

AFIT/GMO/LAC/97Y-1

**RETHINKING
STRATEGIC BRIGADE AIRDROP**

GRADUATE RESEARCH PAPER

Seth Beaubien, Captain, USAF

AFIT/GMO/LAC/97Y-1

THIS QUANTITY DESTROYED 2

19971017 151

Approved for public release; distribution unlimited

The views expressed in this graduate research paper are those of the author and do not reflect the official policy or position of the Department of Defense or the U. S. Government.

**RETHINKING
STRATEGIC BRIGADE AIRDROP**

GRADUATE RESEARCH PAPER

Presented to the Faculty of the Graduate School of Logistics
and Acquisition Management of the Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the
Requirements for the Degree of
Master of Mobility

Seth Beaubien, B.S., M.A.S.

Captain, USAF

April 1997

Approved for public release, distribution unlimited

Acknowledgments

I would like to thank the many sources both military and corporate, whose help made researching this paper easier. From Allied Signal to Boeing Helicopter on the outside, and within the military to Lieutenant Colonel Barnd and the History Office at USTC, the C-17 System Program Office, AMC staff, AFSOC and AMC History Offices, Commander Ahern at the V-22 Program Office and within the Air Mobility Warfare Center Lieutenant Colonel Shackelford, Major Agar and classmates Majors Hershman, Howard, Kochanski and O'Dell who funneled me information, all were instrumental in the completion of this project.

I would especially like to thank my advisor, Dr. Vaughan, for his patience, expertise and guidance as I meandered through this GRP maze.

Lastly, I would like to beg Wendy and Mireille's forgiveness for these last few months when I appeared more attached to my laptop to than either of them. Thank you, *je vous aime*.

Table of Contents

	Page
<u>List of Figures</u>	iv
<u>List of Tables</u>	v
<u>Abstract</u>	vi
<u>I. Introduction</u>	1
<u>II. SBA Past And Present</u>	5
Birth of SBA	5
Southeast Asia	11
Present Day	15
Plans for the Future	19
<u>III. Problems Within SBA</u>	22
Rio Hato	22
Personnel	24
Air Refueling	25
SKE	27
Follow-On Test and Evaluation	29
C-5	31
Acquisition Politics	32
Safety	38
<u>IV. Alternatives</u>	40
Airland	40
C-130J	44
Osprey	46
<u>V. Conclusion and Further Considerations</u>	52
<u>Bibliography</u>	57
<u>Vita</u>	61

List of Figures

Figure	Page
1. Airland intermodal container with palletized seating atop	44
2. Conceptual Osprey DZ	50

List of Tables

Table	Page
1. Strategic Brigade Airdrop Capability	20
2. Passive Detection Warning in NM	28
3. Passive Detection Warning in Minutes	28
4. SBA Options and Costs	51

Abstract

Strategic Brigade Airdrop has been an American force employment method for over fifty years. This paper looks at SBA's viability, now and in the future.

A history of SBA analyzes the tragedies and triumphs of SBA over the years. Specifically noted are common threads through history that continue to effect SBA today. Problems within SBA as varied as doctrine, safety, equipment, personnel and acquisition politics signal the need for change.

Three alternatives are provided to the present plan to airdrop a brigade-size force from C-141, C-5 and C-17 aircraft. The first alternative is a response to changing warfighting doctrine and the political realities of battlefield casualties. It involves the shifting from an airdrop to an airland method of troop deployment. The second alternative offers a less expensive aircraft for the personnel portion of the airdrop mission. It provides more mass on the DZ in less time. The last alternative uses a brand new aircraft to deploy troops in a swarm of aircraft landing like helicopters on the DZ. Multiple corridors and many aircraft are used to increase flexibility while decreasing vulnerability over the DZ.

This paper rethinks SBA from an "outside the box" perspective. Its intention is to show weaknesses and vulnerabilities of the present SBA plan, at the same time offering thoughtful solutions to the problem of deploying Army troops from the fort to the DZ.

RETHINKING STRATEGIC BRIGADE AIRDROP

I. Introduction

Strategic Brigade Airdrop (SBA) is one of the primary methods to deliver the United States Army's soldiers to the combat area. For over half a century the 18th Airborne Brigade has been jumping out of airplanes in the name of God and country. This storied unit was crucial to the successful outcome of many battles such as those fought in Europe during WW II or on the peninsula during the Korean War and brought much glory to the Army. The men and women of Air Mobility Command (AMC) provide the critical service of transporting these military parachutists from port to drop zone. It takes a large formation to put an entire brigade's worth of personnel and equipment across a drop zone in a short period of time. SBA is a colossal task.

The concept of SBA has not kept up with advances in warfighting doctrine and technology. The world and the nature of war have changed. SBA, on the other hand, remains much the same as when General Ridgway's men parachuted into Normandy. The orchestration of a massive integrated air land battle has shifted to a three-phase

approach to military conflicts: halting, buildup and counter-offensive (Monahan). Despite years of progress in transportation systems, weaponry and the application of military thinking and firepower, the United States Air Force and Army train to fly an enormous formation of large aircraft into the combat area and parachute its soldiers onto the battlefield in much the same manner it did fifty years ago. The doctrine of warfighting with airborne troops is stuck in an outmoded paradigm. Change is difficult, but change is needed. It is time for modern, forward-thinking concerning SBA. This is more of a logistical problem than a tactic. SBA is about troop deployment, not employment. Is one long iron alligator, borrowing a term coined by the Royal Air Force, flying through the sky the best way to safely deliver soldiers to a combat zone?

The Army's customer contract specifications for SBA delivery with AMC are numerous, some are classified, and their effects are widespread within both the airlift and air refueling communities. SBA problems with manning, air refueling formation, tactics and simple fleet size exist within AMC. In the 1997 Air Mobility Master Plan Executive Summary, there is a stoplight chart providing the commander's assessment of seven operational tasks and eleven core supporting processes within AMC. Airdrop is one of only three of these categories where, both today and in the short term, AMC has poor capability (AMMP, 96:iii). This paper will suggest that SBA may have outlived its usefulness as a troop deployment method by examining the problems presently associated with it.

The C-17 has been assigned to fill AMC's airlift requirement for SBA. As such, it is the subject of much of the discussion in this paper. AMC has pinned much of its hopes for the future on the C-17. "The C-17 is the most flexible airlift aircraft to enter

the Air Force's inventory" (Air Force website, 97). McDonnell Douglas has a solid product that could satisfy much of America's air mobility needs. It is a direct delivery, three person crew aircraft that can haul outsize, oversize, standard bulk cargo and passengers into primitive, unprepared locations. It is wonderfully reliable and supremely capable.

Possibly AMC is asking too much of its newest airlifter to also perform the personnel airdrop portion of the SBA mission. A tremendous amount of lift is generated by the C-17's wings. The by-products of that lift are large, powerful vortices trailing behind the aircraft. These vortices disrupt the airflow causing problems for both parachutists and trailing aircraft. The creation of the Globemaster superlifter may have optimized some aspects of its performance at the expense of others, specifically its ability to accomplish airdrop.

SBA may not even be necessary. The United States is at the top of the "New World Order," the nature of conflict has changed. Warfighting doctrine has changed significantly since the days when Marines and amphibious soldiers stormed the beaches and paratroopers blanketed the skies at Normandy. The United States Armed Forces must maintain the capability of parachuting personnel, equipment, SEAL team insertion, high altitude-low opening (HALO) and high altitude-high opening (HAHO) operations. If an entire brigade needs to be delivered at once, there are other, more inexpensive and safer, methods than SBA.

This paper researches the question: is SBA viable today and in the future? Three investigative questions support the research. What has been the evolution of SBA? What issues impact SBA effectiveness? Finally, what alternatives to the C-17 are available?

Chapter 2 discusses the inception and growth of SBA as well as historical events and effectiveness. Chapter 3 weaves together the threads of doctrine, personnel, acquisition, equipment, and problems which impact SBA. Chapter 4 provides three specific alternatives to the present method of large-scale Strategic Brigade Airdrop. Two different aircraft options and a doctrinal shift in aircraft employment are provided. Chapter 5 concludes the paper and addresses further considerations.

An SBA process working group is presently meeting regularly with personnel from the Pentagon, AMC and Fort Bragg taking part. It is time to realize that the warfighting and aerospace technology, threats and doctrine have changed. SBA shareholders must reexamine the concept, because if it does not change from within, SBA will eventually get so far behind technology and warfighting doctrine, that SBA will be a tragedy the next time it is used operationally and change will be forced upon the community. The tendency during reorganization from within is to get caught up in minutia while maintaining the basic structure and systems in place. An outsider's perspective is sometimes needed to get a fresh look, a different perspective, and provide a new answer to an old question. Strategic Brigade Airdrop is outdated, expensive, and tactically unsound. America deserves a smarter solution to the problem.

II. SBA Past And Present

Strategic brigade airdrop includes airdrop and airland insertion of a mix of equipment and combat personnel over great distances. Formation operations are essential for adhering to the principles of mass and security. The airdrop capability directly supports the JCS requirement for an immediate response capability to deploy forces throughout the world. Many of the Army forced entry concepts rely heavily on airdrop capabilities. While airland is the preferred method of deploying forces, the airdrop of troops and equipment is a crucial capability that remains an integral part of the joint warfighting doctrine. Airdrop aircraft must be able to conduct formation air refuelings and participate in formations of up to 100 aircraft. Finally, airdrop crews and the airborne troop commanders need real-time situational awareness of the battlefield and assured communications with ground forces in order to react to the dynamic character of combat operations. (AMMP, 96:1-10,11)

Birth of SBA

Parachuting dates back to the early days of ballooning, and for years it was thought of either as a recreational activity or the way to save and extract oneself from an otherwise fatal airborne aviation dilemma. A few forward-thinking individuals saw it as an opportunity to project power. Benjamin Franklin wrote in a 1784 letter to Jan Ingenhousz, "Five thousand balloons, capable of raising two men each, could not cost more than five ships off the line; and where is the prince who can afford so to cover his country with troops for its defense as that 10,000 men descending from the clouds might not in many places do an infinite deal of mischief before a force could be brought

together to repel them[?]" (Joint Staff, 95:6-1). Mischief from above soon became "death from above."

Mass delivered to the conflict swiftly via air transport is a concept that developed during the lull between WW I and WW II. Mr. Clay Blair, a reporter for Time, an editor for The Saturday Evening Post, and author of more than twenty books on the military, describes the nascence of SBA as:

During the twenties and thirties, most of the world's major armies experimented with airborne warfare. Two main theoretical concepts emerged: the use of small commando-like paratrooper units to seize key enemy objectives (bridges, etc.) ahead of advancing armies and the grander scheme of lifting larger regular infantry units by air transport into an 'airhead' which had been previously seized by paratrooper shock troops. (Blair, 85:26)

The debate between military strategists at the time was an important one that continues to be a central issue surrounding today's use of the paratrooper.

A method of concentrating troop strength quickly and precisely from a great distance did not become a reality until the Russians demonstrated their abilities during an exercise in 1936. Two battalions worth of troops were airlanded to a runway and offloaded within eight minutes. This test exercise brought realization to the rest of the world of the feasibility and importance of air transporting troops. Countries began scrambling to develop airborne programs of their own (Blair, 85:26).

Hitler's Nazi Germany developed a short-lived airborne force. Under the guise of sports clubs, civilian recreational parachute teams were created during the 1930s. When the German war machine was set into motion, these highly trained physical specimens were issued uniforms and weapons and then became part of the Blitzkrieg forces. These

paratroopers were used to secure bridges and other points of tactical and strategic interest (Blair, 85:29). Their success increased German confidence in airdrop.

In the meantime, an American General named William C. Lee was impressed by the manner in which Germany employed paratroopers as part of the Blitzkrieg assaults across Europe. He lobbied the War Department to create airborne forces within the United States Army. A test unit was established at Fort Benning on June 25, 1940. Fifty volunteers experimented with equipment and tactics both on the ground and from a 250 foot tower. On August 16th, they accomplished their first jump from an aircraft. One month later the 501st Parachute Battalion was authorized and activated. Quickly, the Army drew the finest soldiers from other units and created the 502nd, 503rd, and 504th Parachute Battalions. The pace was hectic and by November 21, 1941 the 501st made the first unit jump in United States Army history. In the spring of 1942, the four battalions were mated with glider regiments, then divided in two, creating the 82nd and 101st Airborne Divisions. General Matthew Ridgway was named commander of the 82nd, and appropriately enough Lee took command of the 101st (Blair, 85:30-37).

