C-17: HOW TO GET MORE FOR LESS

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ABSTRACT

C-17: HOW TO GET MORE FOR LESS By MAJ David L. Oskey, USA, 52 pages

The Department of Defense has a mission to fight and win two major theaters of war in "close succession." Mobility is the critical link, providing the capability to deploy forces and meet mission requirements. One aspect of mobility critical to meeting current and future needs is airlift. The two types of airlift are inter-theater and intra-theater airlift. The 1998 Air Mobility Master Plan, identifies a shortfall in strategic airlift capability or inter-theater airlift. The C-17 Globemaster III will provide the core for military airlift as it replaces the ageing C-141 Starlifter. The C-17 has unique capabilities that complement Force XXI initiatives, and provide the Air Force with a new capability to provide decisive intra-theater airlift.

The Department of Defense force structure reveals a heavy reliance on force projection operations and mobility. To increase mobility and maximize the C-17s intra-theater airlift capability, it is critical to devise a system that will relieve the C-17 of strategic inter-theater airlift missions. This system must provide a low cost capability to move outsize cargo and the civil reserve air fleet (CRAF) is the primary candidate for change. CRAF provides a large amount of air cargo transport capability and is critical to successful deployment of U.S. Forces during times of national crisis. However, CRAF does not provide an outsize cargo airlift capability.

This monograph will recommend two courses of action that will add strategic airlift capability. This additional airlift will allow the C-17 to perform intra-theater missions. As a result forces will have a rapid response and enhanced mobility capability in the area of responsibility unlike anything experienced in the past. The C-17 has the potential to become decisive on the future battlefield.

TABLE OF CONTENTS

Introduction iv
Background 8
  Civil Reserve Air Fleet (CRAF) 8
  Future Army Operations 15
  C-17 19
Courses of Action 24
  Four Potential Courses of Action 27
Analysis 34
Conclusion 39
Endnotes 42
Bibliography 46

Figure 1: Equipment Comparison 17
Figure 2: COA Comparison 41

Introduction

The Department of Defense mission to fight and win the nations wars is a task reliant on massing the right forces on an appropriate location at the opportune time. Since, it is unlikely that the United States will fight a war on U.S. soil, then personnel and equipment must either be pre-positioned or deployed to the area of operations. The Department of Defense has experienced a significant reduction in active duty forces and reduced its presence of forward deployed forces. The most likely adversaries are not Mexico and Canada and require forces to flow either by air and sea. The purpose of this paper is to examine air mobility, specifically air cargo, to support operations and provide potential solutions that are cost effective.

The National Security Strategy establishes the requirement to defeat enemy forces in two separate major theaters of war. Accordingly, the Department of Defense has to maintain a force structure capable of meeting the mission outlined in the National Security Strategy.

> *Fighting and winning major theater wars entails three challenging requirements. First, we must maintain the ability to rapidly defeat initial enemy advances short of enemy objectives in two theaters, in close succession. The U.S. must maintain this ability to ensure that we can seize the initiative, minimize territory lost before the invasion is halted, and ensure the integrity of our warfighting coalitions.*
>
> *Second, the United States must plan and prepare to fight and win under conditions where an adversary may use asymmetric means against us--unconventional approaches that avoid or undermine our strengths while exploiting our vulnerabilities. This is of particular importance and a significant challenge. Because of our dominance in the conventional military arena, adversaries who challenge the United States are likely to do so using asymmetric means, such as WMD, information operations or terrorism.*

Finally, our military must be able to transition to fighting major theaters of war from a posture of global engagement--from substantial levels of peacetime engagements overseas as well as multiple concurrent smaller -scale contingencies. Withdrawing from such operations would post significant political and operational challenges. Ultimately, however, the United States must accept a degree of risk associated with withdrawing from contingency operations and engagement activities in order to reduce the greater risk incurred if we failed to respond adequately to major theaters of war.[1]

A critical aspect of accomplishing the National Security Strategy mission is mobility. Mobility enables forces the flexibility to respond to global crisis. Since 1989 the current force structure has been significantly reduced. Consequently, the mission has remained stable with a requirement to respond to two near simultaneous major theaters of war. The Army has downsized from 18 to 10 active divisions, the Air Force dropped from 24 to 13 fighter wings, the Navy has decreased their battle force ships from 567 to 346 and the Marines maintain three Marine Expeditionary Forces with declining personnel strengths.[2] The implication is that force projection or mobility of forces from CONUS, small scale contingency operations or forward stationed units are required more now than in the past to support major theaters of war.

The Chairman of the Joint Chiefs of Staff, Joint Vision 2010, provides direction on how the Department of Defense can execute two near simultaneous major theaters of war with a reduced force structure. The four operational concepts are dominant maneuver, precision engagement, full dimensional protection, and focused logistics.[3] These concepts are complementary and with synchronization provide the combat power needed for mission accomplishment. The concept of dominant maneuver does not apply simply to ground forces, but

"... will be the multidimensional application of information, engagement, and mobility capabilities to position and employ widely dispersed joint air, sea and space forces to accomplish the assigned operational tasks."[4] Joint Vision 2010, continues and "require forces that are adept at conducting sustained and synchronized operations from dispersed locations."[5] These concepts all support a vision of mobility using aircraft to transport forces to and within a theater of operation (intra-theater air), unlike operations in the past. Information dominance will allow dispersed forces to converge on the enemy from multiple points of embarkation through an increased situational awareness that identifies enemy and friendly unit locations. This capability is unparalleled by the enemy and can be exploited by an aircraft that allows intra-theater air to support movement of heavy forces. The C-17 provides an austere and small airfield landing capability that has not existed in the past, and provides the ability to move M1 tanks and M2 Bradleys. The C-17 is also the only aircraft capable of airdropping outsized firepower like the M2 Bradley.[6] But, more detail on the C-17's capabilities and limitations will be addressed later.

The Air Force strategy of "Global Engagement" is linked to Joint Vision 2010 and the National Military Strategy through a core competency of rapid global mobility. "Rapid deployment will remain the future Joint Team's most reliable force multiplier. Fighter forces paired with precision weapons provide formidable capabilities that our mobility fleet can deploy worldwide and sustain at high in-theater sortie rates."[7] This concept supports a forced entry operations capability addressed in the National Military Strategy and provides for a suitable

environment to airland follow on forces. This is not advocating that air could transport sufficient forces to support operations in a major theater of war, but does set the conditions for the Military Sealift Command to flow forces into a safe and secure environment.

A research paper presented to Air Force 2025, outlines potential solutions to solve future airlift requirements. The systems described include transatmospheric and hypersonic vehicles that allow global delivery of high priority payloads of 10-30,000 pounds anywhere on the earth in one hour. The limitations on this delivery system are the approximate five day turnaround time to prepare vehicle for reuse and the 11,500 foot runway required to land. Another potential airlifter is the airship, capable of carrying 500 tons, at 250 knots with a maximum range of 12,500 miles, and that has defensive/stealth characteristics. This platform would serve as a "mothership" and unmanned aerial vehicle would shuttle cargo to the point of delivery. This capability is equivalent to the payload of six C-5Bs. Other systems described include very large aircraft with up to 330' wingspans carrying 1,000,000 pounds of cargo, in-ground effect wings capable of carrying 540 tons at cruising speeds of 310 miles per hour (restricted to landing in water), and delivery systems that can deploy cargo from airlift platforms accurately from a distance of 20 miles.[8]

General Ronald R. Fogelman, Chief of Staff, Air Force said "The single biggest deficiency in the Department of Defense is lift."[9] This is a current and relevant problem that that needs short term solutions. The research paper, Airlift 2025 discussed above, provides the framework and generates appropriate

thought to solve future dilemmas, but what is the short term problem? The 1998 Air Mobility Master Plan, identifies a deficiency in cargo aircraft and combat delivery equipment with poor or no capability today, fiscal year (FY) 98, and doesn't improve until the period FY 99-2004, when it improves to partial capability to meet mission needs. Partial capability, is defined as "there are significant problems and proposed solutions identified but with only partial funding identified."[10] To quantify the magnitude of the problem, the Mobility Requirements Study Bottom-Up Review Update (MRS BURU), determined a cargo airlift requirement of 49.7 million ton miles/day (MTM/D). The capability to meet this requirement is not met until FY 2003 or FY2004. This capability is based on the assumption that full National Guard and reserve mobilization with Civil Reserve Air Fleet (CRAF) stage III activation has occurred.[11] The ability to reach CRAF stage III and capabilities associated with CRAF stage III will be discussed later.

