs, based on 16 x A-22 containers; C-130 burns 3 tons JP-8 per hour, traveling 340 miles/hr; 1 x C-17 deliver 8 platforms with up to 14,500 pounds each; C-17 burns 8.5 tons per hour, traveling 410 miles/hour; Facts on HEMTT and HMMWV is available from http://www.army.mil/fact_ files_site/, Internet, Accessed on 13 Dec 2005. Supporting data for calculations is available in Appendix 8.

Figure 12. Ton-miles per ton of fuel consumed.

Assuming a minimum of four armored HMMWVs per convoy (to serve as escorts), the more HEMTTs in the convoy, the better use of the escort vehicles.[76] Conversely, every vehicle in the convoy must make a round-trip through unsecured territory, putting the personnel at risk twice, yet the aircraft can overfly or circumnavigate the ground-based threat in today's COE. Finally, the ground convoy can backhaul. Whether it be vehicles needing depot-level maintenance or personnel needing R&R, a ground convoy can deliver both ways. An airdrop aircraft simply cannot. In fact, in order to minimize airdrop costs, a second platform--truck or helicopter--must participate to return airdrop rigging into the system.

A secondary method of evaluating efficiency would be to consider the time factor involved, as a measure of risk to the forces involved. Appendix 3 lays out an assessment of the time-distance problem that represents the logistician's daily reality. While airdrop is certainly not the most efficient supply method when fuel consumption is the evaluative criteria, it provides three to four times the deliverable supplies that a single ground convoy vehicle could.[77] Depending on the distance involved, the difference may be even greater. For one-way trips that are long enough to require the ground convoy crew to remain overnight at the destination, that convoy crew and the associated vehicles are then unavailable to repeat the process the next day. The aircraft and aircrew, maintenance permitting, could repeat the multi-trip plan the next day.

A final level of efficiency concerns training resources. United States Air Force, Marine Corps and most coalition operators of the C-130 and C-17 train regularly to conduct resupply airdrops. It is not a capability created and sustained for deployment purposes only. Airdrop lies

[76] Richard M. Cabrey, LTC, USA, Interview by author, 13 October 2005, Ft Leavenworth, KS. LTC Cabrey described using escorts in front and back, as well as interspersed within the convoy. With three soldiers per escort vehicle, the number of Americans at risk is much greater than via airdrop from an aircrew of 6 (C-130) or 4 (C-17).

[77] The author acknowledges that convoys do not typically operate as single vehicles. In terms of risk, however, one C-130 airdrop mission risks 6 aircrew lives (four aircrew per C-17) for roughly 15 STONS delivered. A convoy that only risks 6 lives would consist of 1 HEMTT

at the very heart of core training tasks for tactical airlifters. Active duty, Air National Guard and Air Force Reserve units alike all maintain the capability to conduct single-ship and formation airdrop. In the mobility C-130 community, airdrop comprises 16 percent of pilot training events and 26 percent of navigator events every six months; in the C-17 community, 27 percent of pilot requirements; and in special operations' MC-130Es, 21 percent of pilot events and 30 percent of navigator events.[78] Ground forces, however, must train-up their specific mission sets based on the environment and mission they expect to encounter. To prepare for a mission set and not use it even when the situation warrants is perhaps the greatest inefficiency.

Complexity

Airdrop complexity may be better defined as "how difficult it is to coordinate an airdrop," versus coordinate a ground convoy. For organizations with historical ties to airdrop--SOF or the paratroopers of the 82d Airborne Division, for example--airdrop is a recognized and familiar means of supply. For units that can control the airdrop under a common command--SOF and the United States Marine Corps--the complexity of airdrop is not so daunting. For the rest of the conventional Army, however, choosing airdrop over ground convoy requires the purest form of joint interdependence. Understandably, conventional Army units view airdrop as more complex because they are required to coordinate unfamiliar activities.

Airdrop from a ground logistician's perspective, is essentially a "pitch and catch" operation. At the "pitch" end, the Army provides the deliverables to the Air Force through riggers and intrabase transporters. At the "catch" end, the Army operates the drop zone, then recovers and distributes the deliverables. Unlike a ground convoy, however, the Army is not

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and two escort vehicles with 2 personnel each, totaling 6 personnel to deliver 5 STONS. Thus this table compares 1 C-130 to 1 C-17 to 1 HEMTT.

[78] C-130 data from Department of the Air Force, Air Force Instruction (AFI) 11-2C-130 vol. 1, *C-130 Aircrew Training*, Table 4.5 (Washington, DC: Government Printing Office, 2004), 35. C-17 data from Department of the Air Force, AFI 11-2C-17 vol 1, *C-17 Aircrew Training*, Table 4.5 (Washington, DC: Government Printing Office, 2005), 32. MC-130 data from

responsible for clearing the route, securing the load in transit, tracking the load in transit, or even deconflicting the movement of the load with other movements along the same route. The air component performs these functions. In terms of complexity, the benefit is actually twofold, in that the convoy's return trip does not need to be coordinated. From an air perspective, airdrop, unlike airland delivery, does not require garnering "slot times" into airfields with limited aircraft handling capability. Airdrop can deliver to any suitable open space, and is not constrained by runway or parking apron availability.

Conventional Army units in Afghanistan have overcome complexity. One would think that the IEDs and enemy activity in Iraq would prove as strong an impetus to use airdrop as terrain, infrastructure and weather in Afghanistan. With each passing day that coalition forces choose airdrop in Afghanistan, both sides become more familiar with the process--ground and air. In Iraq, the inverse is true. Every day that airdrop is overlooked is another day of reinforcing the familiar.

Such a situation is bearing out in Iraq, but not in Afghanistan. In Afghanistan, the road network, while vastly improved thanks to coalition forces, is still miserable by western standards. Constrained by restrictive terrain and foul seasonal weather, Army logisticians have increasingly turned to airdrop to deliver supplies to conventional combat troops stationed in outlying areas.

In the first half of 2003, logisticians supporting conventional combat forces began to employ airdrop in a planned manner. Based primarily on weather forecasts, but also on intelligence estimates of ground threat to LOCs, corps-level logisticians tasked Army quartermaster rigger units to build airdrop loads, and coordinated with conventional airlift planners at Central Command's air operations center.

In February 2003, a formation of two Air Mobility Command C-130s delivered 70,000 pounds of supplies in 32 bundles to an Army unit isolated when forecasted bad weather prevented

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Department of the Air Force, AFI 11-2MC-130 vol 1, *MC-130 Aircrew Training*, Table 4.5

deployment of helicopter resupply through the mountains. The aircraft, staged out of K2, were tasked via the air tasking order with an initial warning order seventy-two hours prior. On the mission day, they flew to an airfield in Afghanistan along with a spare third aircraft. There, they uploaded the bundles, departed for the airdrop, and recovered back at K2. It is important to note that this mission, and others like it, remained flexible enough to accommodate a shift in drop zone location of four nautical miles--on the morning of the drop. The joint requirement to survey the drop zone for safety produced a "tactical survey," shortening the approval process significantly and ensuring mission accomplishment.[79]

On a separate occasion in the spring of 2003, a unit in the 82d Airborne Division faced a fuel shortage when weather cancelled fuel delivery via ground convoy. Within thirty-six hours, riggers assembled an airdrop package, a two-ship of C-130 aircrews planned and executed the mission, and the customer received its much needed bulk fuel. One aircraft dropped a 28-foot pallet with six 500-gallon fuel bladders, and the other aircraft dropped two 12-foot pallets with three bladders and pumping equipment to operate the impromptu "gas station." The short-term delivery of 4,500 gallons of JP-8 (enough to fill the tanks of 180 HMMWVs or 11 UH-60 Blackhawks[80]) ensured the ground unit's mission continued unabated.[81]

Even as recently as winter 2005, logisticians in Afghanistan called on airdrop to sustain the force. Initial media releases from the United States Central Command Air Forces highlighted 10 missions over 6 weeks, airdropping a total of 197,100 pounds of combat supplies to troops in

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(Washington, DC: Government Printing Office, 2003), 53.

[79] Rod Simpson, Major, USAF, Air Mobility Command, C-130 Navigator, Interview by author and e-mail responses, October and November 2005, Ft Leavenworth, KS.

[80] T.O. 1-HH-60(G)-1, Section III covers basic characteristics of the USAF's HH-60, of which basic fuel capacity is common to the US Army's UH-60 Blackhawk.

[81] Peter Lautzenheiser, CW2, US Army. Telephone interview by author, 12 October 2005, Ft Leavenworth, KS.

central, southern and eastern Afghanistan.[82] In short, airdrop replaced the requirement for twenty HEMTTs and associated escort vehicles on the often-treacherous roads of Afghanistan.

In contrast to Afghanistan, the only organization currently utilizing airdrop for resupply in Iraq is the Marine Corps. Between 19 May and 8 October 2004, Marine forces operationally tested airdrop to deliver over 102 tons of supplies to forces fielded in remote regions of Iraq.[83] Using both KC-130 aircraft and CH-53 helicopters, they performed fourteen missions total; twelve C-130 missions during the day, with only the two helicopter missions at night. The Marine Corps Center for Lessons Learned clearly viewed the effort as a success: "During OIF II, the 1st [Force Service Support Group] FSSG proved that air delivery operations can be an effective means for re-supplying dispersed units in remote geographic areas."[84] Eight of the thirteen missions employed the "Sherpa" GPS-guided parachute discussed earlier.

The operations were not without their fair share of miscues. Miscommunications, procedural errors and system malfunctions detracted from complete success. An average of 8 percent of the total supplies delivered was damaged in the process. Nevertheless, most of these issues were resolved with gained experience between the participating units. This experience paid off in the spring of 2005 as Marines fought in the western Iraqi desert.

On 16 April 2005, a Marine Corps KC-130J airdropped 16 containers totaling 22,430 pounds of supplies to Marines in a "remote outpost in the Iraq desert."[85] Using the conventional container delivery method and flying at night with night vision goggles, the aircrew delivered the load within 25 meters of the target. The key significance of the mission was not the first airdrop employment of the new KC-130J, but the public recognition that the mission actually replaced a

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[82] US Central Command Air Forces, *Daily Airpower Summary*, 10, 17, 28, and 29 November 2005, and 1, 2, 8, 14, 16, and 27 December 2005. Available from http://www.af.mil/news/, Internet, Accessed on dates listed in this footnote.

[83] Brown interview.

[84] Ibid.

[85] Ben W. Grant, 1st Lt, USMC, "KC-130J Aircraft Makes First Combat Aerial Delivery," *USMC News*, 18 April 2005.

convoy of vehicles. "The airdrop measured six truck-loads worth of supplies," reported a Marine air operations officer, "which meant more than 12 Marines weren't required to convoy that day."

The final aspect of complexity addresses the threat to airdrop aircraft. Unlike airland delivery, or even convoy operations, airdrop aircraft retain a greater freedom of maneuver. Airland aircraft, by definition, will always fly the final one-fourth to one-half mile of their approach directly off the end of the runway. Regardless of type of approach flown (straight-in, 90-degree turn, 180-degree turn, high spiral, and others), landing and departing aircraft **must** overfly this piece of terrain when landing. In addition, aircraft configuration prohibits defensive maneuvering during the final landing or initial take-off phases. In order to ensure the safety of airland aircraft, combat ground forces typically secure an area off the end of the runway in use. From prior to arrival, until after departure, these forces are dedicated to preventing enemy action against these high value assets. Given the amount of time needed to unload an aircraft, this security task could last hours, and the amount of area secured by these forces should be consistent with the greatest range of enemy armament locally present. This exact dilemma caused Khe Sanh planners to elect to use airdrop after losing a C-130 to mortar fire.

Ground convoys face a similar constraint. While a road network may offer many variations on how to navigate from "a" to "b," the entry and exit points of a secure compound are finite. If used repetitively, these entry points become easily discernable and thus attackable by enemy forces.

Airdrop, on the other hand, is not nearly as restricted. Granted, certain environments would constrain a run-in to a drop zone--terrain in Afghanistan, or built-up areas known to be insurgent strongholds, for example. Given the COE in Iraq, however, the amount of available space outside urban areas is well suited for airdrop. To establish a drop zone outside an urban area, a receiving unit need only go farther than the longest range surface-to-air weapon system--typically about six kilometers. To ensure the safety of the DZ party, seven kilometers from an

urban area provides sufficient separation from 120-millimeter mortar fire.[86] In the case of LTC Cabrey's unit in Ar Ramadi, a drop zone ten kilometers west of the town would enable a C-130 to approach from nearly any point on the compass. Changing the drop zone location and changing the aircraft run-in heading would enhance security for multiple efforts on different days.

In the end, the perception of airdrop as a complex operation can be largely attributed to two main issues: the majority of conventional ground forces are unfamiliar with airdrop, and an existing ground transportation infrastructure makes it easy to default to the familiar. While complexity is largely a matter of perception, an objective responsiveness evaluation is possible.

Unresponsiveness

The final common critique of airdrop covered in this paper is unresponsiveness. In fairness to the ground customer, short-notice needs (for example, less than forty-eight hours)--especially in a theater where airdrop is not frequently performed and the system to handle such requests is unexercised--are likely to be serviced faster through internal ground coordination for convoy. This presumes an aircraft is not pre-identified to conduct airdrop.

The responsiveness of airdrop is best measured in terms of time. How quickly can a load be delivered from the time it is requested? Figures 13-16 highlight break points in terms of distance, where below the intersection, ground transport is more responsive.[87] Above the intersection, the time-distance problem favors the greater speed of aircraft. As the load quantity increases, however, more time is spent rigging the airdrop load, while the ground convoy is making progress towards the objective. The key assumption to be met in unlocking airdrop's potential is sufficient warning to all parties involved--most likely twenty-four to thirty-six hours out is required to book airspace, coordinate DZ location, and apportion aircraft for the mission.