Across the Atlantic, overconfident German military leaders developed a plan for an airborne and airland assault, with a force 25,000 strong, to invade the British-held island of Crete. In May of 1941, the Germans executed the plan; it was a bloody but successful victory that resulted in a tremendous loss of forces and equipment. The Germans sustained a 44% casualty rate among their airborne forces, with three thousand dead and eight thousand injured. Of the 530 Luftwaffe aircraft employed in the operation, 170 were lost. On the British side the losses were even worse. They

evacuated the island "leav[ing] behind some twenty-seven thousand dead, wounded, missing and captured" (Blair, 85:29).

The German victory on Crete persuaded the Allies of the effectiveness of "death from above." American military leaders and U.S. Army Chief of Staff, General George Marshall, were convinced airborne troop delivery was an employment method to be reckoned with and programmed manpower and money at improving our airborne forces. Hitler, on the other hand, saw Crete in a totally different light. He felt the costs suffered had been too great, when weighed against the gains achieved. According to Blair, Hitler told his staff, "the days of the paratrooper are over" (Blair, 85:30). German paratroopers were attached to ground units and no large scale German airborne operations were launched from that time on (Blair, 85:29).

American forces and aircrew trained and practiced, becoming more and more proficient, and interestingly enough the problems they encountered continue to be many of the same problems SBA wrestles with today:

Mass jumps proved to be very difficult. In order to maximize surprise, concentrate force and keep enemy counterfire to a minimum, the drop itself had to be executed with speed and precision theretofore unknown in the military. The landing area, or drop zone (DZ), had to be free of obstructions such as trees or swamps or open bodies of water.... The planes had to fly in tight, well-disciplined formations, with no recourse to evasive maneuvers to avoid enemy gunfire, in order to drop the paratroopers en masse at the exact aiming point; otherwise, they might scatter the paratroopers all over the landscape. The planes had to fly very slowly (no more than one hundred and twenty miles per hour) and low (about six hundred feet) at the point of the drop to minimize the opening shock of the parachute as it hit the slipstream and the paratrooper's time of decent (when he was exposed). On the ground, paratroopers had to jettison parachutes, collect gear and form up into cohesive, interlocking combat units-squads, platoons, companies, battalions--before the enemy (however much surprised) could stage a counterattack. (Blair, 85:27)

Procedures were developed for the aircrews in the troop carrier wings, as well as the paratroopers, and the 82nd and 101st soon became operational. Prior to the triumphs for which they are well known, these units suffered tragic losses that speak to the vulnerability of aircraft and paratroopers over the DZ.

During the Battle of Biazza Ridge, 11 July 1943, General Patton ordered that the 1st and 2nd battalions of the 504th Airborne Regiment be airdropped into Sicily to meet up with their sister units. In a horrible incident of friendly fire, everything appeared normal until the paratroopers left the lead aircraft over the DZ:

Then suddenly all hell broke loose. It would never be established who fired first--nor did it make much difference--but suddenly a trigger-happy antiaircraft gunner either on land or on a ship opened up on the C-47s. This burst triggered a nearly incredible crescendo of sympathetic fire from other weapons. Within a minute it is probable that every antiaircraft weapon afloat and ashore opened up along the length of the beachhead. Some gunners believed the C-47s were low-flying Axis bombers. Others thought a German parachute division was jumping into the beachhead. The firing continued without letup.

Ridgway could do nothing to stop the slaughter. As he watched, horrified, sixty of the 145 C-47s--about 42 percent of the planes--were savagely hit. Twenty-three of these sixty never returned. They crashed into Sicily or the sea--six of them before the paratroopers inside could jump. . . . The planes broke formation and dumped paratroopers wherever they could. Some troopers came down inside German lines; others, without proper passwords, fell into the 45th Division sector. . . . Eight pilots peeled out of formation and headed for home with their 107 paratroopers, rightly convinced that it was suicidal to fly into the DZ. . . . It was difficult to fix the casualty figures. The best estimate was that the paratroopers suffered about 229 casualties during the drop, the aircrews about ninety. There were 81 paratroopers killed, 132 wounded, 16 missing. Probably 60 airmen died and 30 were wounded. (Blair, 85:101-102)

Many reasons were identified for the breakdown that caused this tragedy: recent Axis air attacks, poor communication and coordination, anxious anti-aircraft gunners following poor procedures, difficult routes to the DZ, and inadequate aircrew training and

navigation skills (Blair, 85:103). However, this incident typifies the vulnerability of a large formation of big, slow, low flying aircraft in a tactical environment.

Large scale personnel airdrop proved its fitness as the Allies retook Western Europe. The combined British/American forces that were airdropped ahead of the D-Day invasion force of Operation NEPTUNE achieved tactical but not necessarily technical success. The delivery precision was poor. Only one of the six airborne regiments dropped in the American sector landed on or near enough to the DZ to fight as a unified team. The poor accuracy of the troop-carrier aircrews can be attributed to poor training and inexperience, because in the words of Blair, "20 percent of them [were] completely green" (Blair, 85:236). The final reason for the inaccuracy was bad weather off the French coast. Although the weather hindered navigation it probably was equally responsible for the survival of the paratroopers. A fifteen mile cloud bank disoriented pilots, hid ground references, and divided the aircraft formations. But that same cloud bank protected the airborne armada from the sights of German anti-aircraft gunners. Of the 1250 airdrop aircraft involved, only 29 were lost. The remaining 1221 were able to find their DZ, or something similar, and give a green light, ensuring approximately 18,000 paratroopers were placed behind the German coastal gun emplacements (Blair, 85:236-7).

The 82nd Airborne Division's fierce fighting on the fields of France is legendary. Despite a poor airdrop into an area known as the St. Mere-Eglise triangle where it was surrounded, the 82nd held out, equipped with only small arms and short on ammunition, for a day and a half until the 8th Infantry Division arrived. The 82nd linked up with the XII Corps, cutting across the Merderet River and isolating the Cotentin Peninsula. In

spite of its losses and ignoring the fatigue, the 82nd traversed ground faster than the better-rested and equipped units it fought alongside. Blair's affection and regard for the 82nd are obvious:

It was the kind of performance generals dream about but seldom achieve. Under Ridgway and Gavin's frontline, personal leadership, most of the paratroopers--and ultimately most of the gliderists--had performed magnificently. . . . The cost had been frightful. Of the nearly 12,000 men of the 82nd Division committed in Normandy, about 46 percent (5,245) were listed as casualties--killed, wounded, or missing. Of these, 1,282 were killed and 2,373 had suffered wounds or injuries severe enough to warrant evacuation. When the division embarked for England on landing craft at Utah Beach, there were only 6,545 officers and men. (Blair, 85:295)

The fighting on the fields of France had been brutal. The losses suffered by the 82nd were external to their method of deployment. The airdrop successfully put the paratroopers on the battlefield (although not all on the DZ), the mass was dispersed during the drop, but quickly gravitated together into a formidable fighting force.

Southeast Asia

During the conflict in Southeast Asia, the United States Army and Air Force had to overcome a series of unique logistical problems. The mountainous jungle terrain, wet weather with low clouds and visibility, and remote sites with primitive or no infrastructure provided many and varied challenges to American forces. The guerrilla nature of the conflict and the condition and scarcity of a solid road or highway system drove planners and commanders to rely on aerial resupply of rations, ammunition and

equipment to many of the troops in the jungle. During the period from 1965-1972, almost 2.75 million tons of cargo moved in and around Vietnam by C-130 and just under one million tons by C-123 (Bowers, 83:683).

The airlift community evolved with many advances in procedures and tactics during the conflict in Southeast Asia. According to Colonel Ray Bowers, who served as a C-130 navigator in Vietnam, worked in the Office of Air Force History, and wrote The United States Air Force in Southeast Asia; Tactical Airlift, "Parachute assaults were few. US Army advisors with the airborne [Vietnamese] brigade urged that the parachute capability be used, but the tactical advantages remained unclear" (Bowers, 83:223). A successful drop of 1,125 Vietnamese paratroopers occurred on September 14, 1965 at a DZ north of Lai Khe, in the vicinity of Saigon. Combat control teams were dropped on occasion, but during 1966 the only airdrop of US Army airborne personnel was simply to maintain currency (Bowers, 83:223). That was the extent of most of the personnel drops. The vegetation and mountainous terrain in much of the country precluded SBA, but not the airdrop of supplies and equipment.

Four specific airdrop advances came about during or as a result of the resupply efforts in Southeast Asia. The container delivery system (CDS) was being tested in 1965 and by 1967 it was operational in C-130 units. The containers provided protection to the supply package being dropped, and with a 600 foot drop altitude, CDS achieved a significant improvement in accuracy. The low altitude parachute extraction system (LAPES) was in its infancy. But commanders liked this method that used a parachute to extract the load as the aircraft passes about five feet off the ground. Therefore, the operational tests were pushed through and crews were quickly qualified in the procedure.

During 1967, 500 tons were delivered via LAPES to Cat Lai, Bu Dop, and Khe Sahn alone. The weather in Southeast Asia caused many problems with airdrops. These problems became the impetus behind the acquisition of the adverse weather aerial delivery system (AWADS). This improved radar system managed to get funded and became operational in 1972. Last, due to the terrain, high altitude airdrop techniques using time delay chutes and ballistics calculations were developed. Amazingly, from altitudes of six thousand feet, errors of only 200 yards off target were achieved (Bowers, 83:259-262). Even though SBA was not a priority, airdrop evolution was taking place.

Perhaps the United States is lucky that for whatever reason, SBA was not a priority, because if it had been the results might have been disastrous. An incident in the A Shau Valley is indicative of how predictable our behavior and tactics had become. It also demonstrates how predictable behavior simplifies the enemy's job in a guerrilla warfare environment.

During the spring of 1968, General Westmoreland decided to take the A Shau Valley from the Viet Cong. The deep valley runs Northwest to Southeast near the Laotian border, west of Hue. The valley and its two airstrips had been under communist control since 1966. The 101st provided a brigade that would travel over ground from Hue. Two air cavalry brigades would join in the fight as well as some South Vietnamese troops. All units would be resupplied by helicopter airland and C-130 airdrop missions, once they were inside the valley (Bowers, 83:332).

On the 19th of April, the 3d Brigade of the 1st Air Cavalry Division commenced the attack on the valley. Bad weather and heavy enemy resistance delayed resupply efforts until one week later, when the A Luoi airstrip was taken and a combat control

team inserted. The morning of 26 April, twelve C-130 crews were briefed to fly missions that entered the valley from the northwest, passed through the valley with 5800 foot peaks on the left and 4000 feet on the right, and made an airdrop pass over A Luoi before heading back to Da Nang. The Hercules crews were to airdrop much-needed supplies and ammunition to the troops. Using regularly spaced intervals, the planes took off and headed to the northern edge of the valley. The navigators then guided descents through the thick cloud formations from 8,000 feet down to a ragged ceiling 300-500 feet above the 2,000 foot valley floor. Precise navigation was required to thread the descent between the rugged terrain on either side. Fighter cover was unavailable due to the poor weather in the valley. The C-130 crews considered that poor weather to be their protection (Bowers, 83:333-335). This was a false assumption.

According to Bowers, "The operation soon fell into a pattern" (Bowers, 83:335). Each aircraft held over Hue until its predecessor called clear off the DZ. Then each aircraft accomplished its descent on instruments, through the valley, where it dropped supplies, despite anti-aircraft fire, and headed back to Da Nang for another load. Twenty loads were airdropped that day with over 270 tons delivered before tragedy struck.

The run-in appeared identical to that of earlier ships, except that the ship broke through the overcast further south than most. Fighter support was still absent. The Hercules began taking 37-mm and .50-caliber fire, and its radio transmissions were silenced. As it approached the drop zone the crew attempted unsuccessfully to jettison the load. As the plane crossed the drop, struggling to hold altitude, holes could be seen in both wings. One engine streamed smoke or fuel while smoke trailed from the fuselage, apparently from fire in the ammunition-laden cargo compartment. Maj. Lilburn R. Stow, an experienced and highly regarded pilot, guided the stricken aircraft into a descending turn, attempting an emergency landing at the A Luoi strip. The craft smashed into trees, the resulting explosions killing the six crewmembers and the two airman photographers on board. (Bowers, 83:336)

Predictability and standardized approaches had given the enemy a simplified targeting solution and a kill. Not until another aircraft was nearly lost were the procedures for the drop changed.