Strategic mobility, inter-theater air is a critical link to future stability and effectiveness of the Department of Defense. The ability to project forces and demonstrate force projection operations will determine the success or failure of future military operations. Additionally, the Department of Defense needs to look into expanding the ability for Combatant Commanders to employ intra-theater mobility. The Department of Defense has developed an aircraft the C-17 Globemaster III, capable of performing inter-theater and intra-theater airlift missions. However, with the inactivation of the C-141 fleet and the deficiencies

noted in cargo airlift capability, it is unlikely the C-17 would be risked to excessive combat loses normally associated with intra-theater airlift missions.

This paper will outline four courses of action that could reduce the cargo airlift deficiencies. Potential solutions cannot affect today, but has potential to relieve or eliminate the problems associated with the mid-term, FY 2005-2013. The importance associated with providing C-17s for intra-theater airlift is clear when examining a two near simultaneous major theaters of war situation. To maximize responsiveness to ground forces, the Combatant Commander needs a responsive capability to move outsize cargo, perform heavy airdrop missions, and operate on small or austere airfields. This is consistent with the operational concepts of Joint Vision 2010 and the C-17 is the only aircraft capable of performing these missions that is available for production now. The simplistic solution of funding additional C-17s for the United States Air Force will not be considered as a course of action. The assumption is, that if such a course of action were possible it would have been funded and executed. The Air Force originally was going to contract 210 C-17s during the Reagan Administration, but that activation was reduced to a total of 40 due to cost overruns and difficulty in production.[12] The Air Force has since increased the future C-17 fleet with a contract for another 80 C-17s that will bring the fleet of C-17s to 120 in FY 2006.[13] Due to the recent drawdown of forces and reduction in Department of Defense budgets it does not appear to be rational that Congress will appropriate the funds for the Air Force to increase the C-17 fleet above the projected 120.

This paper is structured to provide a brief history of CRAF and the support provided during operations Desert Shield and Desert Storm. Next, it will look at the future for ground operations in Force XXI, to try and identify if a reduced need for airlift is possible through technological developments. This is followed by an explanation of the C-17's capabilities and importance. Finally, it will identify the framework for four potential courses of action with a comparative analysis.

Background

Civil Reserve Air Fleet (CRAF)

CRAF is a significant component of airlift operations for the Department of Defense today. The genesis for CRAF owes it roots to World War I and World War II. Prior to WWI, the military was the source of revenue for early manufacturing and testing of aircraft. The government ordered over 12,000 aircraft during the summer of 1917. The war ended November, 1918, and many aircraft were available at bargain prices giving air commerce an opportunity to get established. The next step was the US Post Office, and its ability to separate from the US Army in 1918. The Kelly Act was drafted in 1925, and directed commercial contracts for supplementary routes to the US Post Office's transcontinental routes. All these actions were aimed at establishing a civilian airlines industry, and by 1927 the Post Office was withdrawing from air mail service and designated routes and schedules to be flown.[14] Other Congressional initiatives occurred in an attempt to shape the commercial industry. During WW II, the government was contracting commercial air and "on December 13, 1941, President Roosevelt signed an executive order, citing his powers under the Constitution and the formal declaration of war, directing the Secretary of War to take possession of any portion of any civilian airline needed for the war effort." Control of the civilian airlines as not assumed totally by the military and "by the end of 1942, the civilian airlines provided almost 88% of the

air transportation. However, with the stepped-up manufacturing and training, military planes and crews were producing the 81% of the airlift by 1945."[15]

Civilian airlines continued to support military operations after WW II, including the Berlin Airlift and the Korean Conflict. On March 2, 1951 President Truman issued an executive order directing the Department of Commerce (DoC) to develop a plans and programs to suitable for the transfer of civilian air carriers to support Department of Defense (DoD) needs and maintain essential civil routes and services. The DoC and DoD signed a memorandum of understanding, that developed CRAF and provided responsibility for the Air Force to get commercial airlines under contract and advising the DoC of the military requirements for civil aircraft.[16] The DoD CRAF plan, had several concepts that have remained relatively unchanged.

> *First, the concept was that all aircraft and personnel would remain within the control of the individual carriers. There was a self-support concept that each carrier was to follow unless it needed help. Second, initial response time was to be 48 hours from notification. Third, at both domestic and overseas locations, the U.S. carrier with the greatest presence was designated as 'senior lodger'. The concept was that the carrier would be the MATS (today's Air Mobility Command) on-scene representative in those cases where MATS did not place military personnel on location. Fourth, in addition to aircraft, carriers were to provide crews at a crew to aircraft ratio of 3.7:1. While the crew ratio has evolved to 4:1 as of 1993, the aircraft utilization rate Has remained 10 hours per day from the beginning.* [17]

CRAF was examined several times over the years and is a critical capability for cargo airlift during times of crisis today. Current CRAF activation levels are described as:

> *CRAF Stage I- Committed Expansion: provides increased cargo and passenger airlift capability for our long-range international requirements. Requirements are for 30 wide body equivalents (WBE), for passengers and 30*

WBE for cargo. Stage I is used when our organic fleet cannot meet early contingency deployment and other traffic requirements simultaneously. USCINCTRANS has authority to activate CRAF Stage I when approved by the Secretary of Defense.

CRAF Stage II - Defense Airlift Emergency: This an additional airlift expansion program in support of a national security crisis short of a declared national emergency and involves partial national mobilization. Requirements are for 87 passenger WBE and 81 cargo WBE. USCINCTRANS on approval of the Secretary of Defense, has authority to activate Stage II.

CRAF Stage III - National Emergency: Use of Stage III requires a declaration of national emergency by the president or Congress. The Secretary of Defense issues the order to USCINCTRANS to activate CRAF Stage III. CRAF Stage III involves 37% of passenger (161 WBE) and 76% of the cargo aircraft (114 WBE) in the long-range commercial fleet.[18]

Although CRAF has existed since 1951 with different classifications for activation levels, the first activation of CRAF ever, was for Operation Desert Shield on 17 August 1990.[19] Operations Desert Shield and Storm are the only cases for examining a true CRAF activation and point to the vulnerabilities of the CRAF program. The 17 August activation was only CRAF Stage I and CRAF Stage II was activated for the cargo airlift to reduce worldwide backlogs on 17 January, 1991. There was a question during this time to activate Stage III instead, but CINCTRANS decided to reserve Stage III for a "real national emergency."[20] CRAF, being a voluntary program on the part of the airlines, revealed the fragile working relationship with civilian air carriers. Some carriers were refusing to fly. On 17 January, 1991, Hawaiian Airlines refused to return to a "war zone" and deplaned 194 passengers in Germany that required two C-141s to continue movements into the area of responsibility (AOR). Federal Express, Northwest and World Airlines limited landings into the theater to daylight operations. These restrictions were about a concern the airlines had

with SCUD missiles and chemical warfare, weapons of mass destruction (WMD). To counter this problem, Air Mobility Command employed a program to acquire chemical protection equipment for the airlines and briefed airline CRAF representatives on the current intelligence situation. As a result, most airlines agreed again to 24-hour operations. Another technique employed included moving CRAF aircraft to daylight landing slots that were previously military scheduled landings.[21] The experiences of Desert Shield and Desert Storm were a significant problem considering the disruptions experienced with an enemy during Desert Storm lacking precision missile targeting capability and without a credible Air Force that could challenge local air superiority. This situation exposes a vulnerability, that brings up the question whether CRAF airlines will support in the future against a credible opponent or an asymmetrical threat capability.

The future ability of airlines to support CRAF with cargo capability specifically, is questionable when looking at the projections of worldwide air cargo growth in the civil sector. Boeing has numerous projections that demonstrate the importance of cargo carrying aircraft in the future. "It is anticipated that long-term air cargo growth will average 6.6 percent per year, while the world economy pushes ahead at 3.0 percent. ... The profit squeeze in the passenger industry has focused attention on the cargo market with its lower-hold revenue opportunities. Airline cargo revenues average 16 percent of total international revenues, with some ranging to more that 30 percent."[22] The cargo capability was the main reason for the activation of CRAF stage II as discussed earlier.