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[86] Unclassified weapons system ranges based on SA-18 and 120mm mortar. Available from www.globalsecurity.org, Internet, Accessed on date 10 January 2006.

[87] Appendix 11 contains the supporting calculations and assumptions made in creating this analysis.

Figure 14, the comparison for a 35,000-pound load, demarks 300 miles as the breaking point where beyond that distance airdrop becomes a more responsive means of delivery. This lends credence to the concept of an intermediate staging base (ISB) as demonstrated in OEF, and is borne out in joint and service doctrine (see next chapter). Using airdrop for direct delivery of supplies from an ISB to the customer would reduce not only the "line haul" ground transportation from ISB to forward operating base (FOB), but also the "local haul" from FOB to the customer.

Before departing responsiveness, it is worth restating that recent examples support the notion that airdrop is not so rigid as to deny changes inside the "holy" seventy-two-hour Air Tasking Order cycle. In 2001, MC-130 crews altered their target in flight, after receiving a same-day change in load and customer before departing Incirlik AB, Turkey. In 2003, C-130 crews in Afghanistan changed their drop zone by over four miles during the final three hours of mission planning prior to takeoff. If a system is in place to coordinate, prioritize and deconflict such efforts, most changes can be absorbed.

Class of Supply Analysis

Given such a system, what level of support is airdrop actually capable of delivering? Is it a "drop in the bucket," or more than sufficient? What type of aerial delivery unit is required to support a force of a given size? By returning to our example battalion task force in Ramadi, an examination of supply requirements compared to airdrop capabilities will address these questions.

As with any planning effort, available courses of action are based on mission analysis that compares requirements to capabilities, among other factors. For logistics planners, a class of supply analysis that determines daily consumption rates for allocated forces helps to determine how much of each class of supply is needed to sustain the force. For every unique scenario, there are unique supply requirements and consumption rates, thus this paper provides a singular example tied to the battalion task force presented in the introduction chapter of this paper.

Figure 17 demonstrates that, for a 1600-man task force, a flight of four C-130s--or one C-17 and two C-130s--could deliver one full day of supply (DOS) for Classes I, II, IIIP, IV, VI, and VIII, as well as one unit basic load for all weapon systems assigned (minus 155-millimeter, self-propelled artillery).[88] The absence of Class IIIB--bulk fuel--is noteworthy. Apart from sporadic efforts like CW2 Lautzenheiser's example from Afghanistan, airdrop is neither efficient nor effective as a means of bulk fuel delivery.

[88] Without actual historical consumption rates for these units in Ramadi, the author utilized the Logistics Estimate Worksheet version 10, available for download from www.cascom.army.mil. The number of weapons systems were estimated on a rough order of magnitude based on interview inputs from LTC Lukaskiewicz and LTC Cabrey.

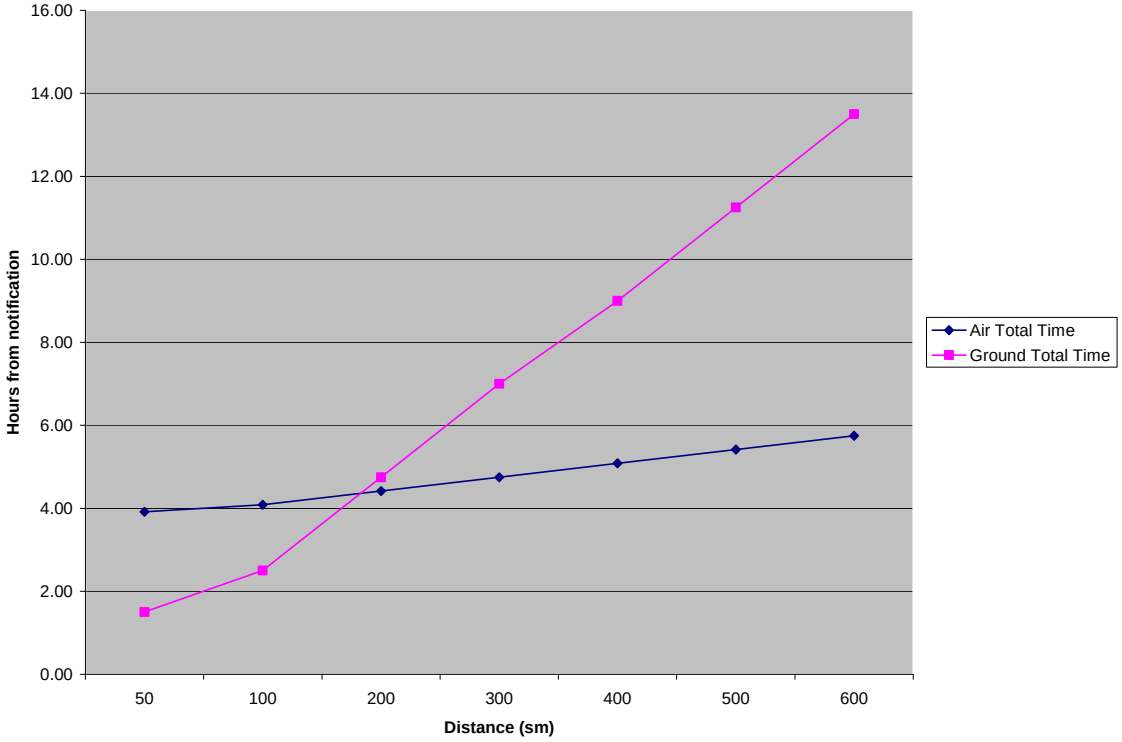

Figure 13. Responsiveness for a 20,000-lb. Load

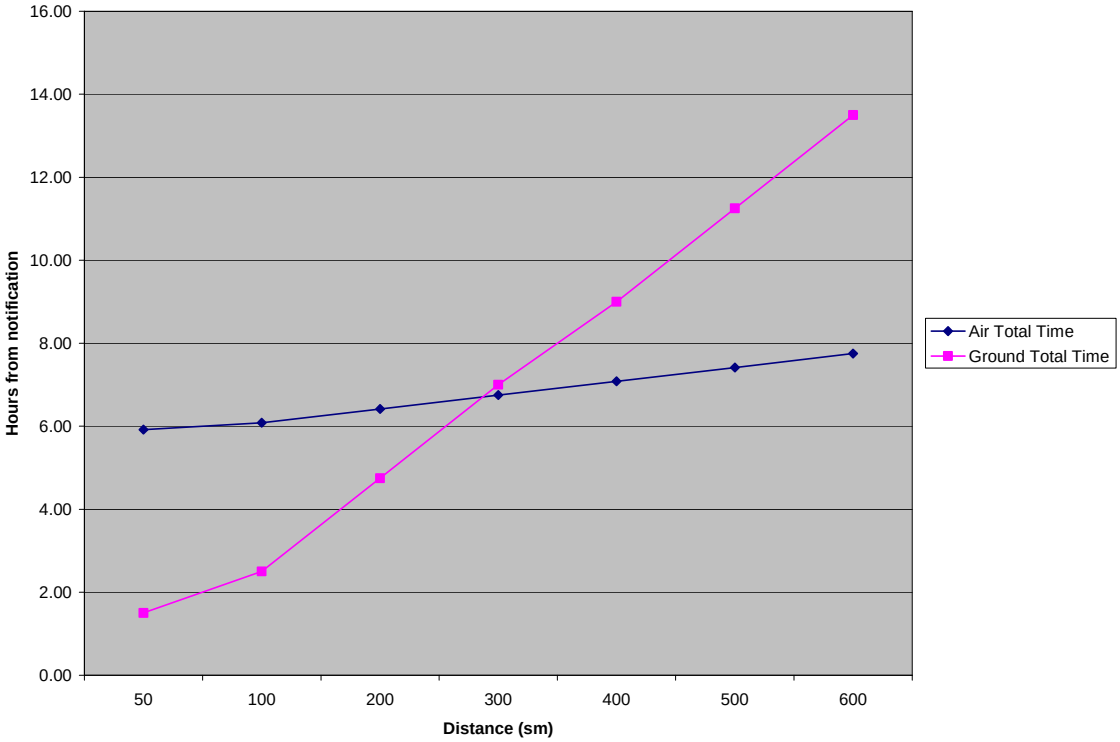

Figure 14. Responsiveness for a 35,000-lb load

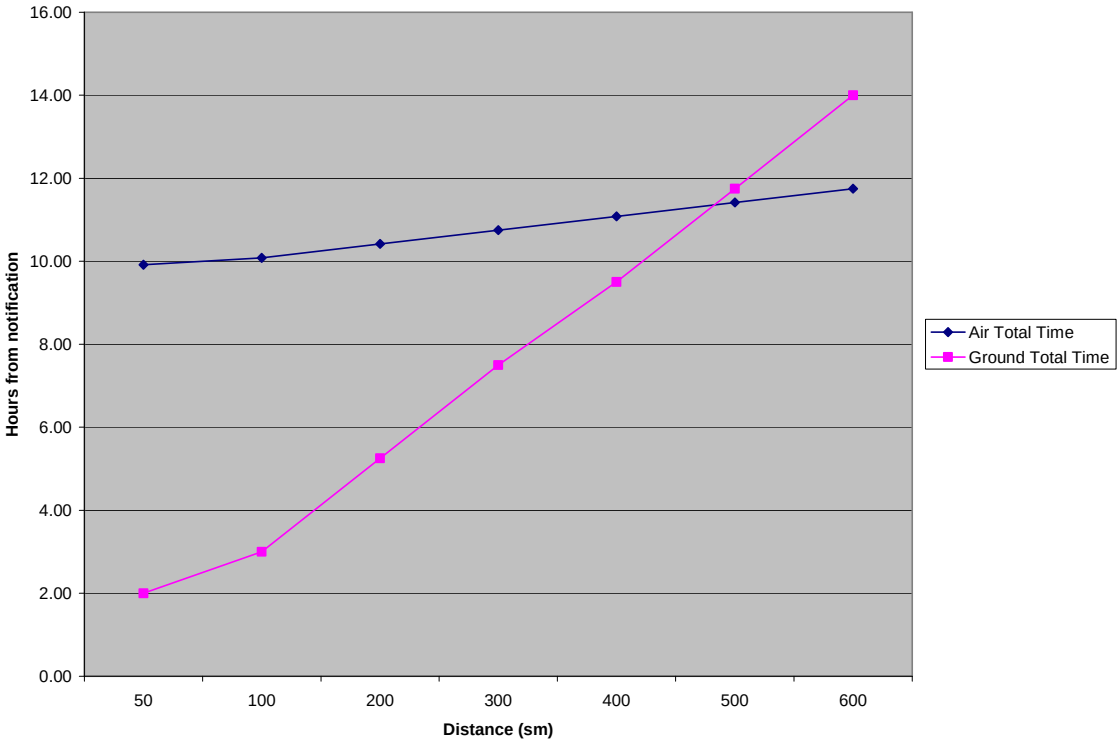

Figure 15. Responsiveness for a 70,000-lb load

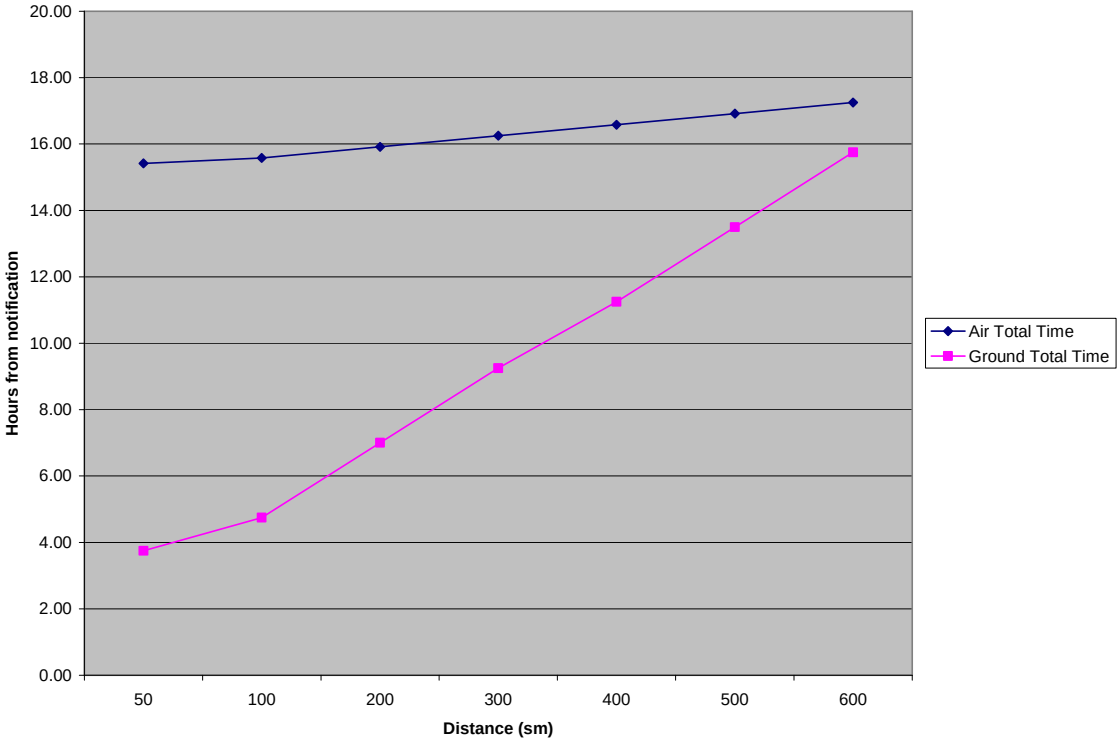

Figure 16. Responsiveness for a 105,000-lb load

Class (1)	Sub Class	STONs for 1 DOS for 700 pers (2)	A-22 containers for 1 DOS for 700 pers
I	Rations	Note (3)	4.8
	Water (pkg)	Note (4)	26.0
II	~	0.5	2.0
III	Packaged	0.1	0.1
IV	Barrier	1.8	4.0
	Construction	1.3	3.0
VI	~	0.5	1.0
VIII	~	0.5	2.0
		SubTotal	43

	Caliber	CBLs in FA Bn (5)	A-22 containers req'd	CBLs/ A 22
V	5.56	700	2.6	269
	7.62	10	0.8	12
	9	700	0.5	1600
	0.5 (9)	80	20.0	4
	25	0	0.0	1.2
	40	20	0.1	192
	105	0	0.0	0.19
	120	0	0.0	1
	155	6	30.0	0.2
		SubTotal	55	

TOTAL A-22s	98	# C-130s	# C-17s
Aircraft needed (C-130s OR C-17s)	~	7	3
# A-22s w/ partial 155mm and w/ 1 platform holding 600gph ROWPU in lieu of H20 (6)	42	~	~
Combined aircraft needed (includes one C-130 for ROWPU)	~	2	1
Aircraft Needed C-130s only (includes one C-130 for ROWPU)	~	4	~
Aircraft Needed C-17s only (does not include one C-130 for ROWPU)	~	~	2
Equivalent # HEMTTs (8)	11		

NOTES

(1) Class IIIB (Bulk Fuel), VII (Major End items (tanks etc), IX (Repair Parts) and X (Supplies for civil-military support) intentionally left out of analysis. The author acknowledges that for purposes of bulk fuel, end items and often-fragile repair parts, airdrop is not well suited. Class X, often used as humanitarian assistance is outside the scope of this paper.