Three days later Captain Ross E. Kramer's crew started to receive anti-aircraft fire about six miles out from the DZ. Despite jinking on the approach, the aircrew could not avoid the flak. One engine was hit and another was shut down for low oil pressure. Jettisoning the load, and later able to restart one of the engines, the crew limped its way back to Da Nang where, with seven feet of the horizontal stabilizer blown off, the aircraft became a semi-permanent static display. The approach to the DZ was changed. The straight-in was replaced in favor of a spiral down through the weather (Bowers, 83:338). But it took the loss of one aircraft and crew and the near loss of another before the predictable, repetitive straight-in approaches to a hot DZ were changed.

The airdrop technology and procedures developed during the Viet Nam War are many of the same used today, twenty-five years later. All that has changed is the arrival of the C-5, C-17 and the codification of requirements.

Present Day

The Army's SBA requirement is based on a medium force package. According to the 82nd Airborne Division, the first echelon would launch within eighteen hours of

notification, fly to a small austere airfield, and airdrop 2,471 paratroopers, 102 wheeled vehicles (Humvees etc.), 18 howitzers, 54 CDS bundles, 12 engineering repair packages and 9 support platforms, within 30 minutes. This force would seize the airfield and four hours later airland missions would bring in another 769 troops, 227 wheeled vehicles, 28 helicopters, 12 engineering support packages, IRC/tracks and an additional 41 pallets (82d Airborne Division).

For the first part of the mission, the airdrop can be accomplished with sixty-eight C-141s, all passing across the drop zone in twenty-seven minutes (82d Airborne Division). Neither the C-141 nor the C-5 is, however, capable of accomplishing the second half of the mission. As stated in the 1997 Air Mobility Master Plan (AMMP),

The airborne division ready brigade (DRB) medium force package is the airdrop requirement for force structure planning. Today's C-141 formation capable fleet cannot meet all of this requirement. Furthermore, war planners need the flexibility, with follow on airland forces, to be able to use austere airfields not suitable for C-5 or C-141 operations. Currently, formation-capable C-141's are reaching the end of their service life and retiring. Analyses have determined that a future fleet of 120 TAI C-17s, coupled with 50 modified C-5Bs, is needed to meet the strategic brigade airdrop requirement. Testing and modification programs are under way with the goal of certifying the C-17 by FY97 and C-5B by FY98 for their requisite roles in a strategic brigade airdrop. (AMMP, 96:1-28)

The pre-WW II arguments about large scale airdrops of paratroopers as opposed to small specialized team insertions continue to be valid today. The United States has chosen to have both capabilities. AMC provides SOLL II (Special Operations Low Level) aircrews for the support of US Special Operations Command (USSOCOM) commitments to the National Command Authority (NCA). This limited number of highly trained crews is prepared for airland or airdrop missions of the highest priority, in the most austere of conditions, using night vision goggles (AMMP, 96:1-13).

Certain AMC active, reserve, and guard units are tasked with supporting the SBA commitment. Those units are assigned navigators, they train in formation procedures, air refueling, and low-level and fly aircraft modified with station keeping equipment (SKE). Airdrop is a unique and challenging mission, and only the best airmen within the wings are chosen for the program. The C-141 training regulation, AMCR 55-141, dedicates parts of chapter 17 as well as chapters 23, 23, and 25 to establishing airdrop policies, procedures and guidelines. C-141 aircrews train to accomplish formation airdrop in conditions ranging from day visual meteorological conditions (VMC) to at night in the weather.

SKE is the equipment around which weather or instrument meteorological condition (IMC) airdrop revolves. It provides the aircrew with precise information to fly formation and approach the DZ. SKE is crucially important to airdrop, and its effects on procedure and capability are so wide-spread that any discussion of SBA is incomplete without a primer on SKE. Sierra Technologies' literature states:

Stationkeeping is a unique airborne electronic system developed and produced by Sierra since 1959. It enables aircraft in formation to locate and identify one another and maintain their relative positions in close formation, regardless of visibility conditions. At the same time, it gives all participating aircraft an integral data transfer capability to communicate flight command information without voice transmission. When used in conjunction with Sierra's electronic zone marker, the system provides the aircraft with precision guidance for airdrop/airland operations. (Sierra, 95:6)

SKE is a time-oriented system. The AN/APN-169 onboard each aircraft within the formation and the zone marker unit on the ground have synchronized clocks. Signal arrival times between units is used to calculate distances and relative position. One SKE set is identified as a master (any set is capable of acting as a master); all other units

(followers) receive clock updates from the master. Each unit is designated a time slot during which it transmits. The rest of the time it receives data from the other formation SKE transmitters. As many as 34 aircraft and a zone marker can operate on a single frequency. SKE has a 360 degree capability with a ten nautical mile range air-to-air and twenty nautical miles air-to-ground (the DZ marker). "One-way ranging is accomplished by using synchronized clocks as a common time reference and extracting range information from the arrival time of pulsed rf [radio frequency] energy" (Sierra, 95:6). Hence, each aircraft has the entire formation on its scope as well as the location of the DZ marker (when inside 20 NM). The SKE information can be programmed into the flight director and coupled to the autopilot. It is a capable system, within its limits, but can also become what is known as a "heads down display" attracting much of the aircrew's time and attention.

SKE is effective. According to the 1995 Annual Off-DZ Crosstell Report, during 1995 approximately 10,000 airdrops occurred involving C-5, C-141, and C-17 aircraft. Only twelve off-DZ drops were reported, and three of the twelve were SKE or computer directed drops with only one where the mission computer was the cause. The remaining nine were visual meteorological condition (VMC) drops. The four human factor errors made up the largest causal category. These ranged from poor mission study, to input error, to poor crew coordination. One off-DZ drop attributed to SKE out of 10,000 total drops; this performance testifies as to SKE's accuracy (Morey, 96:2-10).

Our SBA capability is dependent upon SKE's ability to guide the formation over the DZ, no matter what the weather. SKE provides aircrews the capability of flying 4000 feet intrail separation, at the same altitude in the weather (AMCR 55-141 CH25, 92:23).

SKE allows such precision that the airdrop weather minimums are a 300 foot ceiling and 1/2 NM visibility for Air Force drops and all there are no minimums (theoretically a zero foot ceiling and zero visibility) for Joint Operations (AMCR 55-141 CH24, 92:4). A significant amount of training is needed to become proficient when flying operationally with this complicated equipment and procedures designed to deliver over 2,000 paratroopers safely from post to parachute over their heads.

Most of the missions flown by the C-141 fleet are real world missions hauling cargo for a customer. Compared to most USAF weapon systems where the largest portion of the flying hours is training and a smaller portion operational, the C-141's situation is reversed. Demand for their service is so high that some aircraft are "fenced off" trainers. Otherwise they would be tasked to handle missions in the airlift system. Flying training hours are a crucial commodity in the C-141 community.

SBA consumes a serious segment of that crucial commodity. The 1996 total programmed flying training allotment was 23,195 hours for active duty C-141s, with 3,771 and 6,221 hours allocated for airdrop training and JAAT respectively. This means that 43% of the programmed C-141 flying time is being used to train for SBA, a significant portion of a scarce resource (Waters, 3 Mar 97).

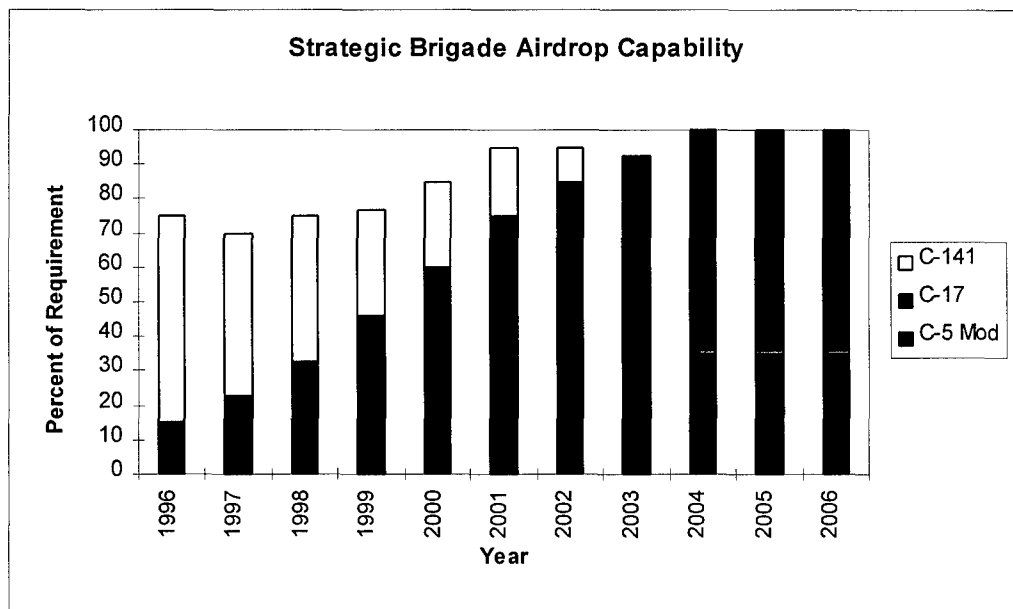
Plans for the Future

The C-17 is the replacement for the C-141 and its missions. But as reported in the Air Force Times on 11 December 1995, the C-17 cannot accomplish SBA on its own.

The C-5 is currently allocated a portion of the SBA commitment. The Air Force plans to modify 57 of the 126 aircraft fleet with SKE, formation position lights, global positioning system (GPS), defensive systems and airdrop rails. As well as modifying the hardware, an aircrew training program must be developed (Watkins 95:34). The airdrop unfilled requirement is evident from the data in Table A. The modification of C-5 Galaxies to handle the airdrop mission, discussed further in Chapter 3, is the plan to fill that gap.

During the summer of 1996, SBA problems elevated to a high enough level that the Army and Air Force decided to convene an integrated process team (IPT). Members of the XVIIIth Airborne Corps, Air Force, AMC, Air Mobility Warfare Center, and unit staffs have met. This unique arrangement brought the service provider and customer together for problem solving, feasibility studies and a discussion of tactics and capabilities (SBA Joint sub-IPT minutes, 28-29 Jan 97).

Table 1. Strategic Brigade Airdrop Capability
(Information provided by HQ USAF/XORM to the SBA Joint IPT)



The Strategic Brigade Airdrop tasking is a substantial undertaking and a powerful method of United States force projection. Despite a significant allocation of aircrew, technology, aircraft, and training AMC, by its own admission, is able to meet only part of the tasking. One solution to the problem is increased use of the C-17. Chapter 3 will discuss the problems and politics associated with the solution.

III. Problems Within SBA

“Look how dangerous this was without anyone even shooting at us!”
Lead co-pilot Captain Brian Sanford after taking part in BIG DROP III
(Howard 96:13-14)

Rio Hato

A problem that has plagued airborne delivery of paratroopers right from its debut has not gone away. The vulnerability of the formation during the run in to the DZ has and continues to be airdrop's Achilles' heel. As in Crete, Biazza, and A Shau, a more recent incident shows the importance of a sanitized DZ.

The 1990 Tunner award to the Military Airlift Command outstanding crew of the year went to Capt Mark Transue and his AC-130 gunship crew out of Hurlburt AFB, FL. On the 20th of December 1990, after a long flight with two night minimum communications air refuelings they showed up over Rio Hato airfield ten minutes prior to the initiation of Operation Just Cause. As the citation to the Tunner award states, “Immediately they began receiving heavy antiaircraft artillery (AAA) from every section of the air base.” The crew orbited over the field knowing fifteen C-130's filled with Army Rangers were only two minutes out (Tunner, 90:80-83). The standing orders for Air Papa 03 (Captain Transue's gunship) were to stay clear of the dropzone until all the rangers were on the ground. But with less than 30 seconds until the lead Hercules would

pass over Rio Hato, Panamanian Defense Forces (PDF) were firing at the incoming airdrop formation, their tracers streaming into the night air. And a functional ZPU-4 stood on the edge of the runway. Disregarding the orders, Transue rolled over the ZPU and his fire control officer turned it into rubble with the 105mm howitzer (McConnel, 91:82-3). As Air Force Magazine states, "Because of the support from the gunship, the rangers, who had expected heavy casualties, received only minimum casualties" (Tunner, 90:80-83). The initiative taken by Transue and company, contravening their orders, staying overhead and sanitizing the Rio Hato airstrip probably saved the lives of hundreds of Army Rangers.

Rio Hato was not an SBA operation, but it was as close as we have come to an SBA under combat conditions in recent history. It is an instructive example of how some military planners assume a benign environment, underestimate the risk, or are overconfident in their operations security (OPSEC). Were it not for the courage, selflessness and situational awareness of Captain Transue, approximately 500 of America's finest soldiers and 15 C-130s would have been exposed and vulnerable targets as they crossed the DZ (Tunner, 90:83). In a low threat environment, SBA is low risk and simply an expensive show of force. In a high threat environment, it could be a risky gamble of expensive aircraft and highly trained paratroopers.