The DoD cannot afford the complications experienced during Operations Desert Shield and Storm in the future, exasperated by a lack of sufficient CRAF cargo participants or by deploying into an area with an asymmetric threat that endangers the safety of CRAF aircraft causing another delay or stoppage in cargo airflow. This problem is complicated with the emerging doctrine of "focused logistics" and "just in time" delivery programs the Army is developing that is dependent on a fast and reliable distribution system.

The DoD had leverage to force CRAF airlines to comply with contractual agreements in Desert Shield and Storm. "Any carrier failing to respond to unilateral orders according to the terms of the contract technically would be in default under the terms of the contract. However, from a practical standpoint, MAC's prerogatives were limited. MAC could exclude the carrier from CRAF and refuse to award additional peacetime or wartime business, or MAC could take possession of certain air carrier aircraft, voluntarily or under court order, and attempt to operate them with military or contracted crews. Neither of these solutions was at all practical and they were not given much consideration."[23] The incentive for CRAF participation is the ability to receive government contracts based on their level of participation. It is questionable whether a predominate air cargo carrier would be substantially hurt by not participating in CRAF when consideration is given to the increased revenues received from an increasing commercial market. The complexity is increased with the concept of "just in time" logistics. The DoD will increasingly rely on air transportation of supplies and repair parts to offset the past trends of stockpiles of supplies and

repair parts maintained by units. This is not the type of contract referred to as a result of CRAF participation. The resupply of units in "just in time" logistics is maximizing the use of current commercial deliveries and will provide air cargo carriers business unintentionally if the purpose of CRAF is to leverage air carriers to participate and receive government business.

The true risk for air carriers that are members of CRAF is their potential loss of market share during periods of CRAF activation. It is difficult to support this potential loss, but an indicator is the 1997 United Parcel Service (UPS) strike. "The company lost $700 million worth of business during the 15-day strike. And company spokesman Mark Dickens estimated that, for the long term, UPS may have lost 5% of its business to competitors, or about 600,000 packages per day."[24] The Gulf War is also an indicator on air carriers fears.

> "Major air carriers supplied 30 percent of the civil transports ... Major air carriers, except Pan Am and TWA, supplied required aircraft only, except a single aircraft from Delta, which was volunteered. This suggests that the major air carriers, taking a long-term view, expected a weak opportunity from the Gulf War in view of the long-term damage to market shares."[25]

But even more critical than loss of market share due to supporting the CRAF missions is the loss of aircrews during a period of Air Force Reserve activation. "The problem is that many of the UPS pilots are USAF Reserve pilots. When these pilots are called, UPS has fewer pilots to meet increasing requirements. When CRAF is activated, UPS has a higher operations tempo and can be short of pilot assets. ... The obvious solution is to have the reservists from UPS fly the UPS CRAF airplanes."[26]

CRAF is the vital link to supporting the two near simultaneous major theaters of war. The 1998 Air Mobility Master Plan depicts a shortage of airlift capacity shortfall until FY 2003. This notional airlift capacity projects the decreasing C-141 fleet and the increasing C-17 fleet. The most critical aspect of the airlift capacity are the assumptions of CRAF Stage III (with a stable CRAF fleet) activation and full mobilization of Reserve and Guard units.[27] This specific situation is the problem addressed by UPS and their potential shortfall of pilots. A Rand study indicates a "softness" in the cargo airlift CRAF participation. In 1990 the largest participant in CRAF stage III cargo was Federal Express with 41 aircraft, followed by Emery/Rosenbaum with 22, UPS with 13, Evergreen with 9 and World with 9 aircraft. At the time of publication Emery/Rosenbaum had withdrawn from the program and four other airlines have withdrawn from the program since 1980.[28] The Rand study stated "Fluctuating support suggests that some carriers have had less than full enthusiasm for the program, presumably because they did not see sufficient opportunity for profit. Some may have participated for patriotic reasons (and assuming that a major conventional war in Europe was unlikely) than because it made good business sense."[29]

The current CRAF stage III airlift capability is 120 WBE, according to USTRANSCOM[30], up from the 95 WBE in 1990 according to the Rand study. Besides the reluctance of airlines to participate in CRAF for reasons of potential loss of long-term market shares, and, inability to maintain sufficient aircrews to man aircraft, and potential loss of aircraft in a hostile environment, does CRAF provide the type of lift required for future operations? CRAF does not have a

capability of moving outsize cargo. The USTRANCOM projections are based on million ton miles per day, but does not delineate how many of these miles are bulk, oversize and outsize cargo. Additionally, does CRAF provide the type of operations to support the future battlefield? This requires a look at the direction land combat operations are heading.

Future Army Operations

The four operational concepts of Joint Vision 2010: dominant maneuver; precision engagement; full dimensional protection; and, focused logistics have led to the services' future direction. The Army has developed Force XXI operations and the Army After Next, as their path to Joint Vision 2010. To keep focused on how mobility is affected by Force XXI and Army After Next, it is beneficial to look at how the weapon systems have changed and how changes in doctrinal concepts affect mobility.

Force XXI largely is an enhanced capability through information dominance. The primary weapons systems remain quite similar to today's weapons systems. The main battle tank is the M1A2, the M2A3 Bradley is the weapon system for mechanized infantry operations, the AH64 Longbow is an improved version of today's attack helicopter and the RAH-66 Commanche will replace the Kiowa Warrior. It is true that these systems are more lethal and have greater precision strike capability, however, from a force projection and a mobility standpoint the basic changes to strategic lift is the quantity that requires movement through

organizational changes.[31] The current heavy division is comprised of armor and mechanized infantry battalions that are formed into task forces during combat operations based on the factors of mission, enemy, troops, terrain and weather and time available (METT-T).[32] Force XXI changes the division organization from pure battalions and transforms them into combined arms battalions. The armor and mechanized infantry companies transition from the current four platoons to three platoons per company. The affect is a reduction from 58 M1A1s or M2A2s in current armor or mechanized infantry battalions to 14 M1A2 and 30 M2A3 in the mechanized heavy combined arms battalion or 30 M1A2 and 14 M2A3 in the armor heavy combined arms battalion using the conservative heavy division objective (CHD-O) design (see figure 1).[33] The aviation brigade changes from two attack battalions and one lift battalion to one attack battalion and one lift battalion with reduced attack helicopters in the attack battalion. The net change is a reduction from 48 AH-64, 16 OH-58D and 24 UH-60 to 15 AH-64, 9 RAH-66 and 24 UH-60.[34]

	M1	M2	AH64	OH58D	RAH66	UH60
Armor Bn	58					
Mech Bn	58					
Comb Arms Bn (Armor)	30	14				
Comb Arms Bn (Mech)	14	30				

Avn Bde Current			48	16		24
Avn Bde CHD-O			15		9	24

Figure 1: Equipment Comparison

Organizational changes also occur in the division support command, the engineer brigade and the division artillery. The indications are that the changes are more of the same reduced number of systems that are an improvement of an evolutionary nature and reduced numbers of personnel. The changes are not finalized and the CHD-O is subject to further development, however there is no indication that anything other than minor changes will occur in regards to equipment.

The one aspect of Force XXI that is significant is the process of digitization and the amount of effort toward attaining information dominance and situational awareness. Although these forces of change do not directly affect strategic mobility through a demand of moving additional equipment, it does have the potential of changing deployment options. Some of the key concepts from TRADOC Pamphlet 525-5, Force XXI Operations revolve around the Army Battle Command System (ABCS) concept that:

> *broadcast battlefield information, as well as information from other sources, and integrate that information, including real-time friendly and enemy situations, into a digitized image that can be displayed graphically in increasingly mobile heads-up displays. These images will in essence, depict a unit's actual battlespace. Collective unit images will form a battlefield framework based on shared, real-time awareness of the arrangement of forces in the battlespace, versus a rigid framework of battlefield geometry—phase lines, objectives, and battle positions. This system permits commanders at every level to share a [common, relevant picture] of the battlefield scaled to their level of interest and tailored to their special needs.*[35]

The current process of digitizing the force is the use of the Army Tactical Command and Control System (ATCCS). The ATCCS is the linking of information that provides the common relevant picture and includes the Maneuver Control System (MCS), the All Source Analysis System (ASAS) the Forward Area Air Defense Command, Control, Communications and Intelligence (FADC3I) system, the Advanced Field Artillery Tactical Data System (AFATDS) and the Combat Service Support Control System (CSSCS). The MCS allows commanders and staffs to rapidly process data and make informed decisions. It displays status reports, processes operations orders, provides maps and overlays, displays unit task organization and integrates messages from all the other ATCCS sub-systems. ASAS is a system that supports intelligence and electronic warfare. Its ability to provide a picture of the enemy positions is critical to developing situational awareness. The FADC3I system integrates air defense, fire units, sensors and command and control centers to defeat/deny the low altitude aerial threat. AFATDS provides automated decision support for fire support to include joint and combined fires. It provides the capability to provide the right mix of firing platforms and munitions to defeat enemy targets. CSSCS provides critical, timely, integrated and accurate logistical information that includes all classes of supply, field services, maintenance, medical services and movements.[36]

What this provides for Force XXI Operations is the ability to be precise by synchronized attacks throughout the battlespace on units and targets. It

promotes non-linear operations allowing execution across the entire battlespace instead of massing of combat power at the Forward Line of Troops. It encompasses distributed operations that are executed where and when required to achieve decisive effects instead of concentrated at a possibly decisive point. Force XXI Operations provide for simultaneous operations that seize the initiative and present the enemy with multiple crises, but no effective response.[37] Force XXI transitions to Army after Next.