(2) Consumption rates are not actual rates used in Ramadi in 2003-2004, but are taken from Logistics Estimate Worksheet ver 10. Entry parameters were static posture; 24-hour period; no surprise; recon pattern of operation; weather as dry, sunshine extreme heat; terrain flat and desert; combat intensity light contact; no NBC threat; Iraq; All types forces in SASO; overwhelming combat power advantage; SWA; arid; division SWA; 700 personnel.

(3) Using LEW ver 10 and CASCOM's Planning Data planning tables for 97-128 days, numbers calculated assuming 1 MRE and 2 UGRs per person per day (Plan 13) as it generated a greater requirement.

(4) Water requirements calculated using LEW ver 10 and CASCOM's Water Planning Data; entry parameters were Arid: SWA, Sustainment Period Rate (Day 33-128), uses included Drinking, Personal Hygiene, Feeding, Heat Injury, & Level I & II Medical,; consumption rate generated was 8.18 gal/man/day. While table represented 8.18 as a bulk water requirement and not packaged, author used this rate in the LEW Water worksheet to generate the greatest possible requirement.

(5) Number of CBLs in Ramadi was generated assuming each individual maintained a 9mm pistol and an M-4/M-16 rifle. 155mm CBL reflects historical average of weekly requiremetns (see Note 6). Other weapon system quantities generated as a rough order of magnitude during conversation with LTC Lukaskiewicz and LTC Cabrey.

(6) Given the nature of the COE in Iraq, the use of 155mm ammunition is significantly different than offensive operations. Thus, the planning factor in the LEW exaggerates the requirement in Ar Ramadi. Per LTC Cabrey, his FA battalion fired roughly 5 fire missions per week, roughly 10 rounds per mission. Additionally, one 20' Type V platform can be rigged to drop a 600 gallon-per-hour Reverse Osmosis Water Purification Unit (ROWPU), from FM 4-20.116 p. 3-94.

(7) Calculations: For mixed aircraft = #A-22s/40 = 46/40 = 1 remainder 6, with C-130 carrying last 6 leftover. For C-130s only = #A-22s/16: 46/16 = 2.87 = 3 C-130s. For C-17s only = #A=22s/40 = =46/40 = 1.15 (notice near emptiness of second C-17 aircraft).

(8) Based on planning factor of 10,000 pounds per HEMMTT, 2200 pounds per A-22 and 1 HEMMTT for the ROWPU platform.

(9) LTC Cabrey estimated he had nearly 70 .50 cal machine guns in his Bn, between armed vehicles and defensive positions.

Figure 17. Class of Supply Analysis. Airdrop aircraft requirements to deliver 1 day of supply and one combat basic load for each person and each weapon system in LTC Cabrey's battalion task force. Supporting data available in Appendices 11 and 12.

To deliver the same amount of supplies, a convoy of eleven HEMMTT trucks would be required. Here, the value of pre-planned airdrop becomes evident. Using pre-planned (or pre-apportioned and pre-allocated) airdrop, logisticians would have supplies set aside and rigged in advance of the scheduled mission. When taken with the responsiveness analysis presented earlier, a 4-ship of C-130s flown from an ISB in Kuwait (over 600 kilometers away by road) could deliver the supplies, and then reenter the airlift system the same day to support airland missions as needed. Alternatively, two C-130s could fly two shuttles and then reenter the airlift system. The convoy, on the other hand, would require over sixteen hours to reach the destination, remain over night, and the same amount of time to return. Over the course of the three-day period required for ground transport to execute the mission and return to base, the airdrop aircraft could execute three airdrop missions and numerous follow-on intratheater airland sorties.

Granted, the likelihood of actually delivering an entire DOS for any unit is low, let alone a full set of CBLs. The point of this exercise is to point out how a little forethought and creativity can mitigate significant physical risk to friendly forces (but not all risk). LTC Cabrey, in his interview, discussed the critical nature of the water purification system in use at his base camp. His brigade commander designated the status of the system as a "Commander's Critical Information Requirement (CCIR)," requiring his staff to inform him directly if any change in the unit's output was suspected or actual. Knowing this, having a purification system pre-rigged for delivery, or a days worth of bottled water pre-rigged, could provide logistical peace of mind without having to generate an extra convoy.[89] Yet again, any of this capability hinges on an established system for coordination and planning. Ad hoc airdrop is simply ineffective, and inefficient.

In order to ensure an effective and efficient system exists, and is not ad hoc each time the joint force undertakes a new campaign, the planning considerations and necessary organizations

must be codified for future use. The tools used here are admittedly rudimentary, but would function in the absence of more refined calculations if actual time factors for rigging, flight, and surface transport were included. Sadly, such planning considerations and evaluation criteria are missing from both current joint and service doctrine, as well as published logistical planning tools. The following section offers not only proposals for airdrop doctrine, but also needed organizational and training changes to ensure airdrop capability continues to exist.

[89] Department of the Army, Field Manual (FM) 4-20.158, *Airdrop of Supplies and Equipment: Rigging Water Purification Units* (Washington, DC: Government Printing Office 2005), pg 1-1.

AIRDROP GUIDANCE

Having reviewed past precedence of airdrop in support of isolated ground forces, and examined airdrop in today's environment, recommendations for the future development of the joint airdrop capability are now suitable. In doing so, using the Joint model of force management to frame this discussion is helpful. Doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) describes how planners analyze a system for integration into the joint community.[90] For the purposes of this paper, considering the fact that airdrop is an existing system in need of modification, not creation, this section will only cover the D-O-T portions, with an annex describing the future of airdrop materiel (Annex 5).

Joint Doctrine

In the United States military, Joint doctrine takes precedence over service doctrine whenever a conflict between the two arises. Thus, it is an appropriate starting point for a review of published airdrop doctrine. According to Joint Publication (JP) 1, *Joint Warfare of the Armed Forces of the United States*:

> military doctrine presents fundamental principles that guide the employment of forces. . . .It does this by promoting a common perspective from which to plan, train, and conduct military operations in combat and noncombat situations. . . .[It] serves as an important method for implementing change as forces train and build effective joint teams. It facilitates development of a common joint culture from which to integrate Service cultures and doctrines.[91]

What then does Joint doctrine have to say about airdrop? JP 4-0, *Doctrine for Logistics Support of Joint Operations*, the capstone manual for joint logisticians does not specifically address airdrop. Admittedly, its focus is above specific methodology, but JP 4-0 does point to conditions where airdrop could offer a suitable alternative to ground convoys. In a section entitled "Organizational Considerations," it states:

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[90] Department of Defense, Joint Publication (JP) 1-02, *Joint Warfare of the Armed Forces of the United States* (Washington, DC: Government Printing Office, 2000), A-40.

[91] Ibid., I-8 and 9.

> Limited logistic resources, combined with reduced force infrastructure, fewer forward locations, austere operating locations with limited infrastructure, and increased joint operations in nonlinear battlespace make it imperative to capitalize on the assets and capabilities available in theater to facilitate support to the warfighter.[92]

Despite writing in pre-9/11 context, the authors were none-the-less aware of future battlespace organization. The also acknowledge the time advantage of air versus ground: "sealift is by far the most efficient mode for bulk tonnage; however, airlift is often the most expedient for people or for rapid movement of essential equipment and supplies when time is critical."[93]

JP 4-01.1, *Joint Tactics, Techniques and Procedures for Airlift Support to Joint Operations*, provides more detail on the joint vision of airdrop employment.[94] JP 4-01.1 defines aerial delivery as "all methods of delivering personnel, equipment and supplies from an airborne aircraft," and notes it is a form of support used less frequently than airland,[95] as airland, in most situations is the "preferred method of airlift delivery."[96] The publication acknowledges the advantages gained from airdrop: surprise, speed and variety of potential objective areas. It provides a list of considerations for planners when employing airdrop, but fails to describe what criteria to use to select airdrop in the first place, or the advantages and disadvantages of its use.

JP 3-17, *Joint Doctrine and Joint Tactics, Techniques, and Procedures for Air Mobility Operations*, addresses airdrop more thoroughly, but not completely. JP 3-17 outlines specific responsibilities, types and methods of airdrop, advantages and disadvantages, and identifies airdrop-related unit capabilities (for example, what forces can operate a drop zone). Drop zones are discussed in detail, to include size, markings and survey requirements. JP 3-17 also references tactical surveys, used by aircrews and Army forces in Afghanistan as mentioned in the

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[92] Department of Defense, Joint Publication (JP) 4-0, *Doctrine for Logistics Support of Joint Operations* (Washington, DC: Government Printing Office, 2000), B-1. Emphasis added.

[93] Ibid., IV-1.

[94] Department of Defense, Joint Publication (JP) 4-01.1, *Joint Tactics, Techniques and Procedures for Airlift Support to Joint Operations*, 20 July 1996. This publication was current and posted on the Joint Electronic Library, http://www.dtic.mil/doctrine, at the time of initial research. It was no longer posted as of writing in January2006, and may be rescinded for revision by the time this paper is complete. No draft version is available at the time of writing this paper.

[95] Ibid., v.

last chapter of this paper. Such surveys allow rapid planning and coordination in non-training environments, and greatly contribute to improving the responsiveness of airdrop. Unlike JP 4-0, this publication briefly addresses selection criteria. Harkening to the airdrop experiences at Stalingrad and Dien Bien Phu, JP 3-17 urges the success of airdrop "hinges on air superiority and threat avoidance."[97]

Yet JP 3-17 seems to limit airdrop in its applicability to the overall joint force. On numerous occasions, it discusses how light Army forces are reliant on airlift. For heavy forces, however, it does not address airlift at all; it cites sealift as a more appropriate means.[98] Such an approach could lead the casual observer to determine that airdrop is not suitable to support heavy forces. Yet given examples of doctrine on kinetic topics like close air support and joint fires, the emergence of non-contiguous battlespace and its associated warrants a new emphasis on airdrop in joint doctrine.

United States Air Force Doctrine

Like joint doctrine, Air Force doctrine documents (AFDDs) are less process-oriented and more concept-oriented. In AFDD 2-6, *Air Mobility Operations*, of the sixteen references to airdrop, ten refer specifically to airdrop as a method of inserting forces into battle. Concerning airdrop delivery of supplies, the document highlights how the direct delivery ability of airdrop "shortens in-transit time, reduces congestion at main operating bases, and enhances the sustainment of forward bases."[99] Yet airdrop is still cited as a secondary delivery method:

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[96] Ibid., ix.

[97] Department of Defense, Joint Publication (JP) 3-17, *Joint Doctrine and Joint Tactics, Techniques, and Procedures for Air Mobility Operations* (Washington, DC: Government Printing Office, 2002), IV-4.

[98] Ibid., IV-7.

[99] Department of the Air Force, Air Force Doctrine Document (AFDD) 2-6, *Air Mobility Operations* (Washington, DC: Government Printing Office, 1999), 40.

> If airland delivery is not practical, or surprise is a consideration, airdrop allows commanders to maneuver forces and materiel directly into otherwise unreachable areas including those behind enemy lines. However, airdrop requires extensive training, coordination, specialized equipment, rigging, and suitable drop zones. This delivery method can be successful in permissive and uncertain environments.[100]

AFDD 2-6 does not, however, define "uncertain environments," or amplify what "extensive training" is required. All C-130 airlift aircrews are airdrop qualified, and a significant portion of C-17 crews are also airdrop qualified. Suitable drop zones, especially in uncongested, unforrested areas like Iraq, are nearly unlimited, unlike airfields or landing zones. The emphasis on extensive training and suitable drop zones may be overstated.