Personnel

Previously AMC had problems keeping its airdrop personnel positions filled. The non-volunteer assignment system was taking its toll. The non-volunteer assignment process fills undesirable jobs that no one has volunteered for. The Air Force Personnel Center (AFPC) issues orders to the qualified individual with the highest amount of time on station, Air Force-wide. An airdrop-qualified instructor, AMC's cream of the airlift crop, takes three to five years to train and develop. This puts an important asset in maintaining SBA capability at the top of most time on station lists. A few years ago, McChord AFB routinely, lost its most experienced airdrop qualified instructor pilots because they either accepted these non-volunteer remote assignments or turned down the assignment and established a date of separation from the Air Force. The non-volunteer system is still with us, but AMC has adapted to overcome the system's pitfalls. Many of the manning problems have been, for the most part, fixed through the special coding and watchful eye being given to airdrop-qualified aircrew. A shifting of personnel between McChord, McGuire, and Charleston AFBs now takes place so that AMC does not lose valuable assets.

According to Major John Shelpman, of HQ AMC/DOTF, SBA manning of qualified airdrop C-141 crews during February 1997 was 89.7 percent of that required to accomplish the mission. This level is better than it has been in the past, but it is not 100%, and more problems lie just ahead on the horizon. The C-141 aircraft are retiring faster than the C-5 and C-17 aircraft are coming on line to pick up the SBA commitment. Therefore, a larger percentage of a shrinking fleet and crewforce must be allocated

expensive flying hours and training dollars in order to keep America's SBA capability whole (Shelpman, 3 Mar 97).

AMC must decide how to prioritize its aging, shrinking C-141 fleet. Flying tired, old aircraft low altitude where the turbulence and stresses are most pronounced is probably not the smartest use of this asset. If no alternative is found to fill SBA commitments, increasingly more of that shrinking fleet will have to be used in the airdrop role.

Air Refueling

McChord AFB lost two C-141s in the fall of 1992 in a mid-air accident on an air refueling (A/R) track over the plains of Montana. Despite the fact that improper procedures and pilot error were the root causes of the mid-air collision, the formation air refueling procedures were drastically changed. The procedures became rigid, verbose in terms of radio transmissions, and limited the C-141s to single or two ship formations during A/R. A thick packet now supplements the A/R manual with C-141 specific procedures. Only recently, after years of acrimonious air refueling conferences and testing, on 1 April, AMC released a message with write-in changes to the procedure, allowing a C-141 three-ship formation to be refueled simultaneously. For the better part of five years, AMC has been unable to practice the kind large formation A/Rs that a real SBA would require.

Part of the air refueling problem is the airlift community's affinity with the SKE. The airlift crews feel so comfortable with SKE equipment and procedures that they want to use it during A/R. The air refueling community grew up in Strategic Air Command (SAC) where three tankers refueling three bombers took place frequently and a six-on-six formation was not uncommon. SAC used vertical separation to ensure the safety of its aircraft. Military Airlift Command (MAC) raised its crews on the separation provided by SKE. C-141 formation A/R procedures are more complicated than those required for any other aircraft, and filled with the many radio transmissions required to safely maneuver aircraft at the same altitude.

The C-141 radar is basically a weather radar, not useful for skin painting aircraft. The SKE is designed to provide formation situational awareness. As a result of these two facts, SKE now influences the way C-141 A/Rs are conducted. According to the training regulation, "SKE will be left on throughout refueling. . . . The loss of SKE after beginning the transition to A/R echelon [in instrument meteorological conditions (IMC)] will require immediate action by serial lead. . . . Serial lead will squawk 'emergency' and declare an emergency with ATC [air traffic control]" (AMCR 55-141 CH17, 93:5-6). SKE is the cornerstone to formation IMC airdrop. Unfortunately it has also become the cornerstone of formation A/R. SKE not only brings problems to air refueling; tactically it has problems of its own.

SKE

The electronic battlefield is a reality of modern warfare. The ability to acquire, manipulate, interpret or destroy signals and information is unquestionably important to battlefield commanders. Meaconing (deceptively luring an aircraft to a false signal), intrusion, jamming, interference (MIJI) and detection are of grave concern to planners and commanders because of the undoubtedly high-tech nature of the next conflict.

Captain Peter Hlinomaz is the Chief of the Special Operations Analysis Team at the Air Force Information Warfare Center in San Antonio, Texas. According to Captain Hlinomaz, the SKE system is not susceptible to jamming for three specific reasons: “[1] APN-169C SKE has a relatively high effective radiated power (ERP); [2] Aircraft to aircraft distances are typically much shorter than typical-aircraft -jammer distances; [3] The majority of threat radar jammers do not cover the SKE’s operating frequency” (Hlinomaz, 97:1). The expectation is that SKE will be able to do its mission and get the formation over the drop zone without the enemy corrupting or jamming the signal between aircraft.

On the other hand, SKE is a formation of flying electronic beacons. This is not discreet in the electronic warfare arena. It is downright boisterous. According to Hlinomaz:

The APN-169C is, however, vulnerable to passive detection [PD] (i.e. ESM) systems. PD systems present a significant problem for airborne emitters because they can detect and track the emitter without setting off the aircraft’s RWR [radar warning receiver] systems. Given the APN-169C’s high ERP, many threat PD systems could detect the SKE signal to at least the radio line-of-sight (RLOS). Radio propagation phenomena such as knife edge diffraction, forward troposcatter, and ducting could extend this range even further. (Hlinomaz, 97:1)

SKE is the equivalent of telegraphing a massive punch to the enemy.

It is possible to determine how much warning of that punch is available to the adversary. The formula for determining the range of an RF transmitter over RLOS is:

$$\text{Range Max (NM)} = 1.23 [(\text{radar altitude})^{1/2} + (\text{target altitude})^{1/2}] \text{ (Hlinomaz, 97:1).}$$

Tables 2 and 3 were developed from this formula.

Table 2. Passive Detection Warning in NM

RADIO LINE OF SIGHT RANGE in NM

		FORMATION HEIGHT (feet)					
		0	100	300	500	800	1000
HEIGHT OF PASSIVE DETECTION RECEIVER (feet)	0	0.00	12.30	21.30	27.50	34.79	38.90
	10	3.89	16.19	25.19	31.39	38.68	42.79
	50	8.70	21.00	30.00	36.20	43.49	47.59
	100	12.30	24.60	33.60	39.80	47.09	51.20
	250	19.45	31.75	40.75	46.95	54.24	58.34
	500	27.50	39.80	48.81	55.01	62.29	66.40
	1000	38.90	51.20	60.20	66.40	73.69	77.79

Table 3. Passive Detection Warning in Minutes

Amount of warning in minutes=Range from above divided by 210 KCAS times 60 minutes per hour

		FORMATION HEIGHT (feet)					
		0	100	300	500	800	1000
HEIGHT OF PASSIVE DETECTION RECEIVER (feet)	0	0.00	3.51	6.09	7.86	9.94	11.11
	10	1.11	4.63	7.20	8.97	11.05	12.22
	50	2.48	6.00	8.57	10.34	12.42	13.60
	100	3.51	7.03	9.60	11.37	13.45	14.63
	250	5.56	9.07	11.64	13.41	15.50	16.67
	500	7.86	11.37	13.95	15.72	17.80	18.97
	1000	11.11	14.63	17.20	18.97	21.05	22.23

An airdrop formation at 800 feet could be detected by a passive receiver 100 feet in the air forty-seven NM out, giving thirteen and a half minutes of warning to the enemy.

More warning is possible if some form of radio propagation phenomenon were to occur.

The importance of the problems associated with SKE cannot be overemphasized. SKE is the technology upon which our SBA capabilities have been built. SKE is the glue that keeps the formation together from take-off and join-up through A/R and all the way to the DZ. SKE's weaknesses and vulnerabilities spotlight those of the SBA program as a whole.

Follow-On Test and Evaluation

During the Personnel Formation Airdrop portion of the Follow-on Operational Test and Evaluation of the C-17, specific problems surfaced for the C-17 in the SBA role. According to the draft final report, these included wake vortex interaction within the formation, parachutists "centerlining," exiting from opposite sides of the aircraft "became entangled directly aft of the aircraft" and problems with paratroopers making contact with deployment bags and the aircraft fuselage during exit (33rd FTS 97:1). The centerlining problem was resolved by limiting the gross weight to 385,000 pounds during personnel airdrop, thereby keeping the aircraft's deck angle at six to seven degrees.

Paratrooper/deployment bag contact was corrected by replacing the 15 foot static lines with 20 foot lines (33rd FTS 97:1). Systemic problems with the fact that 15 foot lines are the United States Army standard still need addressing.

Unfortunately, the problem with wake vortex interaction was not easy to solve. The C-17's wings generate a tremendous amount of lift, due to the heavy gross weights the aircraft must operate at and the swept nature of the wings. A negative side-effect of

these powerful lifting forces is the wake vortex they produce. As a result of tests run by the Wright Laboratories at Edwards AFB CA, using Light Detecting and Ranging equipment, it was determined that "C-17 vortices generated in airdrop configuration were significant in terms of size, velocity and duration" (33rd FTS 97:2). The C-17 produces vortices 1.5 times stronger than that of the C-141. As stated in the 19 February 1997 draft, "Interaction between C-17 aircraft vortices and personnel or equipment parachutes could result in potentially hazardous conditions, including: collapsed or partial deflation of the canopy for 1 to 3 seconds, significant oscillation, loss of planned parachute descent time and altitude, collision or entanglement resulting from changes in parachute descent rate, hard landings, and dragging of paratroopers on the surface" (33rd FTS 97:2). This problem had to be overcome.

After months of work, engineering analysis, integrated process reviews with the Army, and launching mannequin and test paratroopers from formations of C-17s, a non-material solution was found. The formation geometry was changed within the three ship elements and element spacing was increased to 40,000 feet between element leads (33rd FTS 97:16-19). With these two changes, little or no vortex interactions took place. It was less a matter of overcoming the wake than it was stretching the formation so that the wake could decay on its own. The powerful C-17 wake vortex had been accommodated.

Additionally, C-17 equipment problems were noted. Although the SKE was adequate, pilots had trouble interpreting display information for the formations they were flying, and formation lengths were exceeding the 10 NM SKE operational capability. The autothrottles also had problems holding 130 KCAS and maintaining SKE position (33rd FTS 97:10-12). These issues are more annoyances than problems for SBA.

Eliminating the vortex interactions with 40,000 feet separation between elements solves one problem while creating another. According to the SBA Integrated Process Team's calculations, the formation will take somewhere between 36-44 minutes to cross the DZ. Those numbers depend on whether or not C-5s are in the formation and whether or not a dual stick capability is given to the C-17 (82d Airborne Division). This is a significant problem, exposing the formation between 20-47% longer than Army requirements over the DZ.

C-5

Due to the slopes of lines associated with the production of the C-17 and the retirement of the C-141 (see Table 1.), a gap in SBA capability was evident. The bridge built to fill the gap was a plan using the C-5 in the airdrop role. The C-5 is to pick up some of the heavy equipment portion of the drop. Much of this issue has become clouded and political. The need for the C-17 came into question if the C-5 could do the SBA mission. Consequently, the less expensive Non-Developmental Airlift Aircraft (NDAA) could fill part of the country's airlift requirement. The appropriateness of the C-5 in the SBA role came into question during the search for answers to the SBA requirement gap.

Major Mike Marchand is a former C-141 pilot and currently working in the Program Operating Memorandum office at HQ/AMC. In his Air Mobility Operations Course paper, he provides five arguments against the SBA role for the C-5; these are discussed below. The C-5 will be needed during any conflict to provide the strategic lift

it was designed to handle. Recalling fifty aircraft and the associated airdrop crews from within the enroute system would be impossible. The flying hour program cannot afford the training hours associated with an airdrop commitment. The cost per C-5 training hour is \$11,372 compared with \$4,797 for the C-17 (nearly 10,000 C-141 FY 96 training hours were programmed to support SBA). C-5s tactically are a mistake for SBA, because there is "No element of surprise due to aircraft size, Radar/IR signature and noise" (Marchand, 96:3). Approximately six more aircraft would have to be dedicated to training airdrop at Altus AFB. Altus presently cannot provide three training sorties a day with the eight aircraft assigned. It could not accommodate this additional load (Howard, 97).