Army After Next (AAN) is the study of warfare for the Army from 2010 to 2025 as directed by the Army Chief of Staff, General Dennis Reimer.[38] Technologies looked at for AAN includes new forms of propulsion to reduce fuel requirements for vehicles drastically and boost performance, new propellants for weapons that reduce the logistics burden on Army forces, ultrahigh altitude unmanned aerial vehicles that carry sufficient payloads for intelligence and precise fires for ground units, and future airlift capabilities discussed in the introduction. The C-17 is the aircraft that "provides capabilities that blur the lines between strategic and theater combat, enabling 'strategic maneuver' and providing a capability for logistics support directly from the United States into combat."[39]

C-17

The C-17 is the aircraft that will provide the core for the near and mid term future airlift of outsize cargo. When an assessment of the future needs for airlift are evaluated, the C-17 is the only aircraft that provides the capability to lift

outsize cargo fly into and austere environment with limited runways. The current capabilities of the C-17 include the ability to take off from a 7,600 foot airfield, fly a payload of 160,000 pounds for 2,400 nautical miles and land on an austere airfield in 3,000 feet or less. When compared to the C-5, the other outsize capable airlifter, the C-5 has the ability to take off from a 12,200-foot runway, fly a payload of 204,904 pounds 2,150 nautical miles and land on an improved airfield in 4,900 feet or less. The C-17 and C-5 carry 463-L pallets to move bulk cargo. The C-5 carries 36 pallets and the C-17 carries 18 pallets.[40] The C-17, as the core airlift aircraft for the Air Force, is slated for the replacement of the C-141 fleet. The comparison of the C-17 and C-5 is more than the payload it carries and the distance it flies. An analysis of on ground capabilities is also required. The C-5 requires a taxiway and apron to maneuver on while the C-17 can perform operations that include backing down runways and turning in a tight radius as demonstrated at Barstow-Daggett Airfield during the Air Force reliability and maintainability evaluation.[41]

Numerous articles have been published on the C-17 and its capabilities. Articles that range from the marvels of the costs savings related to an improved manufacturing process at McDonnell Douglas, the 22 world records the C-17 set, and the applicability of the C-17 as a strategic and intra-theater airlifter. The 1998 Air Mobility Master Plan explains intratheater airlift as:

> *missions move passengers and cargo, but operations usually are conducted within or near a specific theater (as defined in the Unified Command Plan). These airlift missions provide a time-responsive airlift capability to a commander, which may be critically needed in fulfilling his operational objectives.*[42]

Desert Shield and Desert Storm used intra-theater airlift to support operations to relieve congestion on highways and deliver passengers and supplies to forward destinations. The magnitude of these operations are evident with the 1,400 C-130 missions that flew the 82nd and 101st Airborne divisions a distance of more than 500 miles. Additional intra-theater lift missions included the movement of key components and parts to keep patriot batteries operational, resupply of 11,000 replacements to VII and XVIII Corps, and containerized delivery system missions delivering 600 bundles of food and water to front-line soldiers and enemy prisoners of war.[43] The reason for C130 support of intra-theater airlift missions is assumed to be the lack of airfields supporting throughput of C-141 and C-5 aircraft from their port of embarkation and a desire not to risk those aircraft. The C-17 was not available during Desert Shield, but has the potential to land as C-130s did on MSR Dodge serving as a forward landing strip. The capability the C-130 lacks is the ability to move outsize cargo, a capability that probably would have been used in Desert Shield if it were available.

TRADOC Pam 525-200-2, Early Entry Lethality, and Survivability Battle Dynamic Concept, outlines the capabilities the Army requires to conduct early entry operations in support of U.S. force projection missions across the range of military operations. "Early entry forces must possess capabilities to deploy rapidly, enter the operational area, secure the lodgement and either immediately have decisive effect or create conditions for the arrival of substantial follow-on forces that then conduct decisive operations. Early entry forces must consist of

lethal and survivable units tailored to support or carry out the operational intent of the Joint Force Commander."[44] The C-17 provides the capability to airlift mechanized forces into an early entry operation with its capability to airland in austere environments similar to Bicycle Lake, 29 Palms and Barstow-Daggett, California. Mechanized forces are a new capability that can be added to forced entry packages. With the deletion of the Sheridan tank in the 82nd Airborne Division and the discontinuation of another airdrop system, such as the Armored Gun System, early entry forces are without a mechanized component. Traditionally, forced entry operations have included the 82nd Airborne Division, 101st Airborne Division (Air Assault) and Special Operations Forces. A concept in line with Force XXI Operations is the ability to tailor a ground component package of Light/Heavy Operations with the Division Ready Brigade deploying with a mechanized company to provide the mobility and firepower to support establishing a lodgement for follow-on forces. The C-17 provides this capability to airland outsized equipment and support these type of operations.

The linkage between two near simultaneous major theaters of war, intra-theater airlift and early entry operations is the C-17. Theater Commanders operating intra-theater airlift with C-17s now have the potential to conduct early entry operations in their theater, using intra-theater airlift to execute these missions or resupply these operations. The problem then becomes how do you support intra-theater airlift with C-17, when it has been established that to support strategic lift the C-17 is essential and necessary to execute the deployment and sustainment of forces. A solution is to increase the number of

C-17s in the inventory without directly placing the system in the Air Force. The original purchase concept in the Reagan Administration was for 210 C-17s, which was reduced to 40, and has only recently been increased to an expanded fleet of 120 C-17. If Congress were willing to fund sufficient aircraft to perform intra-theater air, this would have been accomplished. Next, this paper will propose four potential solutions of adding C-17 capability to the strategic lift assets without increasing the number of C-17s in the Air Force.

Courses of Action

The objective of these courses of action is to propose methods of adding C-17 to the strategic airlift fleet in order to free Air Force active component C-17s to support intra-theater lift that will improve the options of the combatant commander in meeting operational objectives. As addressed earlier, the C-17 is the only airlifter capable of moving outsized cargo into the type of environments that the DoD operates. Looking at the two near simultaneous major theaters of war, it is most likely given the strategic environment of today, that these theaters would be in Southwest Asia and Northeast Asia. This could shift in the future, but the requirement for intra-theater airlift is still needed. The Southwest Asian scenario has already used intra-theater airlift and C-17s would have expanded the operational courses of action for the combatant commander. The Northeast Asian theater of the 1950s could have used C-17s in modern times to facilitate MacAurthur's Inchon landing. However, given the airlift inventory of modern times and the near term, C-17 are required to fulfill the strategic airlift role and will not be available for intra-theater assets available to the combatant commander.