AFDD 2-6.1, *Airlift Operations,* drills a level deeper. It outlines advantages and disadvantages of airdrop, and notes "the decision to use airdrop is based on a user's requirements. This method is expensive and exposes the airdropped materials to potential damage not encountered in airland operations. In addition, specialized aircrew training is required."[101] In its discussion on combat sustainment, however, it claims "[m]ission effectiveness is the primary objective and the efficient use of aircraft and support resources is secondary. Combat sustainment employs both delivery methods but is usually associated with airdrop."[102] Finally, this document addresses the need for prioritization of airlift assets--airland and airdrop--yet it fails to state who determines that priority, or what considerations might warrant a priority change.

The last Air Force doctrine document deals not with airdrop specifically, but rather covers the support organizations, facilities and considerations for providing air mobility support. AFDD 2-6.3, *Air Mobility Support*, focuses more on support to, and command and control of, strategic airlift, and tactical airland. Including a section on airdrop support requirements could help planners and facility managers in identifying infrastructure capable of handling the rigging facilities and material handling equipment needed for airdrop.

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[100] Ibid,, 40. Original emphasis.

[101] Department of the Air Force, Air Force Doctrine Document (AFDD) 2-6.1, *Airlift Operations* (Washington, DC: Government Printing Office, 1999), 18.

[102] Ibid., 22.

If there is one clear message from Air Force doctrine regarding airdrop, it is probably that airland is more effective, more efficient and more desired than airdrop. If airdrop is indeed to be the exception to the rule, then the doctrinal guidance concerning its use should clearly point out when and how airdrop would be employed. Unfortunately, it does not.

United States Army Doctrine

Purpose of Army doctrine is not that different from joint or Air Force doctrine; "its objective is to foster initiative and creative thinking."[103] One significant difference, however, is the focus on the Army's role in the different forms of operations. "*Full spectrum operations* combine offensive, defensive, stability and reconstruction, and civil support operations."[104] FM 1 also addresses joint interdependence.

> Joint interdependence is combined arms raised to the joint force level. It reinforces and complements the effects of Army combined arms operations and makes Army forces many times more effective than they would be otherwise. Joint force capabilities provide additional mobility, intelligence, fires, protection, and logistics throughout the land area of operations.[105] Combined arms and joint interdependence make land forces more effective in stability and reconstruction operations. . . .This support is especially important when areas of operations are noncontiguous.[106]

Granted, FM 1 is more current than either the joint or Air Force doctrine previously discussed, and it includes lessons learned from ongoing operations in Iraq, Afghanistan, and the Global War on Terror. But the concept of joint interdependence permeates to other documents as well.

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[103] Department of the Army, Field Manual (FM) 1, T*he Army* (Washington, DC: Government Printing Office, 2005), 1-21.

[104] Ibid., 3-4.

[105] Ibid., 3-5.

[106] Ibid., 3-6.

FM 3-07, *Stability Operations and Support Operations*, calls for forces to leverage joint capabilities and cooperation due to future enemy trends towards unconventional and innovative means.[107] FM 3-07 further defines stability operations as follows:

> They often present the commander with challenges for which there are no prescribed solutions. Success depends on the ability of the commander and his force to adapt structures and methods to accommodate new situations. *Adaptability* is meeting changing situations with flexibility and initiative. *Flexibility* is the ability to avoid dogmatic responses and to "bend" as each situation demands to be receptive and responsive without losing orientation.[108]

While airdrop is not specifically mentioned in either FM 1 or FM 3-07, the demonstrated need for innovation and resourcing all available methods is clear.

The Army's interim manual on counter-insurgency, FMI 3-07.22, *Counterinsurgency Operations*, does not cover airdrop either. In fact, it speaks very little about the unique logistical challenges of COIN operations (apart from civil affairs support in humanitarian action). It does, however, spend seven pages in the movement security section of chapter six discussing convoy operations. Unfortunately, this section does not discuss what conditions would make a convoy unsuitable as a means of supply.[109]

The Army's overarching logistical doctrinal manual is FM 4-0, *Combat Service Support* (CSS). FM 4-0 not only discusses airdrop units and functions, but also lays out certain conditions and operations where planners should consider airdrop. "CSS supports forcible entry operations by aerial delivery,"[110] and planners should expect the high threat potential in urban environments to drive "increased aerial delivery requests."[111] In urban operations, "LOC[s] are more difficult to maintain . . . [r]outes may be limited, making CSS more easily interdicted than in open terrain.

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[107] Department of the Army, Field Manual (FM) 3-07, *Stability Operations and Support Operations* (Washington, DC: Government Printing Office, 2003). Comments on leveraging joint capabilities come from 1-4, and future enemy trends (for example IEDs) are found on 1-8.

[108] Ibid., 1-23.

[109] Department of the Army, Field Manuel Interim (FMI) 3-07.22, *Counterinsurgency Operations* (Washington, DC: Government Printing Office, 2004), pg 6-2 through 6-9.

[110] Department of the Army, Field Manuel (FM) 4-0, *Combat Service Support* (Washington, DC: Government Printing Office, 2003), 1-3.

[111] Ibid., 3-25.

Planners may have to consider such nontraditional means of distribution as precision airdrop."[112] On the offensive, "widely dispersed forces and longer LOC require all transportation resources, including aerial delivery assets, to deliver supplies well forward."[113] Interestingly, FM 4-0 does not include aerial delivery in its section on stability operations, and the manual does not address counterinsurgency operations at all.

FM 4-0 cites air as "the most flexible transportation mode," and it "becomes increasingly important as the intensity, depth, and duration of operations increase. Airlift relieves forces from total dependence on ground lines of communication that can become congested or interdicted."[114] The manual notes that airdrop may be required at the onset of certain types of hostilities, yet due to other force-flow requirements, may not be available. In such cases, commanders should preposition airdrop units to the closest supply and transportation depot used for the operation, a technique utilized in support of SOF in Afghanistan in 2001.

FM 4-0 also recognizes the universal applicability of airdrop. "Airdrop resupply operations apply to all Army forces. . . .[I]t provides the capability of supplying the force even when land lines of communication (LOC) have been disrupted and adds flexibility to the distribution system."[115] This last statement about applying to all forces seems inconsistent with practice, however, as employment of airdrop since the attacks of 9/11 have been strictly in support of light units (for example, SOF, 82d Airborne Division). Perhaps this is a trend about to change.

In March 2005, the Army released the Interim Field Manual (FMI) 4-90.1, *Heavy Brigade Combat Team Logistics*. Approved for immediate use in training and operations of units undergoing modular redesign under the ongoing transformation initiatives, FM 4-90.1 covers the

[112] Ibid., 3-111.
[113] Ibid., 3-4.
[114] Ibid., 7-27.
[115] Ibid., 6-13.

various logistics functions and capabilities in relation to heavy brigade operations across the spectrum of conflict.

Concerning airdrop, FMI 4-90.1 parrots FM 4-0 regarding the flexibility and the need to use alternate operating sites due to prioritized force flow.[116] It is unique among Army doctrine covered thus far in that it dictates heavy units "be prepared to receive both air-dropped and sling-loaded supplies," and these units "must know how to select DZs and LZs and receive aerial resupply."[117] Unfortunately, it does not describe how the BCT will train, or who within the BCT should be responsible for operating these zones. Finally, the interim field manual reaffirms the utility of airdrop: "[it] effectively reduc[es] the forward battlefield footprint . . . [and] mitigat[es] the enemy threat to traditional surface methods of distribution (for example convoy ground attacks)."[118]

Subsequent Army logistics doctrine also recognizes the value of airdrop. From Theater Support Command guidance, through Corps Support Command, to Corps Support Groups, airdrop is consistently identified as useful to light units (as opposed to heavy units also) and capable of mitigating enemy pressure on LOCs. These tactical and operational level documents also offer rudimentary planning questions for logisticians to address in pre-operations phases.[119]

Of all the services, to include joint doctrine, the Army is the only service that has published formal doctrine specifically for conducting airdrop operations. FM 4-20.41, *Aerial Delivery Distribution in the Theater of Operations,* is designed to serve as an "umbrella manual

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[116] Department of the Army, Field Manual Interim (FMI) 4-90.1, *Heavy Brigade Combat Team Logistics* (Washington, DC: Government Printing Office, 2005), 5-32.

[117] Ibid., 6-20.

[118] Ibid., 6-22

[119] Additional airdrop doctrine reviewed includes FM 4-93.4, *Theater Support Command*; FM 63-3, *Corps Support Command*; and FM 54-30, *Corps Support Groups*. While all three are still current doctrine, the last two are dated 1993, and many details about organization and procedures are out of date. The planning considerations include questions to be asked such as "Are there enough airdrop supplies?" and others.

for the maneuver unit commander."[120] As the proponent manual for airland, sling load and airdrop, it is predictably positive in its assessment of airdrop. Like other post-2001 Army logistics doctrine, it too prescribes an increasingly significant role for airdrop. "Aerial delivery is no longer the *last resort*, but rather, through necessity, it is becoming a viable mode of distribution to support the fight against a very flexible, fluid, and ever-changing threat environment."[121]

FM 4-20.41 lays out advantages and disadvantages of airdrop; a comparison of this list with joint and Air Force doctrine lists can be seen in Appendix 6. In nearly all cases, it is consistent with joint doctrine, and contains more detail than its closest Air Force doctrinal equivalent. It discusses the concepts of apportionment and allocation, two key points in understanding how and why sorties become available for airdrop. This manual also looks forward to the future state of airdrop units within the Army.

> As the Army continues its transition from the legacy to the objective force, the additional demands of the non-linear, highly mobile concept of battle will make further modifications necessary. For example, instead of having large, very immobile company-size rigger units, smaller detachment-size organizations may be used as modular "plug-in/plug-out" assets spread throughout the force to increase flexibility and decrease the battlefield footprint.[122]

The manual continues in its coverage of airdrop units by laying out doctrinal organizational composition of airdrop units, and most importantly, their respective capabilities (Appendix 4 contains a complete listing of Army and Marine Corps airdrop units with locations and capabilities). More than two pages are dedicated to request procedures, but the procedures speak little to the jointness of the problem. The procedures focus on who within the Army releases the supplies and who chooses between helicopter and fixed-wing lift. While this is undoubtedly important, it does not cover how a request routes once it leaves the Army's hands and enters the joint system.

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[120] Department of the Army, Field Manual (FM) 4-20.41, *Aerial Delivery Distribution in the Theater of Operation* (Washington, DC: Government Printing Office, 2003), iii.

[121] Ibid., 1-2. Original emphasis.

Finally, like the Heavy Brigade Logistics doctrine, this airdrop specific document dictates that the receiving unit is responsible for selecting, preparing and operating the drop zone. Also like the heavy brigade doctrine, it does not assist with determining who should or could operate the drop zone. Its only comment refers units to requesting Pathfinder assets through higher headquarters.[123] FM 4-20.41 closes the section on request procedures with "JP 3-17 and FM 10-27 contain further information concerning DZs;"[124] In reality, JP 3-17 offers excellent information, but FM 10-27 does not contain the term "drop zone" anywhere within its covers.

United States Marine Corps Doctrine

The fact that Marines have used airdrop to supply isolated forces in western Iraq may simply come down to a comfort factor resulting from customer and provider sharing a common commander. Nonetheless, a review of Marine doctrine is warranted, as it may uncover significant differences from the Army-Air Force system.

Unlike the Army, the Marine Corps does not publish doctrine specific to airdrop. The capstone level of Marine Corps doctrine, known as Marine Corps Doctrinal Publications or MCDPs, addresses airdrop as it pertains to Marine Corps operations. MCDP 1-0, *Marine Corps Operations*, specifically calls for airdrop in support of offensive operations like large-scale movements to contact and infiltrations.[125] In the defense, "aerial delivery of rations and other services may be employed for cut-off, screening or guarding units."[126] MCDP 4-0, *Logistics*, while not specifically citing airdrop as a methodology, does allude to the logistical challenges inherent in non-linear battlespace:

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[122] Ibid., 3-1.

[123] Pathfinders are specially qualified individuals, usually infantrymen. There is no "Pathfinder unit" in the Army. Upon receiving a request for a Pathfinder, the HQ would need to scrub its personnel roster to determine who is qualified to perform the duties of a pathfinder. Determining who is proficient at the task is a completely different matter.

[124] Ibid., 4-3.

> The battlespace of the future could also become relatively empty with much smaller forces possessing an increased destructive potential spread over greater intervals. Greater distances between combat forces and their supporting elements . . . will require our logisticians to extend their reach. . . .[A]nticipating and planning for their sustainment needs, and providing the mobility necessary to deliver the required support will be a considerable challenge in the extended battlespace of the future.[127]

Subordinate to MCDPs are Marine Corps Warfare Publications, or MCWPs. MCWP 4-11, *Tactical-Level Logistics*, notes that airdrop "offers the commander a degree of versatility that can greatly enhance his tactical and sustainability capabilities."[128] More specifically, MCWP 4-11.3, *Transportation Operations*, covers responsibilities and coordination. As outlined below in Appendix 6, Marine Corps doctrine identifies similar responsibilities. As in Army doctrine, the combat service support element commander is responsible for determining the need for airdrop and for requesting airlift aircraft. Supported units are trained and responsible for selecting and operating drop zones, although no specifics are provided as to whom or how this capability is sustained.

MCWP 4-11.3 does include two planning issues not covered in any doctrine previously discussed. "Air delivery support request procedures are developed and specific command and control procedures are established. [although it fails to mention by whom]. . . .Detailed coordination with the G-3/S-3 and the fire control sections is required to ensure that air deliveries do not conflict with supporting fires or other air operations."[129] While MCWP 4-11.3 does not

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[125] Department of the Navy, Headquarters United States Marine Corps, Marine Corps Doctrinal Publication (MCDP) 1-0, *Marine Corps Operations* (Washington, DC: Government Printing Office, 2001), 7-6 and 7-23.