Acquisition Politics

It is important to acknowledge the fact that SBA is a political issue. At \$43 billion, the 120 fleet buy of the C-17 is an expensive Air Force program with a per copy price tag of \$358 million (GAO 97-38:46). SBA is one of the factors that drove the C-17 acquisition. The C-141 is retiring. The C-17 was supposed to pick up the C-141's roles at the same time hauling outsize cargo and operating in and out of small austere fields. According to the Army's 82d Airborne Division, the C-17 represents 60 per cent of the DOD force modernization budget for last year (82d Airborne Division). They feel the Army sacrificed, fiscally, for the C-17. Interestingly, an AMC general officer told the author, in an unsolicited comment, SBA was "a waste of time, a waste of time and money." The politics of joint acquisition, budgetary constraints, and normal

congressional appropriation concerns about the C-17 spill over into any discussion of SBA.

In its report entitled C-17 Globemaster; Support of Operation Joint Endeavor, the GAO articulated some concerns about the C-17 program. The C-17 proved itself during OJE, achieving a 86.2% mission capable (MC) rate vs. 81.2% required, a logistics departure reliability rate of 97.8%, a departure reliability rate of 83.9%, and it exceeded all five required maintenance and repair parameters. Despite reporting the standard exceeding performance statistics achieved by C-17 crewchiefs, aircrew and logistical support, the GAO pointed to those design specifications that were not tested. The C-17 was not deployed to a small austere airfield (SAA), it did not do any medical evacuation, nor did it accomplish any airdrop missions (GAO 97-50:6-7). The C-17 was not employed in any of those three methods for the simple reason that the tactical situation did not warrant it. The GAO is correct that OJE performance is not a rubber stamp certification of the C-17. On the other hand, the GAO is incorrect to think that commanders would put soldiers, aircraft and aircrews at risk, simply to test capabilities.

A different General Accounting Office report, commissioned by the Honorable Elizabeth Furse, House of Representatives, analyzed the 120 multi-year contract buy of the C-17 fleet. The GAO analyzed the November 1995 Defense Acquisition Board decision to purchase 120 aircraft based on the AMC's Strategic Airlift Force Mix Analysis, 1995 Mobility Requirement Study Bottom Up Review (MRS BURU), and DOD's Tactical Utility Analysis (TUA). Specifically, the report offered arguments for a fleet buy of 100 with the remaining airlift requirements to be made up by three conceptual changes. The GAO proposed increases in prepositioning, increasing time

frame assumptions by one or two days from those used in MRS BURU and extracting more airlift capacity from the Civil Reserve Air Fleet (CRAF), trainer aircraft assigned to Air Education and Training Command (AETC) and the KC-10 fleet (GAO 97-38:2-3). SBA was not the report's main focus, but it became an integral issue in the argument for buying 100 aircraft because

The only mission that would require more than 100 C-17s in conjunction with the current fleet is an extended range brigade airdrop mission to a small, austere airfield directly from the continental United States. Until fiscal year 2004, when at least 114 C-17s will be available, the Air Force will not be able to support an extended range brigade airdrop to a small, austere airfield as called for in the Army's concept of operations. In the interim, the Air Force and the Army are considering other alternatives to perform the extended range brigade airdrop mission now required in DOD's Defense Planning Guidance. GAO believes alternatives could be used, with a fleet with 100 C-17s and modified C-5s, to support an extended range airdrop to either a small, austere or larger airfield either indefinitely or until the Air Force begins replacing the C-5—currently planned to begin in 2007. If DOD and the Congress determine that an extended range brigade airdrop, to a small, austere airfield is a valid need, this need could be considered in choosing a replacement airlifter for the C-5. (GAO 97-38:5)

What becomes evident in the GAO report is that the only need driving the procurement of 120 C-17s is the extended range SBA that was added to the Defense Planning Guidance in April 1996. It is as if the DoD strategy is being determined not by requirements but by some acquisition system-generated number, in this case 120. We can't do it now, we haven't done it in the past, but we see the need to do it in the future.

SBA is one area where the GAO can attack the C-17. Confusing and changing Defense Planning Guidance combined with unproven capabilities make the C-17 a vulnerable target.

One point of discussion unique to the GAO report is the Army's exit rate criteria and the fact that the C-17 is not meeting it:

In addition, operational testing revealed that the C-17 does not meet the Air Force and the Army requirement to airdrop equipment bundles and 102 paratroopers in a single pass over an average size drop zone. If this requirement cannot be met, the Army would have to either increase the length of the drop zone, require the aircraft to make a second pass over the drop zone, or reduce the number of paratroopers dropped on a single pass. None of these alternatives would be desirable to the Army because they would delay landing troops in the drop zone and require additional time to consolidate and reorganize troops once on the ground. (GAO 97-38:36)

The C-17 is at risk anytime it does not provide the customer with a stated service level.

The FOTE results previously stated in this chapter are reiterated and criticized by the

GAO:

The C-17 has not yet demonstrated the capability to safely perform a mass airdrop of personnel while flying in close formation. Due to the dangers posed to paratroopers during their descent by the C-17's wake turbulence, the Army has not approved the use of the C-17 for this mission. Until this problem is resolved, the C-17 cannot be used to support the brigade airdrop mission. Further, the C-17 does not meet paratroop exit rate requirements when airdropping personnel along with equipment bundles, which could extend the time required for all paratroopers to get on the ground and increase their separation. Increased separation would further delay organizing troops on the ground making it more difficult to execute the mission. (GAO 97-38:6-7)

The GAO relayed agency agreement with its criticisms, "DOD agreed that the C-17 has a wake vortex problem and has not yet demonstrated the capability to safely perform a mass airdrop of personnel while flying in close formation" (GAO 97-38:8).

Extended Range SBA is like the extended warranty package on a new car.

Performance is guaranteed out to a further distance with a fleet of 120. The GAO describes it the following way:

Lastly, the Tactical Utility Analysis evaluated the need for C-17s to accomplish a strategic brigade airdrop. On the basis of the then existing Defense Planning Guidance, which called for a limited strategic range capability, an airlift fleet with 100 C-17s, along with modified C-5s, would be sufficient to accomplish this mission. The Tactical Utility Analysis, however, also analyzed the number of C-

17s that would be used to conduct an extended range brigade airdrop. It found that acquiring 120 C-17s would allow the Air Force to support a strategic brigade airdrop directly from the continental United States to a small, austere airfield (the Air Force defines a "small, austere airfield" as one with limited taxiway, ramp space, and services. Runways, paved or semi-prepared, are occasionally longer than 5,000 feet, but are usually less than 4,000 feet and normally 60 to 110 feet wide.) located beyond the range required by the Joint Chiefs of Staff at the time of the C-17 DAB. (GAO 97-38:22) . . .

The extended range brigade airdrop was subsequently (April 1996) included as a requirement in the Defense Planning Guidance for fiscal years 1998 to 2003. (GAO 97-38:30)

The GAO brings up interesting points about the Army's vision of SBA.

According to the report, the Army anticipates a launch from the United States directly to some SAA in a third world region. The Army values the tactical surprise it associates with this type of employment. This type of a scenario limits the follow-on airland resupply to only C-130s or C-17s, after the airhead is secure. According to the Tactical Utility Analysis, 114 C-17s and 50 C-5s could accomplish this mission, with the C-5s being left out of the follow-on airlift (GAO 97-38:32-33).

Two options to present SBA guidelines are being discussed within the Army and Air Force. The first involves the forward staging of the SBA package. For example, instead of the entire formation flying a straight line from Fort Bragg to somewhere in Africa, the aircraft and paratroopers would proceed to somewhere in Europe and launch from there for the airdrop. The second option is using a larger C-5 capable airfield for the follow-on airland missions as opposed to an SAA. These two planning factors would reduce the C-17 work load for the SBA commitment (GAO 97-38:31-32).

The report advocates a fleet of 100 C-17s. The lifetime savings of \$7 billion combined with, in their opinion, no detriment to warfighting abilities drove the GAO to

its conclusion. The GAO believes that the one sixth reduction in airlift capacity can be made up by squeezing a little more lift out of other sources (GAO 97-38:37).

Within DOD the politics of SBA have been both powerful and confusing. The C-5 SBA mission took on its own convoluted vocabulary in a HQ AMC/XP staff summary sheet it became known as "NDAA Risk Reduction" (Linde, 94:2). The C-5 SBA mission was a way to avoid the Non-Developmental Airlift Aircraft being shoved upon AMC by Congress at the expense of the C-17. When in the summer of 1995 the Army stated that the C-5 was inappropriate for the airdrop role, it was a tentative situation (HQ USAF/DA, 95:1). As the then head of AMC Plans stated in a memo to the AMC Vice-Commander, "As we discussed, the Army's message (in regards to) C-5 use for airdrop was intended to bolster the C-17 program--we need to be careful how strongly we go back at them. We should continue to develop C-5 capability in heavy equipment and CDS--slowly" (Floyd, 95:1). When it came time for the AMC Commander to testify in front of Congress concerning the issue, he was concerned about answering one question, "If you don't get the 40 C-17s, can you still perform the Brigade Airdrop mission?" (Rutherford, 95:1). The AMC staff was twisting and turning trying to describe the assumptions, impact and scenario dependent information associated with a forty C-17 buy and the C-5 in the SBA role (Hinkel, 95:1). The politics of SBA underscores the importance of assumptions, underlying definitions and vocabulary, and what they mean within the political process.

Assumptions also impact the accounting. John A. Tirpak, the senior editor for the Air Force Association, states that the multi-year C-17 purchase agreement provides "Potential savings might be 'three to five percent,' Secretary [under, of Defense Acquisition and Technology] Kaminski said. That would bring C-17s in for about \$192

million apiece, compared to the early-lot cost of around \$350 million each” (Tirpak, 97:3). There must be some assumptions involved, as five percent of \$350 million is only \$17.5 million. Aviation Week and Space Technology interprets the multi-year buy as \$262 million a piece (Agenda, 97:33). While the GAO holds that the cost reductions amount to \$174 million over what remains a \$43 billion (\$358M per) program (GAO 97-38:45). These are not minor differences, and as the old beltway joke goes, “a few million here, a few million there, the next thing you know you are talking real money.”

Safety

The last problem addressed is training safety. Captain Paul Howard wrote a paper for the C-130 Combat Aerial Delivery School, entitled Large Formation Operations: Impressive, But Safely Within System Capabilities? Leaning on his personal flying experience in both UPHOLD DEMOCRACY and BIG DROP III, Captain Howard calls for procedural, equipment and systemic changes to airdrop training (Howard 96:1-15).

Captain Howard introduces his paper with a tension-filled anecdote about being number 22 in “BIG DROP III, the largest peacetime formation airdrop in history” (Howard 96:1). He describes the turbulence as being so bad during this night IMC mission, that he had all he could do to keep the C-130 upright. He was fearful that the autopilot would not be able to handle the rough ride, forcing him to hand fly the aircraft. His conclusion was that “large formations can challenge aircrews to the limit” (Howard 96:1).

Captain Howard's criticisms of both operations were numerous. Despite months of planning, problems arose both getting the formations off the ground and in rejoining the formation. SKE presentations were unreliable in the large formations. In many cases there were either ghosts or no presentation at all, and problems were especially pronounced for those aircraft the farthest from the master. He repeated the "often heard quote, 'SKE in IMC is an emergency procedure'" (Howard 96:12). The wake turbulence was so bad that, as Captain Howard phrased it, it was a real challenge "using maximum power while holding in full rudder and aileron, and still being unable to fully counter the rolling tendency" (Howard 96:8). He also described one C-130 being forced to fly 900 feet off altitude in order to stay out of its predecessor's wake. Captain Howard noted that five of the 144 BIG DROP III aircraft aborted on the run-in due to turbulence and confusion (Howard 96:4-13).

The problems, politics, and cost of SBA are numerous and great. In these times of shrinking budgets, the "New World Order" and a changing and undefinable threat, we cannot afford to apply the same answers and methods to our problems now and in the future.

IV. Alternatives

In fact, due to the proliferation of manpads and AAA, SBA with any aircraft may be a requirement that has outlived its usefulness (Marchand 96:4).

Three alternatives are discussed. One eliminates airdrop in favor of airland missions. Another replaces the C-17 with a smaller, less expensive aircraft in the personnel airdrop role. The last alternative involves the radical employment of a brand new, leading-edge weapon system.