To make some of the courses of action viable, the C-17 must become appealing to the commercial sector. As stated before the C-17 has appeal to provide air cargo movements to new and expanding markets in the Pacific Rim, Africa, and parts of eastern Europe. The ability to move outsize cargo is a new market the commercial sector currently cannot service. The question of

profitability is then determined on the commercial sectors ability to support operational costs of the C-17 and the maintenance required to support the C-17. The Rand Study appears to make the C-17 too expensive for the commercial sector on the surface. "Substitution of a modified 747-400F for the C-17 to replace two -thirds of the C-141 fleet would lower costs considerably. For example based upon our estimates for key parameters, we found the 25 year cost (1993-2017) for a fleet of 747-400Fs would be $25 billion (1992 dollars) lower than the alternative fleet of 120 C-17s. Other estimates for these same key parameters suggest a more modest opportunity for lowering costs of about $7 billion (1992 dollars). This may underscore the sensitivity of costs and capability comparisons to a relatively small number of parameters, which of themselves worthy of more concentrated attention."[45] This appears to make the C-17 unattractive, but the costs are based on 120 C-17s and only 42 747-400Fs.[46] This is possible only because of the difference in payload capacities of the two aircraft. Additionally, life cycle costs were based on the costs of the 747 and the C-17 at the time of the report, since the C-17 production line has undergone numerous improvements and the cost for a C-17 is $173 to $183 million and the 747-400 is $158.5 to $176.5 million.[47] The question for the commercial sector is whether the costs per aircraft can produce a profit based on the new markets that opened to the airline with the acquisition of C-17s

A further examination of costs shows that the 747-400Fs are more fuel efficient by evaluating the amount of fuel required to move 1,000 tons of cargo daily. The 747 requires 6,000 tons of fuel while the C-17 requires 7,500 tons

daily.[48] The problem with this situation is the payload differences between the aircraft. The C-17 would fly 11.8 sorties at max payload of 169,000 pounds while the 747-400F would fly 8.0 sorties at a max payload of 249,122 pounds. The better evaluation is the fuel efficiency per sortie to compensate for the inequality of comparing an oversize cargo capable aircraft to an outsize cargo capable aircraft. According to Jane's, All The World's Aircraft, the 747 has a fuel efficiency of 12.27 gallons / nautical mile and the C-17 has a fuel efficiency of 10.83 gallons / nautical mile.[49]

On the surface, the costs for a sortie to include the purchase costs makes the C-17 competitive and the maintenance costs are also close. The C-17 is estimated to require .38 hour maintenance / flying hour. During the Gulf War the approximate maintenance times were .2 for the 747, .47 for the C-141 and 1.28 hour maintenance / flying hour for the C-5.[50] For a military aircraft the C-17 has outstanding performance and is exceeding contract standards for maintenance, reliability and utilization rates.[51] What is unknown is whether the maintenance standards for the Air Force equal commercial standards. It is possible the Air Force has stricter standards, but there is no mention in the Rand study about this issue. However, the C-17 still has merit based on its potential new markets for commercial industry. The airfields the C-17 can access (except China and the former Soviet Union and its allies) are 1,486 to 2,084 for the C-17 and 536 to 774 for the 747-400F. These ranges are based on the pessimistic to optimistic airfields worldwide, based on runway subgrade strengths and an aircraft weight of 65% of maximum take off weight.[52] A limiting factor for airfield access in the

Rand study, was a high load characteristic number (LCN) for the C-17, LCN 48 for 120,000 payload and fuel for 500 nautical miles travel after delivery. "The LCN reflects runway reaction and maximum stress levels. To avoid both catastrophic failure and premature wear-out, an empirical scheme was devised by the British during World War II and has since evolved to provide a systematic approach for calculating LCNs that reflect runway reactions and their maximum stresses when used by specific aircraft."[53] In an emergency, AMC intends to make maximum use of available runways, make repairs and move operations only as repairs become too difficult allowing C-17s to use runways with a LCN of 20.[54] What this accomplishes for access to airfields in South America, Africa and the Middle East is to identify 4,619 runways 3,000 foot long, 90 feet wide and a LCN of 20.[55] If commercial airlines accept the C-17 it can be assumed that many of these runways would be upgraded to allow greater trade and commerce between nations.

Four Potential Courses of Action

The courses of action (COA) are: One, to subsidize the procurement of C-17s for commercial airlines under current CRAF contracts; two, subsidize the procurement of C-17s for commercial airlines that are manned by Air Force reservists and transfer to military control during periods of CRAF activation; three, assist in developing the MD-17 and purchase a government owned

contractor operated fleet for the Air Force; four, develop a fleet of C-17s for the United States Postal Service that are CRAF Stage I participants.

COA 1 is to subsidize the purchase of C-17s for commercial airlines that will continue to support CRAF during the life cycle costs of the aircraft, estimated to be 25 years in the Rand study. The operating costs to include the infrastructure, maintenance, aircrews, and fuel. Within the current CRAF contracts commercial airlines would have to support all these aspects on both sides during times of CRAF activation. The C-17 would be spread throughout the CRAF stages I, II and III. The purpose for spreading the level of participation is to avoid the "softness" that is reflected in recent past and airlines participation in CRAF. As mentioned earlier, indications are commercial carriers are fearful of losing their market shares when aircraft are released from CRAF activation. This program will allow further expansion in the air cargo market and provide the equipment to support that market. Additionally, if the Air Force continues to outsource portions of its mission air carriers with C-17 would provide a new source of revenue by transporting outsize cargo. Typical missions that could allow the Air Force to outsource cargo missions could include humanitarian support mission as in Rwanda, peace enforcement missions as in Bosnia, and peace-keeping missions as in the Sinai. An example of the Air Force outsourcing of requirements, is the one year contract worth $160.5 million to McDonnell Douglas, to perform maintenance on the C-17.[56]

The amount of subsidy allowed to air carriers can range from 100% of costs to $16.5 million per aircraft. The $16.5 million is the difference between the high

end costs of the latest Air Force contract of 80 C-17s and median cost of a Boeing 747-400. The question for the DoD to address is whether the government wants a basis in the aircraft that could withstand a filing for bankruptcy. A 100% subsidy would provide a claim for a government owned contractor operated aircraft. Any amount less than 100% would provide an argument that the government offered an incentive to air carriers to expand into new markets, with the end result of providing a service to the government to reduce DoD expenditures for new aircraft.

COA 2 finds its basis in COA 1 with the same question as to what degree does the government choose to subsidize the purchase of C-17s. The distinct difference is how these aircraft are manned and managed by the Air Mobility Command during CRAF activation. The aircrews working for commercial carriers in COA 2 are Air Force reservists and must remain current to serve in the capacity of C-17 crew members. The maintenance for the C-17 on the destination end of CRAF activation missions would be provided for by the Air Force and the Air Force would contract with the air carriers to provide for C-17 maintenance in the continental United States to compensate for Air Force deployment of maintenance crews in the AOR. This serves two functions, first the maintenance and infrastructure to support C-17s at the destination end or AOR would be the burden of the Air Force and would relieve air carriers of associated costs to support these aircraft with personnel, equipment and repair parts. Second, the maintenance for C-17s in the United States is provided by air

carriers, continuing to provide employment for the air carriers maintenance personnel and supporting infrastructure with a source of revenue.

This COA would require an adjustment to CRAF contracts that encompasses most facets of the current contract. The aircraft, crews and operating costs are now the responsibility of the government during CRAF activation. The air carriers would still receive a stipend for their investment in the C-17 based on the number of CRAF missions and payload carried, but at a reduced rate from current standards. The next issue is to address what actions are taken when the aircraft is lost due to hostile fire or accidents consistent with the hazards associated with flying. A reasonable approach is to transfer a C-17 from the Air Force to the air carrier that is comparable in total flying hours and condition. An alternative solution is to replace the aircraft with a new C-17, or like-capability replacement and the government bears the burden of paying the depreciated costs based on the life cycle of 25 years. This should be an option the air carriers select.

COA 3 involves a new aircraft that is not even in production, the MD-17. The proposed aircraft is a commercial freighter version of the C-17. "The Boeing company has received an Organizational Designed Airworthiness Representative (OADR) delegation from the Federal Aviation Administration (FAA) to support its MD-17 Type Certification program." The purpose of the OADR is to certify the MD-17 with FAA certification, a requirement the Air Force does not need as a service in the Department of Defense.[57] The program manager, David Bowman, was officially named on 18 September, 1997 and he

has experience with the C-17. He was the deputy director for flight testing in 1992 and moved director of C-17 production engineering 1994. His most recent assignment was director of C-17 nacelle/engine affordability team.[58]

This COA is predicated on the purchase of a small fleet of MD-17 for the Air Force that would become government owned and contractor operated. The purpose of the government owned contractor operation is to keep the number of personnel in the active component within the established numbers allowed by Congress. The need for this aircraft in the Air Force is to extend the life of the currently contracted 120 C-17s and facilitate the C-17s use for intra-theater airlift missions. In the best interests of the Air Force, a team should be coordinated to work closely with Boeing, to facilitate the design features that will keep the MD-17 as a viable option for the Air Force and meet the specifications of the commercial sector. If the Air Force is allowed to play an active role in the development of the C-17, the future looks bright in fielding an aircraft that serves as an instrumental force of the CRAF air cargo program.