[126] Ibid., D-18.

[127] Department of the Navy, Headquarters United States Marine Corps, Marine Corps Doctrinal Publication (MCDP) 4-0, *Logistics* (Washington, DC: Government Printing Office, 1997), 41.

[128] Department of the Navy, Headquarters United States Marine Corps, Marine Corps Warfare Publications (MCWP) 4-11, *Tactical-Level Logistics* (Washington, DC: Government Printing Office, 2000), E-4.

[129] Department of the Navy, Headquarters United States Marine Corps, Marine Corps Warfare Publications (MCWP) 4-11.3, *Transportation Operations* (Washington, DC: Government Printing Office, 2001), 5-5.

elaborate, provide vignettes, or constraints to such coordination, it is telling to the high level of inherent coordination between Marine components that procedures are mentioned to begin with.

Doctrinal Recommendations

Having reviewed what current doctrine says, is it adequate? From a set of recommended doctrinal modifications, organizational and training suggestions will follow to help turn doctrine into reality. Four major areas stand out as inconsistent, absent or insufficient: request procedures, drop zone operation, airspace control, and considerations for employment and planning.

In order to begin to assuage cultural concerns or pre-dispositions against airdrop, doctrine must address the complexity of requesting and receiving airdrop support. Army doctrine is specific on ***intra***-service channels and request procedures, but stops at the decision to request ***inter***-service airdrop. Air Force doctrine addresses airdrop from the point of having already received the task. There is no discussion of how joint and air components mete airdrop against competing requirements or how much advance time is required to assemble a mission. There is no link for either side to reference in order to understand how and where either side plugs into the other. This is clearly the domain of joint doctrine.

Since airlift apportionment is determined by the joint force commander and only executed by the air component, joint doctrine should clearly lay out how a land component turns its airdrop request into reality. Apportionment--"the determination and assignment of the total expected effort by percentage and or by priority that should be devoted to the various air operations for a given period of time"[130]--is strictly the domain of the joint force commander. The subsequent step of allocation refers to "the translation of the air apportionment decision into total numbers of sorties by aircraft type available for each operation or task."[131] Allocation is a process that the air component, specifically the director of mobility forces, conducts to transform

[130] JP 1-02, 41.
[131] Ibid., 31.

intent (priority) into sortie count. When conditions warrant regular airdrop to supply forces in isolated battlespace, the land component commander, should request a modification in airlift apportionment and allocation to free sorties from airland missions on a regular or periodic basis. The final step in the process is distribution--the process where the land component commander (LCC) determines which land units receive the support identified through apportionment and allocation. In essence, the LCC distributes the allocated sorties among the ground units based on land component priority.

To make this system work in today's COE, the joint force commander should apportion a recurring airdrop effort. Such a system allows both ground and air planners to forecast requirements and capabilities, minimizing adverse effects on the scheduling of ground and air LOCs. Frequent, deliberate (but not predictable) scheduling of airdrop prevents inefficient last minute changes. When one considers it is significantly easier for an aircrew to transition from an airdrop mission to a routine airland mission with short or no-notice, scheduling airdrop in advance is clearly the desirable approach.[132]

In order to address real time changes, the current airlift capability to change drop zones in flight must be coordinated and codified in joint doctrine. Aircrews have long exercised the "9-line" procedure where in-flight re-tasking of the objective area causes crews to re-plan in flight. While not optimal, it is certainly likely that airdrop operations in the COE might require a re-prioritization of receivers, and hence a shuffling of target area. This 9-line procedure closely resembles on-call close air support, as well as medical evacuation procedures, both of which are discussed extensively in joint doctrine. Fortunately, airdrop experts at the Air Force's C-130 Weapons Instructor Course are developing procedures and considerations for "on-call airdrop;"

[132] The author recognizes that there are many considerations for an airland mission that must be accounted for in mission planning. Nonetheless, the COE has tactical airlift crews operating in and out of fixed-base airfields on a routine basis. The tactical assault landing is the exception, rather than the rule.

hopefully joint coordination with aerial delivery experts from the sister services will result in a solid foundation for such tactics.[133]

The concept of on-call or in-flight re-tasking of airdrop missions raises the question of drop zone operation. There is no single source for a supported unit to reference to determine who is actually capable of operating a drop zone. JP 3-17 contains a matrix used by Air Force combat controllers that outlines responsibilities of those involved on the drop zone. This matrix does not, however, identify potential resources to aid the supported commander in creating the necessary conditions to receive the airdropped supplies. Army Special Forces, Pathfinder soldiers, jumpmaster-qualified soldiers, Air Mobility Liaison Officers, Air Force combat controllers and Marine Corps AD platoon members are all capable of operating a drop zone. Without a published reference to cumulative joint capabilities, logisticians do not stand a chance at achieving joint interdependence. Knowledge is power.

Both joint and Air Force doctrine address airspace control. The underlying assumption of this discussion is that the airspace control authority (ACA)--normally the air component commander--only actually controls and deconflicts air movements above a certain "floor." Below the coordinated "floor," the appropriate land component is responsible for ensuring helicopters, UAVs, artillery, and any other hazard does not interfere with airdrop operations. Marine Corps doctrine alludes to the requirement, but fails to "pin the rose" on any one organization. Here too is an opportunity for joint doctrine to standardize across the force.

The greatest doctrinal disparity concerning airdrop seems to come from perceptions: the ever-present effectiveness versus efficiency debate; and a lack of assessment of the value of airdrop in stability operations. Air Force doctrine is very firmly encamped in the efficiency corner. Airland is repeatedly mentioned as the preferred or first choice for planners. No distinction is made over mission or environmental conditions that might warrant airdrop over

[133] Eric Mayheu, Maj, USAF. 29th Weapons Squadron, Little Rock AFB, AR, E-mail interview by author, 23 January 2006, Ft Leavenworth, KS.

airland. In practice, it is even clearer. In November of 2004, the Air Force Chief of Staff directed the USCENTCOM air component commander to take action to mitigate the threat against ground convoys. Previous to the issuance of the command, airlift aircraft were not allowed to fly to air bases in the Sunni Triangle due to the threat level. Curiously, during the week prior to the reversal of policy, a young soldier publicly questions the Secretary of Defense on the inadequacy of vehicle protection. Suddenly, the air component commander is allowed to "throw away the rule book." "[The Air Force Chief of Staff] is not worried about efficiencies, and so I'm not either," said the air component commander on 12 December 2004.[134] Where was that thinking in Fall of 2003 when the insurgency began to boil? With an air component not willing to put its people and assets in harm's way due to efficiency arguments, it is no wonder that ground logisticians are hesitant to request airdrop. Ironically, in an environment where surface-to-surface fires are the primary threat, airdrop is actually better suited than airland.

The only way to cure such perceptions is to provide some hard data and proven calculations about the (in)efficiencies of airdrop. Currently, no published data exists. The admittedly rudimentary analysis presented in the previous chapter serves as only an example of what could be provided, given some intelligent input from land and air experts. There are certainly breaking points where efficiencies are gained and lost. More importantly, there are points where efficiency should no longer be a consideration. When lives are on the line, efficiency should not enter the discussion.

The effectiveness aspects of airdrop lead to the second point of doctrinal modification. As the United States military begins to seriously wrap its collective mind around lessons learned from counterinsurgency and stability operations in Iraq and Afghanistan, the resultant doctrine must articulate how logistics differs from traditional linear battlefields. Much of the doctrine covered in this paper, especially Air Force doctrine, makes no distinction between logistics in

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[134] Bradley Graham, "Dangers on the Ground in Iraq lead to Increased Use of Airlifts," *Washington Post*, 12 December 2004, A26.

different types of operations. As airdrop continues to prove its worth in Afghanistan, and if the Marines expand its use in Iraq, doctrine writers must codify those lessons learned into a distinct capability to be utilized during counterinsurgency and stability operations. Historical examples of airdrop at Stalingrad and Dien Bien Phu highlight the demand for superior firepower and air superiority when supporting isolated ground forces via air. As ammunition-intensive as the demands at Khe Sanh were, today's Army is fuel-intensive. Ammunition and fuel are different commodities, but have similar limitations where airdrop is concerned. The next round of doctrine should recognize both the capabilities AND the limitations of airdrop in support of troops in isolated battlespace, thus ensuring planners can properly identify situations where airdrop is appropriate.

Finally, the resultant doctrine must emphasize that if airdrop is used to reduce the number of convoys on dangerous roadways, then exactly that must take place. Logisticians must not use airdrop to free a convoy to carry on with a different load. If efficiency is disregarded in the name if saving lives and increasing effectiveness, then the lives should truly be given a break.

Organizational Recommendations

The greatest potential organizational gain from an increased doctrinal emphasis on airdrop concerns the employment of United States Army aerial delivery units. The number of aerial delivery supply companies is so limited that to split them amongst the Army Corps worldwide would diminish the community's cohesiveness without any increase in utilization. By keeping the majority of units assigned to Fort Bragg and the XVIII Airborne Corps, training is maximized for both the aerial delivery units and their primary customers.

That said, the demonstrated success of airdrop in Afghanistan, and the potential for success in Iraq, should drive the Army to placing airdrop units on a rotational life cycle alongside the rest of the Army. Currently, airdrop units deploy at the whim of the Army Corps slated to

command a given rotation.[135] Historically, when XVIII Airborne Corps units have deployed, aerial delivery units deployed as well. As such, the 82 Airborne Division, 101st Airborne Division and 10th Mountain Division have all benefited from airdrop in Afghanistan. As long as individual Corps staffs are allowed to determine which capabilities should or should not be in theater, airdrop will continue to be underutilized. That decision should rest with the regional combatant commander, especially for a multi-rotation commitment. With a standing commitment in place, the units can assume a three-year life cycle and gain the benefits associated with a regulated deployment schedule. Such a schedule could then be easily integrated into the Army's overall training cycle, to include the training centers in California, Louisiana, and Germany.[136]

To support the long war, as the Global War on Terror is being increasingly referred to, aerial delivery units in the conventional Army should be cross-leveled, both in terms of manning and equipment. Appendix 12 consolidates data from the tables of organization and equipment (TOEs) for Army aerial delivery units, showing the imbalance of both platforms and chutes that aerial delivery units bring to the fight. Currently, the 18th Airborne Corps' airdrop company maintains the lion's share of equipment--up to thirty times the amount of an airdrop detachment in some cases.[137] Yet the likelihood of the entire XVIII Airborne Corps employing as a corps in today's COE is significantly less likely than the continued rotational deployment of its subordinate units. As the Army continues to transform into modular units capable of plug-and-play task organization, aerial delivery must also realign its organizational structure.

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[135] W. Keith Fegler, MAJ USA, Telephone interview by author, 4 January 2006, Ft Leavenworth, KS. "Whim" is the author's choice of words. The author recognizes that force caps constrain corps-level planning, but feels a significant capability is being overlooked nonetheless.

[136] The next section on training recommendations covers this idea more in depth.

[137] One of the heavy companies, E Co of the 782d Main Support Battalion, is directly assigned to the 82d Airborne Division. Given this division's worldwide alert commitments--which aren't likely to go away anytime soon--keeping E Co intact as it now stands is a solid idea. The remainder of the assets, much of which lies in the reserve component, however, should be evaluated for reorganization.

Training Recommendations

Once doctrine and organizations are adjusted to set the conditions for successful employment of airdrop, the final step must be taken to overcome resistance to this unique supply methodology. Units not habitually reliant on airdrop must experience first-hand the processes, advantages and disadvantages, and resulting effects of airdrop.

Currently, Air Force airlift crews (predominantly C-130, and occasionally C-17) provide airdrop support to Army units exercising at the Joint Readiness Training Center at Fort Polk, Louisiana. The scenarios provide realistic airdrop training, especially from the perspective of command and control. Army units in the field coordinate with logistics planners and aerial delivery soldiers at the forward operating base (FOB) in Louisiana. These requests in turn are transmitted to the air operations center at Little Rock Air Force Base, Arkansas. Operating from Little Rock, the crews plan and coordinate their mission with twenty-four to thirty-six hours advance notice. On the day of the mission, they fly from Arkansas to the FOB in Louisiana, pick up the airdrop load, then drop it to the fielded forces prior to returning to Little Rock. This proved to be an extremely accurate training scenario, which, developed in the 1990s, very closely resembled how current airdrop operations in Afghanistan are taking place. Unfortunately, due to space and terrain constraints this facility trains primarily light units, leaving the heavy units to train elsewhere.

That "elsewhere" is the National Training Center at Fort Irwin, California. The wide-open desert spaces there are perfect training grounds for mechanized forces, and are widely recognized as one of the keys to the sweeping victories in Operations Desert Storm and Iraqi Freedom. As operations in Iraq turned to stability and counterinsurgency operations, Army leaders rapidly realized that armored and mechanized forces were not well suited, let alone well trained, to conduct this unique form of warfare. To accommodate the training shortfall, the Army constructed villages in the middle of the NTC range complex, and hired "locals" to stand-in as

Iraqi nationals. These civilians live within the range complex 24/7, for the duration of the multi-week exercise, and represent everything from Iraqi police to insurgents.[138]

For some reason, however, the experiment did not grow beyond the tactical set currently employed in Iraq. NTC should be expanded to include alternate supply methods as JRTC has. Having airdrop provide supplies to units operating in the non-contiguous battlespace would exorcise the apparently daunting aspects of command and control. As a secondary effect, airdrop could free transportation troops to practice their convoy battle drills while still ensuring forward deployed units received critical supplies.