Airland

The primary alternative to the Strategic Brigade Airdrop, is its elimination. The concept is dated, tactically risky, tremendously expensive, and strategically unneeded. Strategic Brigade Airdrop can be likened to Strategic Air Command and its alert bombers and tankers; they outlived their usefulness, they won the war, and now it is time to adapt to the changing times. General Lee Butler, former SAC and STRATCOM commander, ordered his alert force to stand down. This historic event was not predicted by one military leader or thinker even two years earlier. Now, General Butler is proposing the gradual elimination of all nuclear weapons. The Cold War is over, and so are the days when America needed to darken enemy skies with paratroopers. For change to take place, a senior Army official will probably have to step forward and say those politically

IV. Alternatives

In fact, due to the proliferation of manpads and AAA, SBA with any aircraft may be a requirement that has outlived its usefulness (Marchand 96:4).

Three alternatives are discussed. One eliminates airdrop in favor of airland missions. Another replaces the C-17 with a smaller, less expensive aircraft in the personnel airdrop role. The last alternative involves the radical employment of a brand new, leading-edge weapon system.

Airland

The primary alternative to the Strategic Brigade Airdrop, is its elimination. The concept is dated, tactically risky, tremendously expensive, and strategically unneeded. Strategic Brigade Airdrop can be likened to Strategic Air Command and its alert bombers and tankers; they outlived their usefulness, they won the war, and now it is time to adapt to the changing times. General Lee Butler, former SAC and STRATCOM commander, ordered his alert force to stand down. This historic event was not predicted by one military leader or thinker even two years earlier. Now, General Butler is proposing the gradual elimination of all nuclear weapons. The Cold War is over, and so are the days when America needed to darken enemy skies with paratroopers. For change to take place, a senior Army official will probably have to step forward and say those politically

incorrect words, "We have force structure dedicated to SBA that is outdated, expensive and needs shifting." It probably will have to be a retired general, as the political implications of such a statement are virtual suicide in an arena where defense dollars are so scarce and given such a premium.

Today in most situations, there is no such idea as "acceptable" loss of American life. This being the case, commanders and political leadership will not put American soldiers in harm's way until all possible threats have been eliminated. Were a single C-17, loaded with 105 paratroopers and aircrew, lost on the run-in to the DZ, the casualties would be equal to 71% of the 148 personnel killed in action during the Gulf War (Record, 93:6). We cannot afford, in monetary or human terms, the loss of even one C-17.

During the last two major deployments of Army personnel, neither operation involved the use of airdrop. Ninety-nine point four five percent of all personnel, during Desert Shield/Desert Storm, were brought into theater by airland methods, and 81.37% of that accomplished by the CRAF (Matthews/Holt, 96:13,260). No personnel airdrops were used during the deployment of Army troops as part of the Implementation Force in the former Yugoslavia, either. During each operation, prior to ground troops being put in harm's way, a complete and total suppression of enemy air defense (SEAD) took place. General Horner's air campaign had an absolute effect, the kind that legends are made of. The elimination of the Iraqi air threat, the destruction of command and control, radar, artillery, missiles and softening of ground targets allowed Schwarzkopf's left hook to strike unmolested. SBA was never a realistic option in employing troops in the Iraqi and Kuwaiti theater.

During September of 1995, when it became obvious that American troops would be enforcing the peace in Bosnia, a suppression of enemy air defense (SEAD) campaign was initiated. OPERATION DENY FLIGHT had been in effect for years enforcing the Bosnian No-Fly Zone, already ensuring air superiority. For three and a half weeks, using high-tech and conventional weapons from Tomahawk cruise missiles to GBU dumb bombs, NATO pummeled the Bosnian air defense and command and control structure. This SEAD campaign eliminated virtually the entire airborne and ground to air threat. NATO transports could then deliver the troops and equipment needed to enforce the Dayton Accords and keep the peace in Bosnia-Herzegovina.

It is point of fact that the halting, build up, and counter-offensive set of phases is a tenet which military planners and leaders plan to follow in the next confrontation (Monahan). The halting force would be stand off aircraft operating either from an aircraft carrier or a base in the region using air refueling platforms to project power from a safe distance to the conflict. The build up will be the diversion of prepositioned equipment and forces, as well as the airlift forces rushing required equipment and virtually all of the personnel. Our sealift assets within Military Sealift Command will transport the ammunition, supplies, and heavy equipment. The counter offensive will involve joint or combined forces orchestrated into an overwhelming powerful punch to re-establish old boundaries or attain whatever goals are stated by the National Command Authority.

This method of fighting changes the element of time associated with deployment. No longer are all the forces required in the theater immediately. SBA would be totally inappropriate for the build up phase and, as discussed in Chapter 3, tactically, there are numerous arguments against SBA in the counter offensive phase. Any air head should be

sanitized until the area is safe for airland operations directly in and out. It would be suicidal and ignorant to fly expensive, troop-laden aircraft low and slow over an airfield on which it is unsafe to land. Therefore, airheads should lily pad or hop forward along with the friendly territory and forward edge of the battle area (FEBA). Airland missions should bring in troops and supplies to the airhead, then they can be transported overland to the fight.

The C-17 is a cavernous aircraft, built to be large enough to carry outsize cargo like helicopters and the M-1 tank. The cargo compartment height, at its lowest point, forward of the wing, is 12 feet 4 inches and 13 feet 6 inches aft (Air Force website, 97:1). When it is used in the personnel role, the C-17 is a tremendous waste of space. If the C-17 were used more in the airland role as opposed to the airdrop, a more efficient use of its space could take place. The KC-135 community has developed a palletized seating system with twelve airline type seats bolted to each pallet. If a 20 or 40 foot equivalent unit (FEU) were filled with the brigade's Humvee (an average Humvee will fit tightly in a 20 FEU) and equipment, the pallets could be mounted on top (see Figure 1.). Because of the wing box design, palletized seating might not be possible at all pallet positions. Alternately, scaffolding system could be created that would allow the soldiers to travel above their unit's equipment. A comfort pallet could be installed and, with 18 pallet positions, easily over a hundred soldiers, their equipment, and vehicles could be transported at the same time. This would cut the number of sorties to less than half that required to airdrop the same brigade.

Figure 1 depicts the container concept. An average Humvee with dimensions of 7'1"x 6'2"x 16' will fit inside the standard container, having dimensions of 7'8"x 8'6"x

19'4" (CSX Intermodal, 97). Rucksacks and gear can fill the rest of the container space, maximizing the volume efficiency of the sortie.

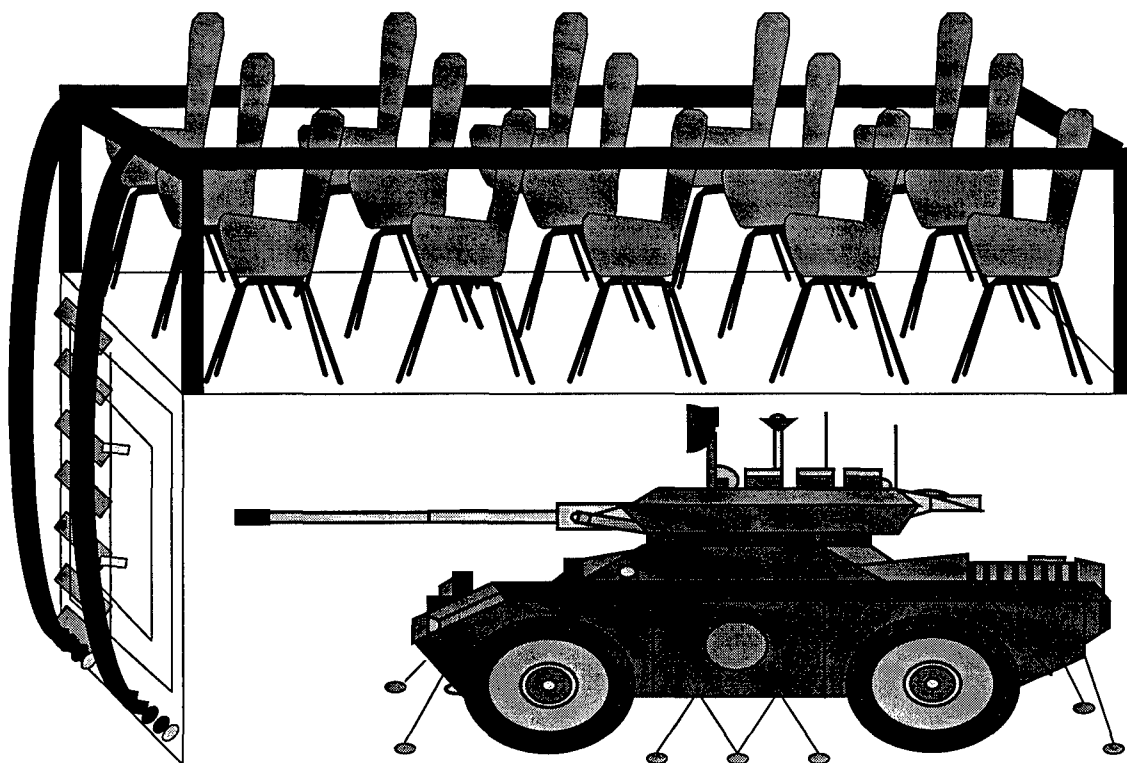


Figure 1. Airland intermodal container with palletized seating atop

The United States needs to maintain some airdrop capability in the form of small SOF insertion teams and single ship airdrop of supplies etc. But SBA can be replaced with much less expensive airland missions.

C-130J

There are other aircraft available that can perform the personnel portion of the SBA more efficiently at lower cost. The latest in a long line of models of the Lockheed C-130 Hercules, the "J," is now available. It is a proven platform, with a long and storied airlift career. Using risk management, the C-130J, or some other major weapon system (MWS), could provide an operational valence equal to that of the C-17 at a lower associated cost or risk. The Hercules provides significantly smaller wake turbulence patterns that allow tighter formations. It has proven the ability to handle tactical formation airdrop; the Hercules could be stretched into the strategic arena.

The C-130-J is a significant improvement over its predecessors, the E and H models. It also provides some savings and advantages over the C-17. According to Lockheed Martin Company (LMCO), the refuelable J model has smokeless engines that make it harder to visually acquire from the ground. It has a lower spares requirement, more efficient engines, a 40% increase in range, and better mission reliability than the E model. These all translate into lower costs for the user (JAAT rates), while carrying 92 paratroopers in the stretch model. The J-model has Traffic Collision Avoidance System (TCAS), dual GPS/INS, and AWADS capability. The improvements in the engines and propellers alone translate into 0.854 hours less maintenance man-hours per flight hour (MMH/FH). For the aircraft as a whole, MMH/FH decreased from 21.0 to 10.3 with the J-model (Lockheed Martin Website, 97:1-6). In comparison, the C-17 logistics support system has driven its MMH/FH (3 month running average down from 10.4 back in October 1996 to 7.4 in February 1997 (Varcarel, 97). These improvements, according to LMCO, assimilate into savings: "Compared to other aircraft, the savings per flying hour of joint training could be as much as 75%" (Lockheed Martin Website, 97:1-6). Most

important for the Army is the fact that sixteen C-130s can fit in the same formation airspace as six C-17s passing over the DZ, while carrying only ten fewer paratroopers per aircraft. This translates into 1474 troops on the ground versus 612 with the C-17, in the same amount of time.

The one J-model set aside in the FY98 budget request has a \$54.7 million price tag (Agenda, 97:38). This translates into three to six C-130Js for every C-17. The Air Force could leverage its position, and a multi-year buy could probably drive the costs down further. Mr. Jim Faulkner works in the financial management section of the C-130J System Project Office. He states that a multi-year buy could drive the price down to around \$50-51 million per copy. He also expects that C-130J JAAT, SAAM and other reimbursable rates charged to DOD users will be comparable to those of the H-model. They may actually even be less due mainly to lower operating and support costs associated with the J-model (Faulkner, 97). According to Attachment A15-1 of Air Force Instruction 65-503, the H-model's reimbursement rate (1996) is \$1656 per flying hour. This is just 29% of the C-17's \$5694 per hour (SAFFM Website, 97:A15-1). A stretch J-model is much better suited to handle the personnel portion of the SBA role than the C-17, at a significantly cheaper cost. But the Hercules is not the only new bird that could get the Army to the fight.

Osprey

The Marines and the Special Operations Forces (SOF) of the Air Force have signed up in favor of the Boeing/Bell partnership's newest creation, the V-22 Osprey. With vertical take off and landing characteristics like a helicopter, and the transportability and speed of a turboprop, the Osprey may be the chameleon weapon system for the future SBA role.

One of the entrenched paradigms surrounding SBA is the use of large in-trail formations across the drop zone (DZ). This is based on traditional formation procedure, knowledge of the wake turbulence patterns and in large part to the station keeping equipment (SKE) installed on the aircraft. This is a rigid and predictable formation. The tactical surprise of an in line SKE formation is limited. An enemy's targeting solution is simplified, and the formation is extremely susceptible to a man portable air defense device (MANPAD). The Osprey should be employed as a swarm of aircraft arriving on five or so separate headings.