COA 4 is a departure from the trends in the aviation history since World War I. This COA would have Congress mandate to the United States Postal Service that it expand its service to include the transport of outsize cargo with C-17s. This would be a monumental act, considering the recent history of the United States Postal Service. The United States Postal Service was created as a result of the Postal Reorganization Act, because of the ineffectiveness of the Postmaster General, due to excess control measures placed upon him by Congress. After extensive hearings Congress submitted this act to create a

"self-supporting postal corporation wholly owned by the federal government." The control of this corporation was placed under a board of 11 governors, nine appointed by the president serving nine year terms, the Postmaster General who is selected by the nine presidential appointees and the Deputy Postmaster General selected by the other ten governors. As a result of reform, the United States Postal Service was self-sufficient prior to the 1983 deadline established in the Postal reorganization Act.[59] Current Congressional appropriations "recover the expense of revenue forgone on free and reduced-rate postage for certain types of mail mandated by Congress."[60]

The United States Postal Service has a history of managing their own fleet of aircraft in the early 1900's. The difficulty in executing this COA would be convincing the board of governors that the outsize cargo movements market could become self-supporting. Initially, Congress would have to appropriate the funds for the first fleet of C-17s and the DoD would supply the bulk of business until the market develops in the commercial sector.

The logistics to support these operations would be difficult and extensive. The aircrews would be Air Force reservists as in COA 2. The entire infrastructure to support the fleet would be the responsibility of the Postal Service. The role in CRAF, would become Stage I participation and the maintenance arrangement during times of activation would be identical to COA 2. This COA is costly, just like starting any new business and would require a large fleet. However, to keep the fleet to a minimum the market sought would be outsize cargo and the current package delivery service offered and supported

through commercial contracts would remain unchanged. The purpose of targeting the outsize cargo market is to prevent commercial airlines from complaining the government is trying to steal a share of their oversize cargo business.

Analysis

The purpose is to evaluate the ability of accomplishing our objectives. The objectives are to determine a COA that can be further developed to increase the number of C-17 capable aircraft to facilitate its use for intra-theater airlift. Another objective is to develop a COA that will encourage commercial airlines to participate in CRAF with outsize airlift capability. The critical assumption is that Congress will not simply fund the aircraft, personnel and life cycle operating costs to increase the C-17 inventory in the Air Force to meet intra-theater airlift requirements. The three criteria used to evaluate the four potential COAs are suitability, feasibility, and acceptability. These criteria are taught at the Army's Command and General Staff College, and are used for "evaluating strategy to ensure that national strategy is not in danger." These criteria are framed in establishing the appropriate answer to simplistic questions. Suitability is "will attainment of the objective accomplish the desired effect?" Feasibility is "can the action be accomplished by the means available?" Acceptability is "are the consequences of cost justified by the importance of the effect desired?"[61]

Although the amounts Congress would appropriate for any of these is questionable and the exact dollars required for each COA are not available, a subjective evaluation of each COA is used to derive a conclusion. Additional study is required to determine the extent that any of these potential solutions could be implemented. This paper has already shown the linkage from the National Security Strategy, the National Military Strategy, the Air Force Global

Engagement and the Army's Force XXI operations. The Common thread to all these are the lack of sufficient strategic airlift to support the two near simultaneous major theaters of war, thus aircraft are not available for intra-theater airlift.

When evaluating the four courses of action against the criteria of suitability, only COA1 is questionable is its ability to accomplish the desired effect. Assuming the subsidy entices commercial airlines to purchase C-17s, the aircrews become the critical link to success. Although the government has a legal basis to force the aircraft into service during activation, the civilian aircrews and their unions could refuse to enter into a war zone. A safe and secure environment is difficult to establish during modern times with the proliferation of weapons of mass destruction and the relative accuracy of threat ballistic missiles. It is true that the nuclear arsenals are being reduced, but the newest threat as a weapon of mass destruction is the threat of chemical and biological weapons. Rogue nations and terrorist organizations, operating as an asymmetrical threat attempting to prevent the arrival of US Forces at sea ports of debarkation and aerial ports of debarkation could employ these techniques to disrupt deployment operations. These are similar problems to those encountered during Desert Shield and Desert Storm addressed earlier. The rationale that allows COA2 and COA4 to satisfactorily answer the question of suitability, is the fact that the Air Force reservists that man the crews would be called to active duty and treated as any other serviceman in the theater of operation. COA 3, the MD-17 fleet in the Air Force that is government owned

and contractor operated, would require a clause requiring service during a time of conflict in hostile environment to be suitable. The clause requirements are not any different from the contracted government service employees that are considered mission essential or the contracted services under logistics capability (LOGCAP) that have operated in Somalia and Haiti.

Examining the criteria of feasibility, COA 3 and COA 4 have serious flaws. COA3 is totally reliant on an aircraft that is not completely developed, the MD-17. The MD-17 should come along much more quickly than the C-17 that began development during the Reagan Administration. However, there is still the difficulty of designing the MD-17 to meet commercial requirements and meet FAA standards, building a prototype and demonstrating performance standards. COA 4's feasibility is reliant on convincing the Board of Governors of the United States Postal Service that this is a long term viable options that will allow continued self-sufficiency from government support to remain inside the Postal Reform Act. If this was not successful, then COA 4 would literally require an act of Congress to establish the framework for implementation of the program. COA1 and COA2, are extremely feasible in that the aircraft that are currently in production and changes to the CRAF contracts that make these viable options are within the power of USTRANSCOM.

The criteria of acceptability needs an assessment on two levels. The first level relates to costs, and are they justified by the importance of the effect desired? The support for additional cargo airlift has been supported and according to the 1998 Air Mobility Master Plan, the fix is not projected until

FY2014. This projection is based on the fact that MRS BURU places the DoD in an environment of having to accept risk in meeting the National Security Strategy. This assessment does not account for the C-17s needed to meet the objective of having sufficient lift to support intra-theater needs. Without these capabilities, the options available to support Force XXI Operations and Army After Next are limited. Limitations that prevent fielding a capable force that can strike fast and deploy quickly causes an additional level of risk, potentially placing more soldiers in harms way and unnecessary loss of life. These reasons support the justification for all COAs, and examines the seriousness of the situation making the expenditure of funds acceptable.

The second level of assessment for acceptability, is the level of costs required to execute each COA. COA 1and COA 2 are the most cost effective. The difference in paying for military airlift and paying for CRAF during a time of crisis are comparable. According to the Rand study it is actually cheaper to employ all available military aircraft before paying for CRAF,[62] would support COA 2 as the best. Although these costs were not quantified, it would appear the additional cost associated with paying for the Air Force reservists drill time and potential retirements in COA 2 would offset each other causing COA 1 and COA 2 to be equal. Obviously this would also depend on the number of CRAF activations and the number of aircrews employed, an evaluation required with additional study. COA 4 and the United States Postal Service is by far the most costly of all options. The complete infrastructure, appropriate management, and administrative costs associated would require funding and could possibly make

this option as not acceptable. COA 3 is not capable of examination due to the developmental state of the MD-17.

Conclusion

The importance of additional airlift cannot be understated. The downsizing of forces in the DoD, and the current / future reliance on force projection operations emphasize this need for future airlift. The research paper for Air Force 2025 project still has a major role for the C-17 in the future and the C-17 has received laudatory comments in all aspects from production to performance. Finding a solution that is suitable, feasible and acceptable with an end state of sufficient airlift to support the two near simultaneous major theaters of war and C-17 availability to support intra-theater airlift is the objective.

Though it would be nice to find a free ride for the government to attain this lift without any expenditures, that solution does not present itself. The need for subsidies or incentives are necessary to stimulate a new commercial market for outsize airlift capability. The potential air cargo market does not indicate sufficient air cargo capability in the near future to support voluntary participation of CRAF based on projections of an increasing market for air cargo outpacing economic growth.[63] The fact that Boeing is in the developmental stage with the MD-17 adds merit to a claim there is a viable outsize cargo market or a need to increase the global reach of commercial airlift by increasing the number of available airfields that are accessible.