To facilitate such training opportunities, the Air Force needs to expand the capabilities of the currently existing liaison force. Attached to each major Army (and Marine) maneuver unit are air liaison officers (ALOs), tactical air control parties (TACPs) and air mobility liaison officers (AMLOs). ALOs and AMLOs are rated United States Air Force pilots or navigators; the former from the fighter and or bomber community and the latter from the airlift community. Enlisted terminal attack controllers, or ETACs, man the TACPs and are "sliced" to the brigade level (and sometimes lower) to provide the final ground--air link in close air support.

For airdrop, AMLOs have the expertise to assist Army units with planning and coordination.[139] Given the dispersed nature of the COE, however, the one or two AMLOs assigned to each division or corps are hardly sufficient to control drop zones across an AO. The work force to be tapped into is the ETACs. These Airmen not only "speak airplane," but they understand airspace, weather and aircraft control and are inherently distributed throughout the

[138] Carmen L. Burgess, SSG, US Army, "NTC Training Readies Guard Brigade For Iraq," *Army News Service*, 25 April 2005.

[139] Dustin Hart, 2nd Lt, USAF, "AMLOs Turn Army, Marine Airlift Needs Into Reality," *AMC News*, 24 February 2004.

battlespace. Despite the brief additional training required to certify a DZ controller, there is no recurring training requirement.[140] This is an investment well worth the time and resources.

The last training piece concerns airlift aircrew training specifically. Currently, all deployed C-130 crews are airdrop qualified. The same is not true for C-17 crews. Roughly 70 percent of C-17 crews are actually trained at any given time, and not every C-17 squadron retains airdrop-qualified aircrews. Of the crews that are airdrop qualified, they are not always kept together for immediate use if needed. If not pre-identified for use as airdrop crews, they "float" through the global air mobility system, changing airframes and occasionally crewmembers as the mission warrants. This system forces air planners to scramble to build airdrop, qualified crews on short notice.[141] In order to make airdrop viable, the aircrew management system should recognize the need for airdrop crew continuity and adjust its scheduling practices. Additionally, a larger percentage, if not all C-17 crews should earn and maintain airdrop qualification. If NTC is also expanded to include airdrop opportunities, the increased training needs of the air component will benefit from the symbiotic effect of expanded training opportunities at NTC.

[140] Department of the Air Force, Air Force Instruction (AFI) 13-217, *Drop Zone and Landing Zone Operations* (Washington, DC: Government Printing Office, 2003), 28-29.

[141] William D. Hall, Major USAF, E-mail interview by author, 10 January 2006, Ft Leavenworth, KS. When C-17s dropped the 173d Brigade at Bashur, Iraq in 2003, the aircrews were pre-assembled and sent forward intact to accomplish the mission. Had it been short notice, however, assembling the crews may have been problematic.

CONCLUSION

Has airdrop evolved beyond its historical underpinnings of the 20th century? Is the apparently new battlespace configuration significant enough to warrant an increased focus on airdrop? The answers to these questions lie in two methods of evaluation: looking backwards and looking forward. Would today's airdrop system achieve better effects in yesterday's scenarios? Could today's airdrop system dramatically contribute to the current operating environment, and will it maintain utility in the future?

After the Luftwaffe failed to keep the 200,000 Germans alive at Stalingrad, the Luftwaffe's Chief of Air Transport, General Fritz Morzik, set out to document why. In the post-war history effort "German Air Force Airlift Operations," he makes some very direct points about airdrop employment. He cites three cases where airdrop is suitable: 1) dire necessity where the terrain does not permit landing of aircraft; 2) in support of an encircled force where no airfields are controlled by friendly forces, but then only as a temporary solution; and 3) geography or enemy strength does "not warrant surface supply transport."[142] Morzik continues to say "airdrop *cannot, for example, be utilized* to expedite a ground operation already underway by providing additional supplies."[143] While making an efficiency versus effectiveness argument, his model of warfare is clearly linear, and does not include counterinsurgency or stability type operations in this construct of "ongoing ground operations."

To Morzik's credit, seven of his eight disadvantages of airdrop are cited in contemporary doctrine, with only "impossibility of dropping awkwardly-shaped items" having been overcome by improved aircraft technology.[144] Yet he turns again to arguments of efficiency: "inasmuch as the benefits to be gained are not sufficient to warrant the expenditure of effort involved."[145] If he could compare the reduced range and cargo capacity of 1930s era aircraft with today's aircraft

[142] Fritz Morzik, *German Air Force Airlift Operations* (Maxwell AFB, AL: Research Studies Institute, 1961), 335.
[143] Ibid.
[144] Ibid., 384-385.

and expanded LOC distances, his conclusions on efficiency vs. effectiveness might well be different.

Artillery Battalion in Ar Ramadi Revisited

Today, aircraft efficiency has improved to the point that for a set amount of cargo, aerial delivery is more efficient than surface delivery at some longer distances. For LTC Cabrey and his battalion task force, airdrop could have relieved competing pressures on his ability to stay sustained and accomplish his primary counterinsurgency mission.

By nature of being an artillery battalion, LTC Cabrey identified and utilized a substantial piece of open desert outside of Ar Ramadi as an artillery training range. Use of this range kept his soldiers proficient in their core artillery tasks, enhancing the overall combat capabilities of coalition force in the Sunni triangle. The size of this range, suitable for firing 155-millimeter artillery shells, measured nearly 6 kilometers by 4 kilometers. The range, just southwest of the battalion compound, was secured by battalion troops during all live fire exercises, and more than tripled the size requirement for a C-130 to deliver a full load of sixteen containers.

The battalion maintained and operated a fleet of trucks well suited for recovering containerized supplies from a drop zone. Delivering food, water, small arms, and barrier/construction material via airdrop would have reduced the number and or frequency of weekly supply runs. Most importantly, LTC Cabrey, as commander of the battalion, could have continued his primary mission unimpeded by logistical escort requirements. Free from a three-day rotation of supply escort duties, he could have realized additional opportunities to mass his combat power for offensive operations, humanitarian activities or even mere presence. Even infrequent airdrop would have enabled unit training on a larger scale than previously allowed.

Given the nature of doctrine, organization, and training throughout the joint force, pulling off such a feat for LTC Cabrey's battalion would not have been simple. Finding personnel to

[145] Ibid., 384.

operate the DZ would have been challenging, but not impossible. The air liaison officer assigned to the brigade could have coordinated the airspace to allow the airdrop without interfering with air traffic patterns into Habbaniyah airfield. Yet with each attempt, the collective learning curve of all involved would contribute the ease of the next effort.

Airdrop is not a panacea for all ills logistical; not by any means. It requires certain conditions to be effective--air superiority, dominant firepower, favorable winds and adequate rigging support--and is more efficient than surface transport only under certain cargo-distance situations. Nonetheless, in support of ground forces in non-contiguous battlespace, airdrop provides a freedom of maneuver unattainable by surface transport. Whether overflying extreme terrain, circumnavigating surface threats, or freeing combat power for other purposes, airdrop offers the deployed commander an additional supply option.

To ensure airdrop realizes its fullest potential, however, joint and service doctrine must reform to address the significance of airdrop in today's COE. Planners should be given left and right limits for the use of airdrop, as well as "decision-assisting" tools to aid in the determination of whether or not to use airdrop. Until the Army and Air Force train together using airdrop to support unaccustomed ground forces, the Marines will hold the monopoly on effective and efficient command and control of airdrop. Air component commanders need to reference their own doctrine and realize airdrop is a safer method of delivery than airland in an insurgency environment. Everyone agrees that the roads are unsafe; it's time to pick a new route.

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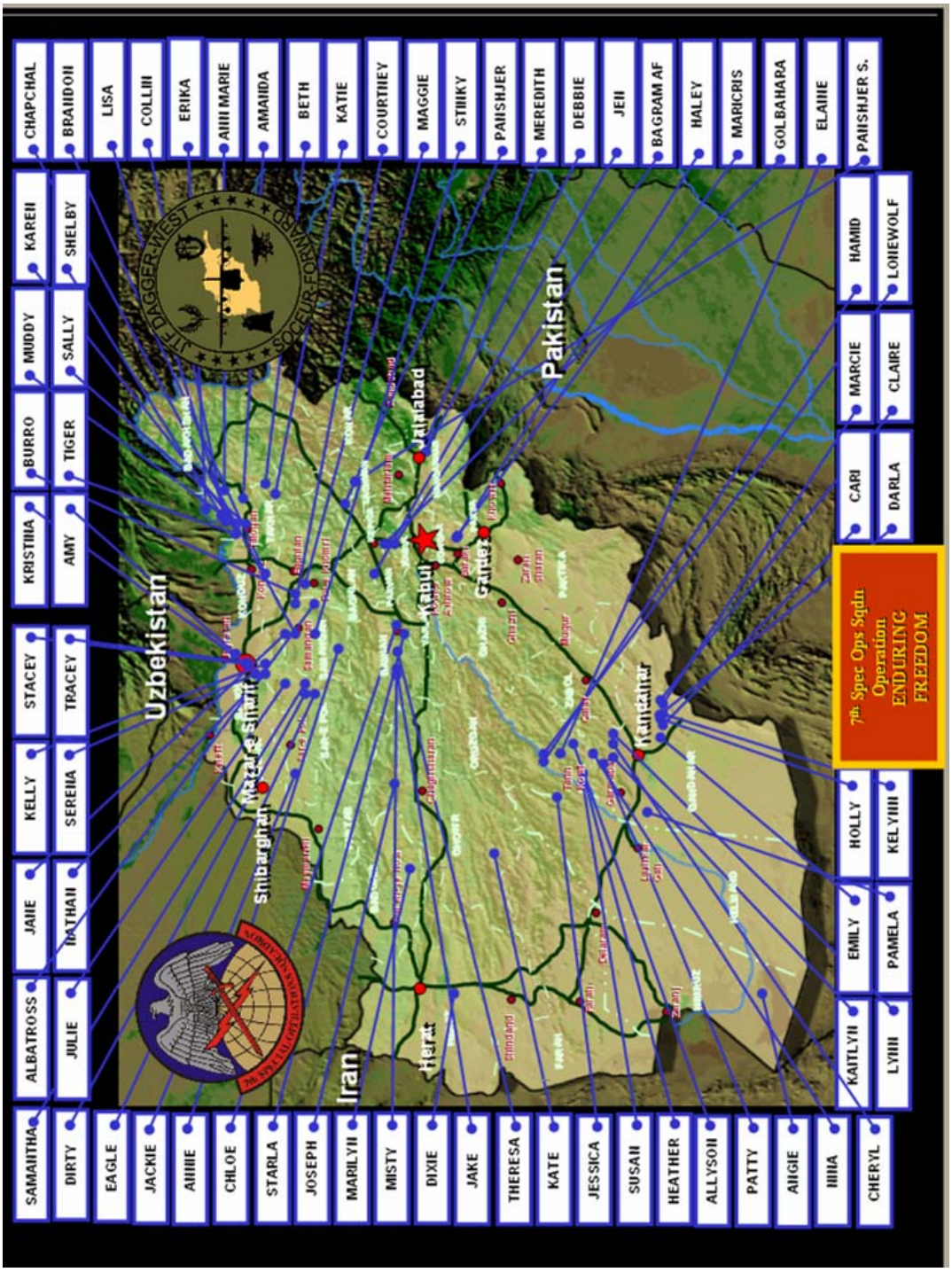
Appendix 1. Afghanistan Drop Zones used by 7th Special Operations Squadron during Operation Enduring Freedom



Source: 7th Special Operations Squadron History Document, 2004. Available from Squadron Executive Officer, 7 SOS/CCE, Unit 250, Box 8815, APO AE 09459.

Appendix 2. Efficiency Calculations of Ton-miles per Ton of Fuel

	Platforms	Tons JP-8 required for 300 miles	Miles per ton JP-8	Tons Carried	Ton-miles per Ton Fuel
Package G1	1 x HEMTT	0.54	556	10	5560
Package G2	2 x HEMTT	1.08	278	20	5560
Package G3	3 x HEMTT	1.62	185	30	5560
Package A1	1 x C-130	2.64	113	18	2052
Package A2	2 x C-130	5.28	57	36	2052
Package A3	3 x C-130	7.92	38	54	2052
Package A4	1 x C-17	6.2	48	58	2784
Package A5	2 x C-17	12.4	24	116	2784
Assumptions	1 gal JP-8 = 7 lbs				
	1 x C-130 airdrop load of 36,000 lbs, based on 16 x A-22 containers				
	C-130 burns 3 tons JP-8 per hour, traveling 340 miles/hr				
	Facts on HEMTT and HMMWV from http://www.army.mil/fact_files_site/				
	1 x C-17 deliver 8 platforms with up to 14,500 pounds each				
	C-17 burns 8.5 tons per hour, traveling 410 miles/hour (AFI 11-2C-17V3, p. 137)				

Appendix 3. Efficiency Calculations of Time and Distance.