According to Glenn W. Goodman Jr., senior editor for Armed Forces Journal International,

Senior DoD officials are scheduled to give the final go-ahead for V-22 low-rate initial production next month [Feb 97]. The V-22, which will carry 24 combat-loaded Marines, can take off, hover, and land vertically like a helicopter and fly horizontally like a C-130 transport at a speed of nearly 300 knots by tilting its two huge rotors forward. It flies more than twice as fast as the CH-46E and has about four times the range. . . . The first of the 425 production MV-22s will be delivered to the Marine Corps in 1999. The aircraft is slated to achieve an initial operational capability (IOC) in 2001. (Goodman, 97:30)

The Air Force needs to look at the Osprey not as a replacement for a helicopter but as an airplane that can transport troops and land like a helicopter. A flying bus, the V-22, with

two dozen soldiers onboard, can travel great distances, then like a hummingbird, land at remote SAAs. SBA is a perfect mission for this aircraft.

Discussions with Boeing personnel revealed some of the characteristics of this fledgling aircraft. According to Charles Ednie of the Payloads Division, Boeing Helicopter, Philadelphia PA, during the OTTA testing phase with Osprey aircraft number one, twenty-four troops with full gear and rifles were able to exit the aircraft via the aft ramp in just under fourteen seconds (Ednie, 97). According to Mr. Tony McVeigh of Boeing Philadelphia's Helicopter Aerodynamics Division, the Osprey is designed to be landed vertically, like a helicopter in a 100' x 100' clearing. He says that without testing, based on an educated engineering guess, V-22s will be able to operate side by side as long as there is 50' spacing between the rotors (McVeigh, 97).

Those Ospreys going to the Special Operations Forces will be built with a probe that will allow air to air refueling (A/R) from a basket or drogue configured A/R platform. The aircraft headed to the Marines will include bolt-on probe kits to allow future A/R. Mr. McVeigh says that Boeing is analyzing the type of basket that will be needed to accommodate the 180 KIAS A/R speed that is expected (McVeigh, 97).

One of the aspects of present day SBA that makes it so vulnerable during the run in is the simple, straight line, single heading formation. Another is the number of paratroopers in each of the personnel airdrop aircraft, creating a dense target. More aircraft from different headings would confuse the enemy's AAA or SAM batteries, complicating their targeting solutions. More aircraft with less personnel in each also means that fewer lives would be lost if a single aircraft were destroyed. The V-22 Osprey would make an excellent platform for the personnel portion of the SBA.

Instead of bringing a formation of large slow moving aircraft in a single line to the DZ, a swarm of Ospreys could descend upon the DZ. Five corridors could be designated to access the DZ. Those corridors would lead to lanes within the DZ. If the DZ were divided into a checkerboard of little helo-pads with GPS coordinates designating a landing zone for each Osprey, one hundred aircraft could hover, land, and offload their troops in less time than it would take for 25 C-17s to make their airdrop passes (23.7 minutes). Figure 2 depicts a 600 yd x 1000 yd DZ. Each aircraft is provided a 100 yd x 100 yd patch for increased safety (compared to pushing design specifications) as well as to accommodate heavy equipment already airdropped onto the DZ.

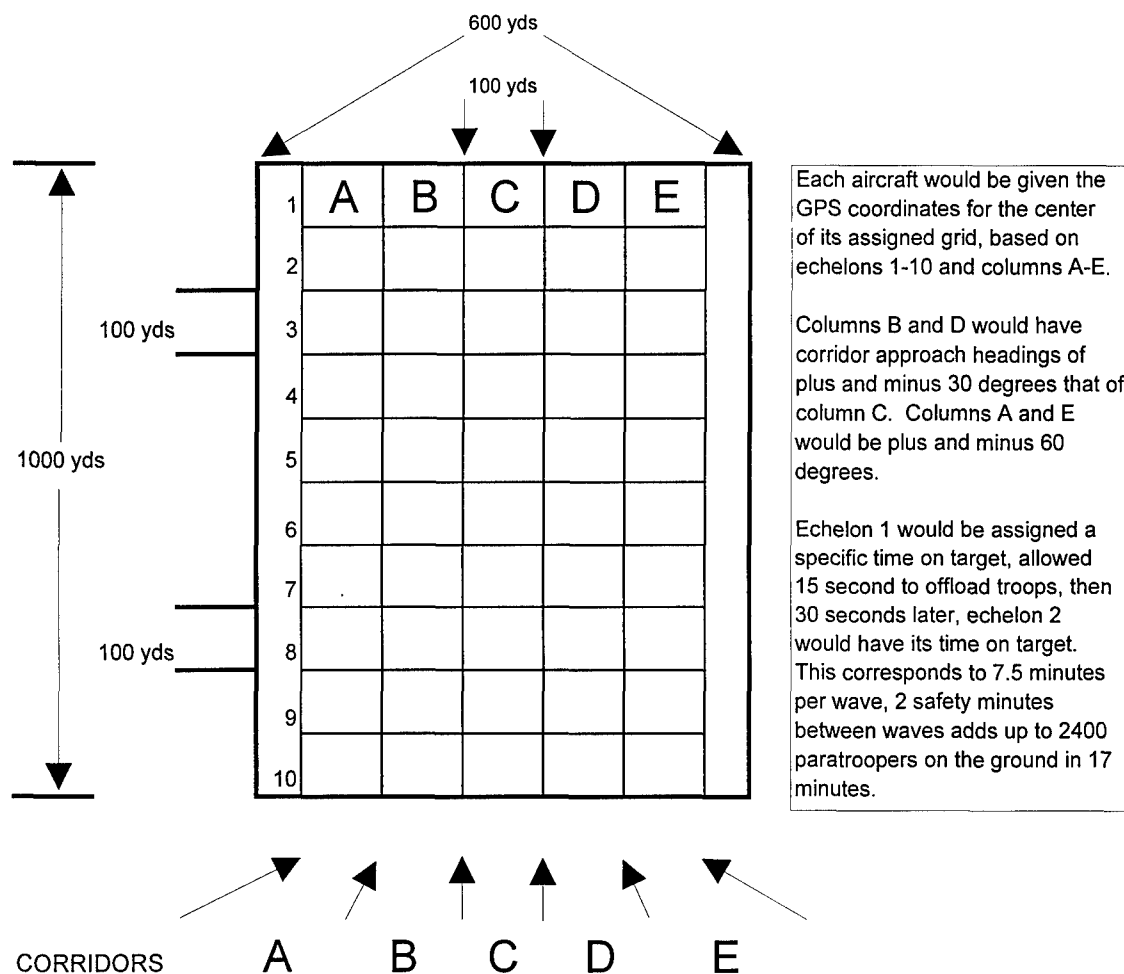


Figure 2. Conceptual Osprey DZ

With a buy of 425 V-22s, the Congressional Budget Office is estimating a per copy cost of \$42 million (Agenda, 97:35-36), whereas the Marines believe a more conservative \$29.4 million will do the trick (USMC Website, 97). Somewhere between four and twelve Ospreys could be purchased for the cost of each C-17. According to Commander Mike Ahern of the V-22 Program Office, the Osprey will have a reimburseable rate of around \$4,600 per flying hour, when it becomes operational (Ahern,

97). A swarm of Ospreys would be a cheaper and more flexible method of deploying ground troops compared to SBA.

Table 4 summarizes previously cited information.

Table 4. SBA Options and Costs

	C-17A	C-130J	CV-22
Cost per Copy	\$358-168M	\$54.7-50M	\$42-29.4M
MMH/FH	10.4-7.4	10.3	
Reimbursement/FH	\$5,694	\$1,656	\$4600
Planned Fleet Buy	120	1	425
# reqd for a single personnel formation SBA drop	25	27	103
Cost of formation	\$8.95-4.2B	\$1.48-1.35B	\$4.33-3.03B

The C-17 is a tremendous airlift asset, but the use of it within SBA is problematic. The United States does not have to look at SBA the same old way, and even if it chooses to do so some further considerations are warranted.

V. Conclusion and Further Considerations

The 1997 AMC Mobility Master Plan has a roadmap for the C-17. In it the AMMP states, "C-17 is critical to support Brigade Airdrop mission" (AMMP 96:A-2). The first question that needs asking by DOD leadership is not whether or not the C-17 is critical to strategic brigade airdrop, but is Strategic Brigade Airdrop critical to the United States?

The nature of warfare and its role in foreign policy are changing. Precision, laser-guided and other smart munitions are the weapons of choice. Non-lethal combat weaponry that disable without killing is in the development phase. A world-wide chemical weapons ban treaty is being debated in the Senate. A former commander of SAC is calling for the elimination of our nuclear arsenal. The United States Armed Forces are being called into more and more military operations other than war (humanitarian assistance, peace-keeping and nation-building). The political consequences of the loss of American servicemen and women's lives are great. Evidence of this are the investigation into the Khobar Towers bombing and the helicopter losses in Northern Iraq and Somalia.

A risk assessment of SBA would show the possible costs and losses associated with paratroopers raining down upon the soils of other continents greatly exceed the military valence of the operation. Airdropping cargo and personnel from expensive aircraft over an airfield where it is unsafe to land is patently ludicrous. If it is unsafe to

land there, the aircraft should not be overhead. If it is safe enough to there, simply land. There is no point to parachuting in.

America needs to maintain the capability to airdrop personnel and equipment in unique and special circumstances. We must be able to insert Special Operations Forces and their equipment for specific, time sensitive, clandestine activities. We must also be able to airdrop personnel and equipment into remote, non-hostile environments. But America may no longer need to airdrop on 18 hours notice an entire brigade's worth of paratroopers and equipment anywhere in the world. SBA is expensive, out-dated, and risky. There are cheaper, safer deployment methods that are more efficient and more suitable than the present-day and future SBA. DOD should examine these options.

If SBA is determined to be in the national interest, then the C-17 should exploit its strengths and downplay its weaknesses. The Air Force Association quoted Lieutenant General Wilson, Army's Deputy Chief of Staff for Logistics, as saying, "The C-17 provides an unequaled capability for America's military" (AFA Website, 97:1). It very well may be unequaled, but it has its own limitations and flexibility in personnel airdrop may prove to be one of them. Approximately equal (maybe even greater) capability at less cost may be exactly what America needs. The C-17 should continue to airdrop the heavy equipment and airland as much as possible. However, the personnel portion of SBA should shift to a more inexpensive weapon system such as the stretch C-130J or the V-22; each of which can put more mass on the DZ more quickly than the C-17.

Should SBA continue in its present form there are some worthy improvements that deserve consideration. The KC-135 cockpit modification program, PACER CRAG, has yielded an interesting spin off of current collision avoidance technology for

situational awareness (SA) and formation monitoring. The Traffic Collision Avoidance System (TCAS) could be used within airdrop formations to replace or augment the SKE, increase SA, allow vertical altitude separation, and decrease the strenuous aircrew workload described earlier.

According to Tony Codispoti of Allied Signal's Communication and Avionics System Division, Allied has three versions of Traffic Collision Avoidance System (TCAS) available. The standard off the shelf TCAS, for the commercial community, can track approximately forty aircraft. Allied also has an ETCAS which has been contracted as part of the KC-135 PACER CRAG cockpit modernization program. ETCAS has two modes, the first of which monitors forty aircraft as far forward as forty NM with 12-20 NM on the back and sides, depending on conditions. The second mode is called formation or rendezvous mode that will be used with the tankers. It provides forty aircraft capability for forty NM in any direction. Allied also has a military TCAS program which uses a datalink, encrypts SKE-type signals and would theoretically allow for infinite formation length, passing information back from each successive aircraft. It would take about a year for Allied to prepare the program for acquisition. The ETCAS for the PACER CRAG program has an off-the-shelf price of around \$130,000 (Codispoti, 97:1). The military TCAS would be perfect for SBA. Tankers and airdrop aircraft, would be able to pass and receive information and monitor the formation and rendezvous, with limited or no radio communications.

The British combat aerial delivery system (CADS), witnessed by the ASAM class 96-A during its trip to European bases this January, features a system which involves two C-130s loaded with armored personnel carriers and jeeps landing simultaneously on a

runway. Once the aircraft stop, loadmasters release the chains and the vehicles loaded with soldiers roar off the aircraft. The Royal Air Force aircrews deposit two plane loads of vehicles and troops on the airfield in short order, then take off straight ahead on whatever amount of runway remains. This system may only be practical for insertions much smaller than that of SBA. CADS is impressive and warrants further investigation.