The support for subsidizing the commercial sector with monetary incentives can find a basis of support with the air power theorists Giulio Douhet. He stated

Civil aviation employs planes, train pilots and maintain them in active

service, and makes use of various aviation accessories—all means directly utilizable by the organs of national defense, provided they meet certain conditions—such as, for instance, that the planes be easily and rapidly convertible into warplanes. ... In the matter of training of personnel, the only conditions imposed upon civil aviation are that it must be ready for instant mobilization in case of war, and in time of peace must undergo a minimum of training to fit it for war service at the instant of mobilization. The fulfillment of these conditions should be directed and supervised by the aerial branch of national defense; and to this end subsidies should be granted to civil initiatives. And in this sense the subsidy may be considerable: If we calculate the cost of the military administration of training and maintaining a pilot, this cost is the maximum limit of the subsidy which the military may grant to civil initiatives for each pilot trained and maintained in operation. But the maximum limit is so high that the subsidy may be brought down to a much lower sum, thus effecting a great economy.[64]

The policy of offering subsidy is commonly referred to in America as "pork barrel politics". This should not be a concern in the prospects of this paper. It is truly cost saving measures to provide for a more economical means of defense of our nation. It is common practice in Europe. "...European countries' airlines evolved as government owned and financed national airlines. This practice has continued until today and has been a source of economic friction for the U.S. air carrier industry."[65]

The previous analysis favored COA 2 as indicated in the figure 2, below. This is a concept that Doughet would support. A majority of support for the peacetime training and maintenance is the burden of the commercial industry with an appropriate level of government subsidy. Additionally, the aircrews would maintain a limited amount of training during their Air Force Reserve training. This training would focus on soldier specific skills, aerial refueling, air drop missions and other necessary skills. The best quality of COA 2 for Douhet would be the total control of the C-17s during a time of CRAF activation.

	SUITABLE	FEASIBLE	ACCEPTABLE
COA 1	QUESTIONABLE	YES	YES
COA 2	YES	YES	YES
COA 3	YES	NO	INSUFFICIENT DATA
COA 4	YES	NO	NO

Figure 2: COA Comparison

DoD should support additional study to determine an effective method to assure wartime support with a commercial capable force of outsize cargo aircraft. Unless the MD-17 can come on line quickly, and within acceptable cost limits it doesn't warrant consideration in the near-term. However, its potential to phase into the mid-term and long-term as a government owned contractor operated fleet indicate active participation in the design standard requires DoD's immediate attention.

This issue is too critical to neglect and should be addressed to provide the basis for a force projection military. Force XXI operations should not be limited by our inability to provide adequate intra-theater airlift or an inability to surge deployment of mission essential heavy forces. CRAF has proven it has value for DoD, but it requires a safe secure environment that only rapid expansion of a lodgement can provide.

Endnotes

[1] The White House, *A National Security Strategy For A New Century*, (Washington, D.C., May 1997), pp. 12-13.

[2] Department of Defense, Joint Chiefs of Staff, *National Military Strategy 1995*, (Washington, D.C., 1995), p. 17

[3] Department of Defense, Joint Chiefs of Staff, *Joint Vision 2010*, (Washington, D.C., 1996), p. 1.

[4] Ibid., p. 20

[5] Ibid., p. 20

[6] Jackson, Paul and others, eds., *Jane's All the Worlds Aircraft*, (Frome and London: Butler and Tanner Limited, 1996), p. 661.

[7] United States Air Force Headquarters, *Global Engagement A Vision for the 21st Century Air Force*, (Washington, D.C.., HQ USAF, undated)[electronic on-line] available at http://www.xp.hq.mil/xpx/21/global.pdf, p. 9.

[8] Fellows, James A., and others, *Airlift 2025: The First with the Most*, (Maxwell AFB, Al, Air University, 1996), [electronic on-line], available at http://www.au.af.mil/au/2025/volume2/chap04/v2c4-1.htm, pp. 11-19.

[9] Ibid., p. 1

[10] *1998 Air Mobility Master Plan,* (Scott AFB,Ill.,AMC,24 October 1997)[electronic on-line] available at http://www.safb.af.mil:80/hqamc/pa/, pp. i, 5-2.

[11] Ibid., pp. 2-28, 2-29.

[12] Peters, Katherine McIntire, "It Flies!," *Government Executive* (June 1996), pp11-13.

[13] *1998 Air Mobility Master Plan,* p. 2-29.

[14] Ronald N. Priddy, *A History of The Civil Reserve Air Fleet In Operation Desert Shield, Desert Storm and Desert Sortie*, (Cambridge, Ma, Volpe National Transportation Systems Center, 1995 (?)), pp. 1-3

[15] Ibid., p. 6.

[16] Ibid., pp. 15, 16.

[17] Ibid., p. 16.

[18] David C. Walden, *The Near term Gap in U.S. Airlift Capability*, (Combined Arms Research Library, Kansas; Carlisle: U.S. Army War College, 1997), p. 11, ADA326949. LTC Walden cites Air Mobility Command, "Civil Reserve Air Fleet Capability Summary" (Scott Air Force Base: Headquarters Air Mobility Command, 1 January 1997).

[19] Lund, John, Ruth Berg and Corrine Replogle, *An Assessment of Strategic Airlift Operational Efficiency*, (Santa Monica, Ca; Rand Corporation, 1993), p. 11.

[20] Priddy, *A History of The Civil Reserve Air Fleet In Operation Desert Shield, Desert Storm and Desert Sortie*, p. 146.

[21] Ibid., pp. 148-153.

[22] Boeing, "World Air Cargo Forecast," (Seattle; Boeing Corporation, 1997) [electronic on-line], available at http://www.boeing.com/commercial/info/cargo.html#anchor105, p. 1

[23] Priddy, *A History of The Civil Reserve Air Fleet In Operation Desert Shield, Desert Storm and Desert Sortie*, p. 149.

[24] Anonymous, "Purchasing," *Cahners Magazine*, 6 November 1997, p93.

[25] Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 2 Analysis*, (Combined Arms Research Library, Kansas; Santa Monica, Ca; Rand Corporation, 1994), p. 53. ADA290958.

[26] Joint Transportation Corporate Information Management Center, "Defense Transportation System (DTS) Industry Visit Assessment Report" (Scott AFB, Il.: United States Transportation Command, 1997, photocopied), p. 97.

[27] *1998 Air Mobility Master Plan,* pp. 2-28, 2-29.

[28] Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 2 Analysis*, pp. 46,47.

[29] Ibid., p. 48.

[30] Director, Operations and Logistics, "Operations and Logistics Update," (Scott AFB, Il.: United States Transportation Command, 1998, photocopied), p.17.

[31] Combined Arms Center, *Conservative Heavy Division Objective*, (Ft. Leavenworth, KS: Combined Arms Center, 1997), [electronic on-line] available at Combined Arms Center common server R/common/fdd/force21/phase 3/divalts/consobj, pp. 24, 27

[32] Department of the Army, *FM 71-3 The Armor and Mechanized Infantry Brigade*, (Washington D.C.: Department of the Army, 1996, p. 4-27.

[33] Combined Arms Center, *Conservative Heavy Division Objective*, pp. 24, 27. Command and General Staff College, *ST101-3 Battle Book*, (Ft. Leavenworth, KS: Command and General Staff College, 1996), p. 2-10

[34] Combined Arms Center, *Conservative Heavy Division Objective*, p. 44. Command and General Staff College, *ST101-3 Battle Book*, p. 2-51

[35] Training and Doctrine Command (TRADOC), *TRADOC PAM 525-5 Force XXI Operations*, (Ft. Monroe, VA: TRADOC, 1994), pp. 3-3, 3-4.

[36] Maneuver Control System Project Manager Operational Tactical Distribution System (PM OPTADS), *MCS Prototype V12.01 Software Users Guide Draft*, 26 August 96, pp1-3 to 1-6.

[37] Training and Doctrine Command (TRADOC), *Land Combat in the 21st Century,* (Ft. Monroe, VA: TRADOC, 1996), pp9-11.

[38] Killebrew Robert, "The Army After Next: Defining Future Landpower Challenges," *Army Magazine,* February 1998, pp23

[39] Ibid., pp25-26

[40] United States Air Force, "C-17 Globemaster III Fact Sheet," (Maxwell AFB, AL.:USAF, 1995), [electronic on-line], available at http://www.af.mil/news/factsheets/c_17globemaster_III.html, pp 1-3.
United States Air Force, "C-5A/B Galaxy Fact Sheet," (Maxwell AFB, AL.:USAF, 1992), [electronic on-line], available at http://www.af.mil/news/factsheets/c_5_a_b_galaxy.html pp1-4
Boeing, "C-17 Globemaster III," (Seattle, WA: Boeing, 1997) [electronic on-line], available at http://boeing.com/defense-space/military/c17/c17.htm, pp1-2
Jackson, Paul and others, eds., *Jane's All the Worlds Aircraft*, pp 661-662.