Kuwait City to Baghdad										
Platform	**Speed (mph)**	**Dist (miles)**	**One-Way Time**	**Enroute Rest (1)**	**Total time enroute**	**Off/up load Time**	**Runs/ day (3)**	**Round trip time**	**Tons/Day /Platform**	**RON?**
HEMTT (2)	50	340	6.8	0.8	7.6	2.0	1	N/A	10	Y
C-130	340	340	1.0	0.0	2.0	0.0	3	2	54	N/A
C-17	410	340	0.8	0.0	1.7	0.0	3	1.7	174	N/A
Baghdad to Mosul										
Platform	**Speed (mph)**	**Dist (miles)**	**One-Way Time**	**Enrte Rest***	**Total time enrte**	**Off/up load Time**	**Runs/ day****	**Round trip time**	**Tons/Day /Platform**	**RON?**
HEMTT (2)	50	185	3.7	0.25	4.0	2.0	1	10	10	N
C-130	340	185	0.5	0	1.1	0.0	4	1.1	72	N/A
C-17	410	185	0.5	0	0.9	0.0	4	0.9	240	N/A

NOTES:

(1) Most convoys offer 15 min rest stops for every 2-3 hours of driving.

(2) The HEMTT is advertised to be governed at 57 mph.

(3) The limiting factor in runs per aircraft is load time, and the resultant impact on tactical crew duty day (12 hours). Assumes 1.5 hrs between sorties, 3 hours pre-flight.

RON = Remain Overnight

Distances are ground (road) distances. Air distances would likely be shorter given the direct nature of flight.

Appendix 4. US Army & USMC Aerial Delivery Units

US Army Aerial Delivery Units					
Component	**Type**	**Organiaztion**	**HHQ**	**Location**	**Capability (STONs/Day)**
Army (Active)	Div Unit	E Co, 782d MSB	82d Abn Div	Ft Bragg, NC	200
	Corps unit	600th AD Equip Repair & Supply Co	1 COSCOM	Ft Bragg, NC	0
		612th AD Supply Co	1 COSCOM	Ft Bragg, NC	120
		623d AD Equip Repair & Supply Co	1 COSCOM	Ft Bragg, NC	0
		647th AD Equipment Co	1 COSCOM	Ft Bragg, NC	200
	Detatchment	4th AD Support Det	19th TSC	Korea	50
		5th AD Support Det	21st TSC	Germany	50
		24th AD Support Det	S. European Task Force	Italy	50
		87th AD Support Det	25th ID	Hawaii	50
		534th AD Support Det	4th BCT/ 25th ID	Alaska	50
		4th Plt, 647th AD Equip Co	101st Abn (Aaslt) Div	Ft Campbell, KY	50
	Spec Ops	Rigger Detatchment	1 SFG (Abn)	Ft Lewis, WA	50
		Rigger Detatchment	3 SFG (Abn)	Ft Bragg, NC	50
		Rigger Detatchment	5 SFG (Abn)	Ft Campbell, KY	50
		Rigger Detatchment	7 SFG (Abn)	Ft Bragg, NC	50
		Rigger Detatchment	10 SFG (Abn)	Ft Carson, CO	50
		Rigger Detatchment	528th Spec Ops Supt Bn	Ft Bragg, NC	50
Army Reserve		421st QM Co (Light AD Supply)	81st Regional Supt Cmd	Fort Valley, GA	120
		824th QM Co (AD)	81st Regional Supt Cmd	Ft Bragg, NC	0
		861st AD Supply Co	81st Regional Supt Cmd	Nashville, TN	200
Army Nat'l Guard		128th QM Co (AD Supply)	CA ANG	Santa Barbara, CA	120
		Rigger Detatchment	19 SFG (Abn)	AL, MD, FL NG	50
		Rigger Detatchment	20 SFG (Abn)	Utah NG	50
Data compiled from interview with MAJ W. Keith Fegler, USA and TOE documents from www.cascom.army.mil					

US Marine Corps Aerial Delivery Units					
Component	**Type**	**Organiaztion**	**HHQ**	**Location**	
Active	Platoon	1st Air Delivery Platoon	1st Marine Logistics Group	Camp Pendleton, CA	See NOTE below
		2nd Air Delivery Platoon	2nd Marine Logistics Group	Camp Lejeune, NC	See NOTE below
		3rd Air Delivery Platoon	3rd Marine Logistics Group	Camp Foster, Okinawa	See NOTE below
Data compiled from interview with Gunnery Sergeant L. Bush, USMC					

US Army AD Unit Capabilities by Class (STONs)		
Class	**Light**	**Heavy**
I	12	20
II	6	10
III(P)	6	10
IV	12	20
V	66	110
VII	6	10
VIII	6	10
IX	6	10
Total	120	200
Data from FM 10-500-9, tables 2-1 (light) and 3-1 (heavy)		

NOTE: The USMC AD platoon is composed of 30-40 riggers. It is estimated a rigger team of 8 Marines is capable of rigging 96 short tons in 6 hours. Total daily capability is limited by shift schedules, personnel availability and materials on hand.

Appendix 5 Future Aerial Delivery Systems

Affordable Guided Airdrop Systems (AGAS). Uses the standard Army G-12 cargo parachute to guide the load to its geographic location. The A-22 container, capable of holding 2200 lbs of supplies and equipment, is used to carry the load to its destination. The components of the system include electromechanical actuators which adjust the length of the parachute risers in order to steer the canopy. A GPS is used to send signals to the actuators to compensate for fluctuations in the wind. In November of 2003, out of a total of six test airdrops, AGAS was able to guide each load within 65 meters of the target. Three of the loads landed within 25 meters of the objective. Each of the drops were made from an altitude of 10,000 ft. The system now weighs 150 lbs. *Source*: Aerial Delivery (AD) Magazine #4, June 2004

SARFIND (Search and Rescue Finder Decoder) reads and displays the location of the airdropped item(s)

Airdrop Locator System (ALDS). Attaches a beacon to the airdrop load (see picture at right). The beacon transmits a signal to the ground party's decoder (see picture at left) when the load exits the aircraft. The decoder receives the signal and its encoded GPS position. ALDS locations are accurate within 10m. *Source*: AD Magazine #3, February 2004

SARBE (Search and Rescue Beacon) 8 GPS (Global Positioning System) with antenna is mounted to the load

Low Cost Air Delivery System (LCADS) Lo-Velocity and Hi- Velocity Parachutes. The delivery system has a weight capacity of 2200 lbs. and can be dropped from an altitude of 15,000 - 25,000 ft above ground level. This "black widow" chute has 12 "legs" that are knotted, not stitched, to the suspension lines. LCADS is used for high-volume delivery of non-fragile items where airdrop equipment is not recoverable. *Source*: Department of the Army, FM 4-20.103, Airdrop of Supplies and Equipment: Rigging Containers (Washington, DC: GPO, 2005), 12-1; AD Magazine #2, November 2003 p. 5; and #4, June 2004

Low cost container The Low Cost Container is roughly 60% cheaper than the current A-22 container, costing the user about $200, rather than $480 for the standard A-22. The cost savings is due to the use of light polypropylene webbing rather than the nylon webbing used for the A-22, and a simplified design that uses less material. It would be an inexpensive alternative to the A-22 cargo container, which uses metal hardware and multiple straps of nylon webbing to contain a CDS load. Cheaper fabrics and a simpler design were used to fabricate a container that did not have the durability of the A-22, but promised to be a perfect one-time use alternative. This container is a sub-component of the LCADS. *Source*: AD Magazine #6, February 2005

Sherpa Each system, which includes a body, canopy, riggings, remote control, rechargeable batteries and software, costs $68,000. A standard military cargo parachute runs approximately $11,000.Sherpa provides accurate drops day or night from as high as 25,000 feet and as far as nine miles from the drop zone. Numerous Sherpas could be dropped during one pass, saving time and fuel, and each could soar to a different unit at a different location stretched over several miles. *Source*: Bush, Gunnery Sergeant, USMC, Interview.

Appendix 6. Doctrinal Cross Walk

Doctrinal Comparison of Advantages and Disadvantages of Airdrop								
	Joint		Army		USAF		USMC	
Issue	Pro	Con	Pro	Con	Pro	Con	Pro	Con
Useful when no other delivery means exists			+		+			
Allows direct throughput			+					
Reduces battlefield logistics footprint			+		+		+	
Shorter turn time for aircraft than airland			+				+	
Vulnerable to surface-air threats				-				
No Backhaul				-				
Need to establish recovery of AD equipment				-				-
Less payload than airland		-		-		-		
Special personnel required (DZ party, riggers)		-		-		-		-
DZ security				-				-
Winds		-		-				-
Extensive planning effort				-		-		
Less aircraft range due to low-level flight*						-		
Surprise, mass, concentration	+				+			
All weather**	+							
Risk of damage to equipment		-				-		
Operational risk of detection of large formations		-						
Delivery to AOs not collocated with LZ or airfield	+				+		+	
Minimizes threat to aircraft at objective area (vs. airland)					+		+	
Allows greater dispersal of ground forces							+	
Less handling of supplies/faster shipment							+	
Aircraft availability for airdrop mission								-

Responsible Entity by Doctrinal Source				
Responsibilities	JP 3-17	FM 4-20.41	USAF	USMC
Planning	Joint	Joint		CSSE
Mark, operate, Control DZ	Army	Army		Supported unit
Provides Supplies	Army	Army		Supported unit
Rigs supplies	Army	Army		AD Platoon
Load Supplies onto Aircraft	Army^	Air Force^		AD Platoon
Inspect load	Joint	Joint		AD Platoon
Determine DZ location	Army	Joint*		Supported unit
Request Airlift Support	Army	SPO		CSSE
Decides to use airdrop	JFC	SPO	User's reqmts	CSSE
Recover supplies at DZ	Army	FSB		Supported unit
Retrograde airdrop equipment	Army	FSB		Supported unit
Apportionment of airlift assets		Air	DIRMOBFOR	
Airspace deconfliction			JFACC (ACA)	
Source	p. IV-17	p. 4-2	Multiple pgs	MCWP 4-11.3

Appendix 7: Limitations for Type V Airdrop Platform when Dropping from a C-130, C-141, C-5 and C-17 Aircraft

C-130, C-141, and C-5 Aircraft

Length (Feet)	Width (Inches)	Weight (Pounds)	Platform Surface (Square Feet)	Minimum Rigged Weight (Pounds)	Maximum Rigged Weight (Pounds)
8	108	820	72	2,520	15,000
12	108	1,220	108	3,780	21,000
16	108	1,590	144	5,040	28,000
20	108	1,950	180	6,300	39,000
24	108	2,280	216	7,560	42,000
28	108	2,820	252	8,820	42,000
32	108	3,056	288	10,080	42,000

C-17 Aircraft

Length (Feet)	Width (Inches)	Weight (Pounds)	Platform Surface (Square Feet)	Minimum Rigged Weight (Pounds)	Maximum Rigged Weight (Pounds)
8	108	820	72	2,520	*10,000
12	108	1,220	108	3,780	*18,500
16	108	1,590	144	5,040	*27,700
20	108	1,950	180	6,300	39,000
24	108	2,280	216	7,500	42,000
28	108	2,820	252	8,820	42,000
32	108	3,056	288	10,080	42,000

* Aircraft restraint rails reduce the weight

Source: Department of the Army, FM 4-20.102, *Airdrop Of Supplies And Equipment: Rigging Airdrop Platforms* (Washington, DC: GPO, 2001), 2-2. Maximum weights noted have some exceptions, especially concerning special operations MC-130E/H aircraft. Page 2-3 denotes these differences.

Appendix 8. General Weight Limitations for Cargo Parachutes

Table 2-5. General Weight Limitations for Cargo Parachutes

*Suspended Weight in Pounds

Parachutes	Minimum	Maximum
G-11B		
1	2,270	5,000
2	5,001	10,000
3	10,001	15,000
4	15,001	20,000
G-11C		
5	20,001	25,000
6	25,001	30,000
7	30,001	35,000
8	35,001	40,000
G-12E*		
1	501	2200
2	2,270	3,500

* Suspended weight in pounds is the total rigged weight less the weight of the cargo parachutes.

Source: Department of the Army, FM 4-20.102, *Airdrop Of Supplies And Equipment: Rigging Airdrop Platforms* (Washington, DC: GPO, 2001), 2-19. Table demonstrates the parachute/weight relationship for Type V platform drops.

Appendix 9. Parachute/Weight Relationship for Container Delivery System (CDS) Drops.

Table 1-1. Parachute Requirements for Low-Velocity Airdrop

Parachute	Suspended Weight (Pounds) Minimum	Maximum
One 68-inch pilot	30	50
Three 68-inch pilot	51	200
One G-14	200	500
Two G-14	501	1,000
*Three G-14	1,001	1,500
One G-12E	501	2,200

* Loads must be dropped one at a time.

Note: Clustering G-14 cargo parachutes should be used **only** when a G-12E cargo parachute is not available.

Table 1-2. Parachute Requirements for High-Velocity Airdrop

Parachute	Suspended Weight (Pounds) Minimum	Maximum
* One 68-inch pilot	75	150
Three 68-inch pilot	151	500
*One 12-foot high-velocity	151	500
One 15-foot cargo extraction	151	500
*One 26-foot high-velocity	501	2,200
One 22-foot cargo extraction	501	2,200

*Primary parachute

Source: Department of the Army, FM 4-20.153, *Airdrop Of Supplies And Equipment: Rigging Ammunition* (Washington, DC: Government Printing Office, 2004), 1-2.

Appendix 10. Supporting Calculations for Figures 13 through 16.