Major Marchand offers two options to the C-5 airdrop modification program, eliminate SBA or rethink the C-5 use:

In fact, due to the proliferation of manpads and AAA, SBA with any aircraft may be a requirement that has outlived its usefulness; [c]ancel the C-5 airdrop modification program and save \$289M for other AMC programs. Make up the shortfall in capability by developing C-17 'dual stick' (equipment extracted on both sides of cargo bay) procedures for heavy equipment airdrop. Joint Staff needs to reassess SBA requirement and whether or not it will ever be used due to strategic airframe availability and high risk of aircraft losses then establish joint doctrine between sister services. (Marchand 96:5)

The mounting of dual stick rails in the C-17 does appear to be a simple material solution that would increase SBA capacity. Dual stick drop capability could allow the same amount of equipment airdropped in half the time with half the number of aircraft. This modification would pay for itself many times over.

Captain Howard in his CADS paper advocates three improvements to increase the aircrew proficiency and precision. He proposes the use of GPS to allow slight altitude differentials between the aircraft within the formation. These altitude differentials would decrease the effect of the wake turbulence and reduce the workload and stress on the aircrew. He also states that smaller formations launched from different bases would have tactical advantages: "In the realm of tactical deception, the presentation of numerous formations flying could be used to great effect. The element of surprise would also be

greater with numerous smaller formations flying dissimilar routes to the objective area versus one large formation that is telegraphing its destination by sheer size.” His final recommendation is that this procedure is so unique and intensive that simply doing one large formation airdrop exercise per year is not enough (Howard, 96:10-14). SBA needs to be practiced more often on a large scale to be effective when called upon for real.

SBA is a tremendous weapon of force projection. If we want it to be effective, we must modernize, we must be critical, we must continue to improve, and we must be realistic in terms of its cost, value, and tactical appropriateness.

Bibliography

"Agenda for Congress." Aviation Week and Space Technology, 17 Feb 1997:33-38.

Ahern, Mike. Commander. Naval Air Systems Command, V-22 Program Office, Director of Business and Operations, Philadelphia PA. Telephone Interview. 23 Apr 1997.

Air Force Website. "C-17 Globemaster III." WWWeb, [http:// www.airforce.com /visitor/flightln/aircraft/transport/c17/c17html](http://www.airforce.com/visitor/flightln/aircraft/transport/c17/c17html) (22 Mar 1997).

Air Force Association Website. "Why We need At Least 120 C-17s." WWWeb, [http:// www.afa.org/c17/html](http://www.afa.org/c17/html) (1 Apr 1997).

Air Mobility Command. C-141 Operating Regulation. AMCR 55-141 Chapters 17 (15 May 1993), 23 (23 July 1992), 24 (1 July 1992), 25 (23 July 1992). Scott AFB IL.

Air Mobility Master Plan (AMMP) 1997. Air Mobility Command, Scott AFB IL. Oct 1996.

Blair, Clay. Ridgway's Paratroopers: The American Airborne in World War II. Garden City NY: The Dial Press, 1985.

Bowers, Ray L. The United States Air Force in Southeast Asia: Tactical Airlift. Washington DC: Office of Air Force History, 1983.

Codispoti, Tony. Senior Product Manager, Commercial Avionics Systems, Allied Signal Inc., Fort Lauderdale FL. Telephone Interview. 16 Apr 1997

CSX Intermodal. Office of George Bundick. Philadelphia PA. Telephone Interview. 18 Apr 1997.

Ednie, Charles. Payloads Division, Boeing Helicopter, Philadelphia PA. Telephone Interview. 28 Feb 1997.

Faulkner, Jim. C-130J System Project Office, Financial Management. Wright-Patterson AFB OH. Telephone Interview. 18 Apr 1997.

Floyd, Bobby. Major General. HQ AMC/XP. Memorandum to AMC/CV. AMC Scott AFB IL. 20 Jun 1995.

General Accounting Office. Military Airlift: Options Exist for Meeting Requirements While Acquiring Fewer C-17s. Report GAO/NSIAD-97-38. Washington: Government Printing Office, 19 Feb 1997.

General Accounting Office. C-17 Globemaster: Support of Operation Joint Endeavor Report GAO/NSIAD-97-50. Washington: Government Printing Office, 14 Feb 1997.

Goodman Jr. Glenn W. "A Multidimensional Force; Marine Corps Set to Reap Long-Desired Mobility Upgrades," Armed Forces Journal International: 30 (January 1997).

Hinkel, James F. Major General. HQ/AMC/DO. Memorandum for HQ/AMC/XP, 15 May 1995.

Hlinomaz, Peter V. Captain. Chief, Special Operations Analysis Team, Air Force Information Warfare Center, San Antonio TX. Memo correspondence. 6 March 1997.

Howard, James R. Major HQ AMC/AMWC ASAM Graduate Research Paper An Analysis of the 57th Airlift Squadron Training Production. Personal Interview. Spring 1997.

Howard, Paul C. Captain. USAF Combat Aerial Delivery School Little Rock AFB AR. Large Formation Operations: Impressive, but Safely Within System Capabilities? 27 Oct 1996.

HQ USAF/DA. "C-5 Brigade Airdrop Role." Electronic Message. DAMO-ZA 1915Z 17 May 1995.

HQ USAF/XORM Graph provided to the SBA Joint IPT. 13 Aug 1996.

Joint Staff. Joint Tactics, Techniques and Procedures for Theater Airlift Operations. Joint Publication 3-17. Washington: JCS, 18 Jul 1995.

Linde, Gwen. Major. HQ/AMC/XPPF. Staff Summary Sheet for AMC/XP memo, 23 May 1994.

Lockheed Martin Website. "C-130J Operational Benefits." WWWeb, <http://www.lmasco.lmco.com/busdev/a...t/c130/c130j/perform/benefits.html> (31 Mar 1997).

Marchand, Mike. Major. HQ AMC/XPP. C-5 Brigade Airdrop. Air Mobility Operations Course, Air Mobility Warfare Center, Fort Dix NJ, Fall 1996.

Matthews, James K. and Holt, Cora J. So Many, So Much, So Far, So Fast. Joint History Office, Office of the Chairman of the Joint Chiefs of Staff and Research Center, United States Transportation Command. 1996

McConnel, Malcolm. Just Cause. New York: St. Martin's Press, 1991.

McVeigh, Tony. Aerodynamics Division, Boeing Helicopter, Philadelphia PA. Telephone Interview. 28 Mar 1997

Monahan, Dan. Major. Mobility Branch Chief. HQ USAF/XOXD. "General Fogelman's Corona Briefing and Slide presentation 1996." Address to Air Mobility Warfare Center, Fort Dix NJ 19 Feb 1997.

Morey, Ronald L. Colonel. HQ AMC/DOT. Off-Drop Zone Crosstell Report 1995. Scott AFB IL: AMC, 22 Feb 1996.

Record, Jeffrey. Hollow Victory. Riverside NJ: Brassey's US Inc. Division of Maxwell Macmillan Inc, 1993.

Rutherford, Robert. General. AMC/CC. Scott AFB, IL. Staff Summary Sheet, 21 April 1995.

SAFFM Website. "Attachment A15-1 of Air Force Instruction 65-503, 5 Jan 1996." WWWeb, <http://www.saffm.hq.af.mil>, 27 Mar 1997.

SBA Joint sub-IPT minutes, 28-29 Jan 1997.

Shelpman, John. Major. HQ AMC/DOTF, Scott AFB IL. Telephone Interview. 3 Mar 1997.

Sierra Research Division. Mod SKE & ZM: AN/APN 169C Stationkeep Equipment, AN/TPN 27A Zone Marker. P-3320, Sierra Technologies Inc, January 1995.

Tirpak, John A. "Airlift Moves Up and Out." WWWeb, <http://www.afa.org/c-17a.html> (1 Apr 1997).

"Tunner Award, The," Air Force Magazine, 73:80-83 (September 1990).

USMC Website. "V-22." WWWeb, <http://www.usmc.mil/factfile/232a> (24 Feb 1997)

Varcarel, Emelio. Major. C-17 System Program Office, Wright-Patterson AFB OH. E-mail correspondence. 22 Apr 1997.

Waters, Steve. Major HQ AMC/DOTR, Scott AFB IL. Telephone Interview. 3 Mar 1997.

Watkins, Steven. "Airdrop Mission Will Go to C-5s," The Air Force Times, 11 Dec 1995:34.

33rd Flight Test Squadron. AMC. C-17 Personnel Formation Airdrop; Follow On Operational Test and Evaluation of the C-17 Aircraft, Draft Final Report 19 Feb 1997.

82nd Airborne Division. Slides provided to SBA Joint IPT "SBA and Airfield Seizure." 28 Jan 1997.

Vita

Captain Seth Beaubien [REDACTED]
[REDACTED]
[REDACTED] grew up on a dairy farm in
Maine, where he went Dexter Regional High School. [REDACTED]
[REDACTED]

He graduated from the United States Air Force Academy in 1986 with a B.S. in engineering and a minor in French. He received an M.A.S. from the University of Montana in 1995.

Captain Beaubien has spent the better part of his Air Force career as a KC-135 crewmember at Wurtsmith AFB, Michigan and Malmstrom AFB, Montana.
[REDACTED]

AFIT/GCA/LAS/97S-1

CALIBRATION AND VALIDATION OF THE
COCOMO II.1997.0 COST/SCHEDULE ESTIMATING
MODEL TO THE SPACE AND MISSILE SYSTEMS
CENTER DATABASE
THESIS

Wayne A. Bernheisel
1st Lieutenant, USAF

AFIT/GCA/LAS/97S-1

Approved for public release; distribution unlimited

Switchboard results

People

Business

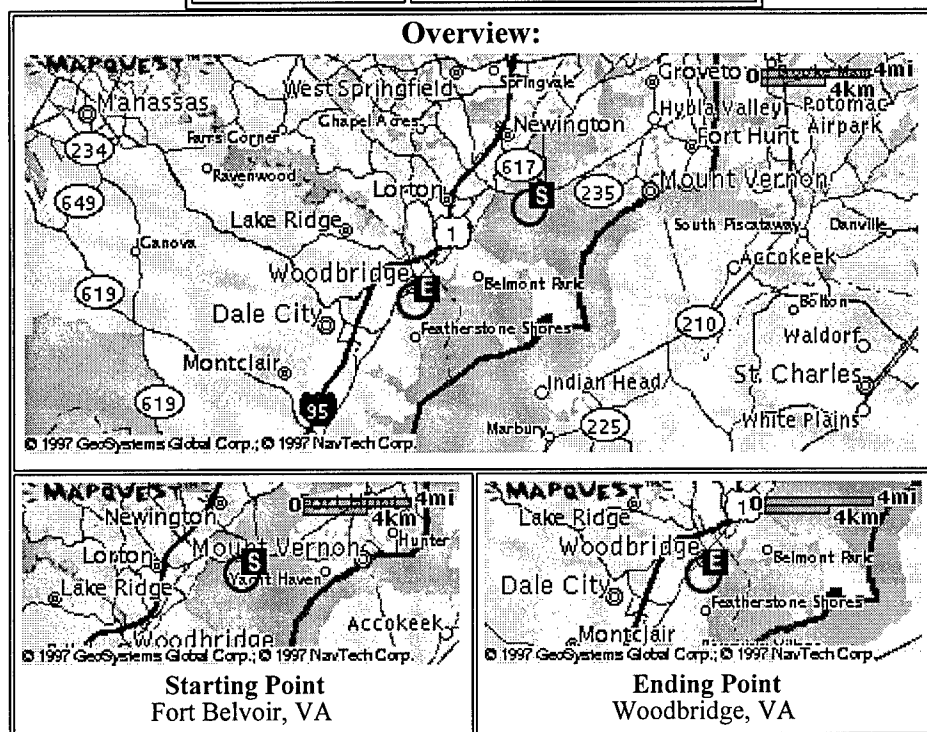
Home

CATALOGLINK **FREE CATALOGS!** **click here to request free catalogs!**
http://cataloglink.com **THE ULTIMATE CATALOG SITE**

[Back to listings](#)

City to City Directions

Start:	Fort Belvoir, VA
End:	Red Lobster Restaurants Woodbridge, VA
Direction	Distance
1: Go West on US 1	5.2 miles
Total Distance:	5.2 miles

Use subject to [license/copyright](#).

Copyright © 1996, 1997 Switchboard Incorporated Questions? See the Help
 Copyright © 1997 Database America Inc. **DATABASE AMERICA Enabled**