Cargo Weight (lbs)	Distance (statute mi)	Air prep	Air travel	Air Total Time	Ground Prep	Ground travel	Ground Travel + rest	Ground Total Time	Air Speed	Ground Speed
20,000	50	3.75	0.17	3.92	0.5	1	1	1.5	300	50
	100	3.75	0.33	4.08	0.5	2	2	2.5	300	50
	200	3.75	0.67	4.42	0.5	4	4.25	4.75	300	50
	300	3.75	1.00	4.75	0.5	6	6.5	7	300	50
	400	3.75	1.33	5.08	0.5	8	8.5	9	300	50
	500	3.75	1.67	5.42	0.5	10	10.75	11.25	300	50
	600	3.75	2.00	5.75	0.5	12	13	13.5	300	50
35,000	50	5.75	0.17	5.92	0.5	1	1	1.5	300	50
	100	5.75	0.33	6.08	0.5	2	2	2.5	300	50
	200	5.75	0.67	6.42	0.5	4	4.25	4.75	300	50
	300	5.75	1.00	6.75	0.5	6	6.5	7	300	50
	400	5.75	1.33	7.08	0.5	8	8.5	9	300	50
	500	5.75	1.67	7.42	0.5	10	10.75	11.25	300	50
	600	5.75	2.00	7.75	0.5	12	13	13.5	300	50
70,000	50	9.75	0.17	9.92	1	1	1	2	300	50
	100	9.75	0.33	10.08	1	2	2	3	300	50
	200	9.75	0.67	10.42	1	4	4.25	5.25	300	50
	300	9.75	1.00	10.75	1	6	6.5	7.5	300	50
	400	9.75	1.33	11.08	1	8	8.5	9.5	300	50
	500	9.75	1.67	11.42	1	10	10.75	11.75	300	50
	600	9.75	2.00	11.75	1	12	13	14	300	50
105,000	50	15.25	0.17	15.42	2.75	1	1	3.75	300	50
	100	15.25	0.33	15.58	2.75	2	2	4.75	300	50
	200	15.25	0.67	15.92	2.75	4	4.25	7	300	50
	300	15.25	1.00	16.25	2.75	6	6.5	9.25	300	50
	400	15.25	1.33	16.58	2.75	8	8.5	11.25	300	50
	500	15.25	1.67	16.92	2.75	10	10.75	13.5	300	50
	600	15.25	2.00	17.25	2.75	12	13	15.75	300	50

Assumes

- C-130 at 300 mph; Convoy at 50 mph, with 15 min break every 3 hours
- Both ground and air time assume adequate supplies on hand
- 1 QM rigger Company (Light) available, and aircraft colocated with rigging facility
- 35,000 pounds per C-130 (16 x A-22 container at 2,200# ea)// 20K = 9 CDS containers
- Some rigging and movement to aircraft takes place concurrently with aircraft and aircrew preparation
- Prep time for airdrop = 1) load cargo on vehicles + 2) movement to rigger facility + 3) rigging + 4) aircraft loading + 5) Jt Airdrop Inspection (JAI)
- Prep time for convoy = load cargo on vehicles
- Assumes multiple aircraft loaded simultaneously, and aircrews arrive at aircraft upon completion of loading and inspection
- Assumes AD rigger Co.(Light) which is doctrinally capable of rigging 240,000 lbs (120 STONS) per day (IAW FM 4-20.41, p. 3-3)
- Rig times are based on ratio of load required to full days capacity (ie 20K is 1/12 of full days capability, therefore takes 2 hours)
- Load times assume competent truck/forklift operator (non-PLS), and 30 min per truck to load HEMTT, 4 forklifts available

	Aircraft Prep			
	20K	35K	70K	105K
1) Load	0.5	0.5	1	2.75
2) Move	0.25	0.25	0.25	0.25
3) Rig	2	3.5	7	10.5
4) Aircraft load	0.25	0.5	0.5	0.75
5) JAI	0.75	1	1	1
Total	3.75	5.75	9.75	15.25

	Ground Prep			
	20K	35K	70K	105K
1) Load	0.5	0.5	1	2.75
Total	0.5	0.5	1	2.75

Appendix 11. Airdrop of Ammunition

Container Delivery System							
1 x A-22 Bundle (Low-Velocity) (3)							
Weapon System	**Caliber**	**Rounds/ box**	**Boxes/ Low-Vel A-22**	**# Total Rounds / A-22**	**# Combat Basic Loads/A-22 (2)**	**#C-130s/ CBL**	**#CBLs/ C-130**
M-4/M-16	5.56 mm	1680	24	40320	269	<1	4301
M240 MG	7.62 mm	800	24	19200	12	<1	192
Pistol	9 mm	2000	24	48000	1600	<1	25600
M2 MG	0.50 cal	200	24	4800	4	<1	64
M2 IFV	25 mm	30	36	1080	1.20	<1	19
105T How	105mm	2	16	32	0.19	<1	3
M1A2	120mm	2	20	40	1	<1	16
155 SP How	155mm	1	10	10	0.04	1.45	0.69
1 x A-22 Bundle (High-Velocity) (4)							
Weapon System	**Caliber**	**Rounds/ box**	**Boxes/ Hi-Vel A-22**	**# Total Rounds / A-22**	**# Combat Basic Loads/A-22 (2)**	**#C-130s/ CBL**	**#CBLs/ C-130**
M-4/M-16	5.56 mm	1680	5	8400	56	<1	896
M240 MG	7.62 mm	800	5	4000	2.5	<1	40
Pistol	9 mm	2000	5	10000	333	<1	5333
M2 MG	0.50 cal	200	5	1000	0.83	<1	13
M2 IFV	25 mm	30	8	240	0.27	<1	4
105T How	105mm	2	3	6	0.03	1.79	0.56
M1A2	120mm	2	4	8	0.2	<1	3.2
155 SP How	155mm	1	3	3	0.01	4.83	0.21

Heavy Equipment Delivery							
		16' Type V Platform (non-PLS) (5)			**24' Type V Platform (PLS)**		
Weapon System (6)	**Caliber**	**Boxes / Platform**	**Rounds/ Platform (Note 1)**	**# Combat Basic Loads (2)**	**Boxes/ Platform**	**Rounds/ Platform**	**# Combat Basic Loads (2)**
105T How	105mm	140	280	1.63	245	490	2.85
155 SP How	155mm	96	96	0.41	n/a	n/a	n/a
		8' Type V Platform (with 4 x A-22 low-vel attached)			**24' Type V Platform (with 8 x A-22 low-vel attached)**		
Weapon System	**Caliber**	**Rounds/ A-22**	**Rounds/ Platform**	**# Combat Basic Loads (2)**	**Rounds/ A-22**	**Rounds/ Platform**	**# Combat Basic Loads (2)**
M-4/M-16	5.56 mm	40320	161280	1075	40320	322560	2150
M240 MG	7.62 mm	19200	76800	48	19200	153600	96
Pistol	9 mm	48000	192000	6400	48000	384000	12800
M2 MG	0.50 cal	4800	19200	16	4800	38400	32
M2 IFV	25 mm	1080	4320	4.80	1080	8640	9.6
105T How	105mm	32	128	0.74	32	256	1.49
M1A2	120mm	40	160	4	40	320	8
155 SP How	155mm	10	40	0.17	10	80	0.34

NOTES: Tables selected from FM 4-20.153 are representative of the majority of applicable situations, but in the case of some forms of ammunition, different rigging instructions apply. Refer to FM 4-20.153 for data on specific ammo/fuses etc.

(Note 1) FM 4-20.112, Ch 8 describes the 16' platform as carrying 96 x 155 mm, but only 72 powder cannisters.

(Note 2) CBL data from Logistics Esitmate Worksheet ver 10. System used to calculate CBL in above tables identified below in **bold.**

	5.56 mm	**7.62 mm**	**9 mm**	**0.50 cal**	**25 mm**	**105mm**	**120mm**	**155mm**	
System	**M-4/M-16**	**MG**	**Pistol**	**MG**	**M2 IFV**	**105T How**	**M1A2**	**155 SP How**	
CBL	**150**	**1600**	**30**	**1200**	**900**	**172**	**40**	**232**	
System	MG	M2 IFV		M1 MBT		M1 MBT			
CBL	800	2300		900		51			
System		M1A2/M1MBT							
CBL		11400							

Source of Boxes/A-22 Container = FM 4-20.153 Figure X.X								
	5.56 mm	**7.62 mm**	**9 mm**	**0.50 cal**	**25 mm**	**105mm**	**120mm**	**155mm**
(Note 3)	2.1	2.1	2.1	2.1	2.6	2.17	2.28	2.35
(Note 4)	4.1	4.1	4.1	4.1	4.6	4.3	4.18	4.22

(Note 5) According to FM4-20.112, 155mm may be rigged on a 16' Type V platform using either regular 155mm rounds and powder (p. 5-26) or using the Modular Artillery Charge System (MACS) (p. 8-1).

(Note 6) FM 4-20.112 only specifies rigging procedures for 105mm and 155mm ammo. According to MAJ Keith Fegler, Aerial Delivery Section at the Combined Arms Support Command, these two calibers are specified because the primary customer (XVIII Ariborne Corps) requested their inclusion.

Appendix 12. Capabilities of US Army Rigging Units.

Type V Platforms									
		8'	12'	16'	20'	24'	28'	32'	TOE
Equip on Hand IAW TOE	Det	10	6	4	2	2	2	2	10510LA000
	Lt Co								10443L000
	Hvy Co								10643L000
	EAD Co^	207	216	246	108	78	81	24	10437L000

		Low Velocity Parachutes			High Velocity Parachutes		
		Platform	A-22 Containers		A-22 Containers		
		G-11 (5)	G-12E (5)	G-14	26'	22'	12'
Equip on Hand IAW TOE	Det	50	89	22	80	10	8
	Lt Co		315	141	36		15
	Hvy Co	100	360	18	39	15	
	EAD Co (1)	2385	1002	300	201	267	
Suspended Weights (1,000 pounds) (2)	.2 to .5			1			1
	.5 to 1			2			
	1 to 1.5			3			
	.5 to 2.2		1		1	1	
	2.2 to 3.5		2 to 3				
	2.2 to 5	1					
	5 to 10	2					
	10 to 15	3					
	15 to 20	4					
	20 to 25	5					
	25 to 30	6					
	30 to 35	7					
	35 to 40	8					
Wind Limits (kts) (6)		17	13	20	n/a	n/a	n/a
Min Drop Altitude (# chutes/feet above surface) (3)		1/700 2-4/750 5-7/1100 8/1300	1/300 2-3/450	1-2/300 3/400	500	250	400

Number of Simultaneously Riggable Loads Given TOE Stocks of Type V Platforms and Chutes (4)										
	Weight (K #)	8'	12'	16'	20'	24'	28'	32'	A-22 (Lo-V)	A-22 (Hi-V)
Det	.5-2.2	n/a w	n/a w	n/a w	n/a w	n/a w	n/a w	n/a w	89	80
	2.2 to 5	10p	6p	n/a w	n/a w	n/a w	n/a w	n/a w	n/a w	n/a w
	5 to 10	10p	6p	4p	2p	2p	2p	n/a w	n/a w	n/a w
	10 to 15	10p	6p	4p	2p	2p	2p	2p	n/a w	n/a w
	15 to 20	n/a w	6p	4p	2p	2p	2p	2p	n/a w	n/a w
	20 to 25	n/a w	n/a w	4p	2p	2p	2p	2p	n/a w	n/a w
	25 to 30	n/a w	n/a w	4p	2p	2p	2p	2p	n/a w	n/a w
	30 to 35	n/a w	n/a w	n/a w	2p	2p	2p	2p	n/a w	n/a w
	35 to 40	n/a w	n/a w	n/a w	2p	2p	2p	2p	n/a w	n/a w
Lt Co		n/a p	n/a p	n/a p	n/a p	n/a p	n/a p	n/a p	n/a p	315	36
Hvy Co		n/a p	n/a p	n/a p	n/a p	n/a p	n/a p	n/a p	n/a p	360	39
EAD Co	.5-2.2	n/a w	n/a w	n/a w	n/a w	n/a w	n/a w	n/a w	1002	201
	2.2 to 5	207 p	216 p	n/a w	n/a w	n/a w	n/a w	n/a w	n/a w	n/a w
	5 to 10	207 p	216 p	246 p	108 p	78 p	81 p	n/a w	n/a w	n/a w
	10 to 15	207 p	216 p	246 p	108 p	78 p	81 p	24 p	n/a w	n/a w
	15 to 20	n/a w	216 p	246 p	108 p	78 p	81 p	24 p	n/a w	n/a w
	20 to 25	n/a w	216 p	246 p	108 p	78 p	81 p	24 p	n/a w	n/a w
	25 to 30	n/a w	n/a w	246 p	108 p	78 p	81 p	24 p	n/a w	n/a w
	30 to 35	n/a w	n/a w	n/a w	108 p	78 p	81 p	24 p	n/a w	n/a w
	35 to 40	n/a w	n/a w	n/a w	108 p	78 p	81 p	24 p	n/a w	n/a w

Note: TOE tables do not identify plywood on hand, nor specific rigging equipment (honeycomb, nylon webbing, etc.)

(Note 1) Echelon Above Division, Airdrop Equipment Supply Co (Corps)

(Note 2) Weight limits from AFI11-231, Computed Airdrop Release Procedures, p. 150-151

(Note 3) Drop Altitude limits in feet above ground level (AGL) from AFI 11-231 p. 150-151

(Note 4) Based on comparison of Type V platforms on hand and G-11B chutes on hand; number identified with p (platform) or c (chute) suffix to indicate limiting factor. Weight ranges for Type V platforms from FM 4-20.102, p. 2-2. n/a p denotes unit has no platforms on hand, n/a w denotes weight is out of range for given platform.

(Note 5) From FM 4-20.102, p. 2-19

(Note 6) Surface wind limits from AFI 13-217, p. 16; limits only apply to training loads; actual limits of non-USAF equipment are at the discretion of the DZ party, understanding that higher winds increase probability of damage upon landing. "n/a" represents unlimited surface winds. Winds aloft do not apply.