[41] Grier, Peter, "The C-17 Makes its Point," *Air Force Magazine*, October 1995, pp38.

[42] *1998 Air Mobility Master Plan,* p. 2-8.

[43] Langenus, Peter C., "Moving an Army: Movement Control for Desert Storm," *Military Review*, September 1991, pp46-50.

[44] Training and Doctrine Command (TRADOC), *TRADOC PAM 525-200-2 Early Entry Lethality, and Survivability Battle Dynamic Concept,* (Ft. Monroe, VA,: TRADOC, 1994), ppi,ii.

[45] Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 1 Executive Summary*, (Combined Arms Research Library, Kansas; Santa Monica, CA,: Rand Corporation, 1995), p. 11. ADA290963.

[46] Ibid., p. 51

[47] Peters, Katherine McIntire, "It Flies!," *Government Executive* p. 17. Data for C-17.
Boeing, "Boeing Airplane Costs as of Febuary 4, 1998," (Seattle, WA,: Boeing, 1998), p. 1 Data for 747.

[48] Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 2 Analysis*, p. 132.

[49] Jackson, Paul and others, eds., *Jane's All the Worlds Aircraft*, pp 576,578,661,662. Calculations are based on a max fuel capacity of 53,985 US Gallons for 747 and 27,086 for C-17. Ranges are based on 249,122 lbs and 4400 nautical miles for 747 and 160,000 lbs and 2500 nautical miles for the C-17.

[50] Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 2 Analysis*, p. 93.

[51] Grier, Peter, "The C-17 Makes its Point," *Air Force Magazine*, p. 40.

[52] Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 1 Executive Summary*, p. 53.

[53] Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 2 Analysis*, pp. 152,161.

[54] Ibid., p. 172.

[55] Ibid., p. 177

[56] Wall Street Journal, "McDonnel Douglas Unit Gets$160.5 Million Award," December 22 1997, p. B4

[57] Boeing, "Receives FAA Certification," (Seattle, WA,: Boeing, 1997), [electronic on-line], available at http://boeing.com/news/releases/1997/news_release_970828n.html, p. 1

[58] Boeing, "Bowman Named MD-17 Program Manager," (Seattle, WA,: Boeing, 1997), [electronic on-line], available at http://boeing.com/news/releases/1997/news_release_970918n.html, p. 1

[59] United States Postal Service, "History of the United States Postal Service," (Washington, D.C.: USPS, 1997), [electronic on-line], available at http:/www.usps.gov/history/his3.htm#service, pp. 1-3.

[60] United States Postal Service, "Postal Service Saving American Taxpayers $6 Billion," (Washington, D.C.: USPS, 1997), [electronic on-line], available at http:/www.usps.com/news/press/98/98026new.htm, p. 1

[61] Davis, Ted, "Evaluating National Security Strategy and National Military Strategy," in *C510 Syllabus Strategic, Operational, and Joint Environments*, ed. US Army Command and General Staff College (Ft. Leavenworth, KS: US Army Command and General Staff College, AY 96/97), Davis, Ted, "Evaluating National Security Strategy and National Military Strategy," in *C510 Syllabus Strategic, Operational, and Joint Environments*, ed. US Army Command and General Staff College (Ft. Leavenworth, KS: US Army Command and General Staff College, AY 96/97),. p. 47.

[62] Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 2 Analysis*, p. 44.

[63] Boeing, "World Air Cargo Forecast," p. 1.

[64] Douhet, Giulio, *The Command of the Air*, trans. Dino Ferrari (Washington, D.C.: Office of Air Force History, 1983), p. 83

[65] Priddy, *A History of The Civil Reserve Air Fleet In Operation Desert Shield, Desert Storm and Desert Sortie*, pp2

BIBLIOGRAPHY

BOOKS

Douhet, Giulio. *The Command of the Air.* Translated by Dino Ferrari, Washington, D.C.: Office of Air Force History, 1983.

Jackson, Paul, Kenneth Munson, Lindsay Peacock and Dr. John W. R. Taylor, eds. *Jane's All the Worlds Aircraft.* Frome and London: Butler and Tanner Limited, 1996.

Magruder, Carter B. *Recurring Logistics problems As I Have Observed Them.* Washington D.C.: U.S. Government Printing Office, 1991.

Sullivan, Gordon R. and James M. Dubik. *Envisioning Future War.* Fort Leavenworth, KS: U.S. Army Command and General Staff College Press, 1995.

Sullivan, Gordon R. and Michael V. Harper. *Hope is not a Method.* New York: Random House, 1996.

GOVERNMENT PUBLICATIONS

Air Mobility Command, *1998 Air Mobility Master Plan,* (Scott AFB,Ill.,AMC,24 October 1997)[electronic on-line] available at http://www.safb.af.mil:80/hqamc/pa/.

Command and General Staff College. *ST101-3 Battle Book.* Ft. Leavenworth, KS: Command and General Staff College, 1996.

Department of the Army. *FM 71-3 The Armor and Mechanized Infantry Brigade.* Washington D.C.: Department of the Army, 1996.

Department of Defense. Joint Chiefs of Staff. *Joint Vision 2010.* Washington, D.C., 1996.

Maneuver Control System Project Manager Operational Tactical Distribution System (PM OPTADS), *MCS Prototype V12.01 Software Users Guide Draft*, 26 August 96.

Priddy, Ronald N. *A History of The Civil Reserve Air Fleet In Operation Desert Shield, Desert Storm and Desert Sortie.* Cambridge, Ma: Volpe National Transportation Systems Center, 1995 (?).

Training and Doctrine Command (TRADOC). *TRADOC PAM 525-200-2 Early Entry Lethality, and Survivability Battle Dynamic Concept.* Ft. Monroe, VA,: TRADOC, 1994.

Training and Doctrine Command (TRADOC). *Land Combat in the 21st Century.* Ft. Monroe, VA: TRADOC, 1996.

United States Air Force Headquarters, *Global Engagement A Vision for the 21st Century Air Force*, Washington: D.C.., HQ USAF, undated. electronic on-line. Available at http://www.xp.hq.mil/xpx/21/global.pdf.

The White House. *A National Security Strategy For A New Century.* Washington, D.C., May 1997.

ARTICLES

Anonymous. "Purchasing." *Cahners Magazine*, 6 November 1997, 93.

Boeing. "Boeing Airplane Costs as of February 4, 1998." Seattle, WA,: Boeing, 1998.

Boeing. "Bowman Named MD-17 Program Manager." Seattle, WA,: Boeing, 1997. Electronic on-line. Available at http://boeing.com/news/releases/1997/news_release_970918n.html,

Boeing, "C-17 Globemaster III." Seattle, WA: Boeing, 1997. Electronic on-line. Available at http://boeing.com/defense-space/military/c17/c17.htm.

Boeing. "Receives FAA Certification." Seattle, WA,: Boeing, 1997. Electronic on-line. Available at http://boeing.com/news/releases/1997/news_release_970828n.html,

Boeing. "World Air Cargo Forecast." Seattle; Boeing Corporation, 1997. Electronic on-line. Available at http://www.boeing.com/commercial/info/cargo.html#anchor105.

Davis, Ted. "Evaluating National Security Strategy and National Military Strategy." in *C510 Syllabus Strategic, Operational, and Joint Environments*, ed. US Army, Command and General Staff College 47. Ft. Leavenworth, KS: US Army Command and General Staff College, AY 96/97.

Grier, Peter. "The C-17 Makes its Point." *Air Force Magazine*. October 1995.

Killebrew Robert. "The Army After Next: Defining Future Landpower Challenges." *Army Magazine.* February 1998.

Langenus, Peter C. "Moving an Army: Movement Control for Desert Storm." *Military Review.* September 1991.

Peters, Katherine McIntire. "It Flies!," *Government Executive* (June 1996), pp11-13.

United States Air Force. *C-17 Globemaster III Fact Sheet.* Maxwell AFB, AL.:USAF, 1995. Electronic on-line. Available at http://www.af.mil/news/factsheets/c_17globemaster_III.html.

United States Air Force. *C-5A/B Galaxy Fact Sheet.* Maxwell AFB, AL.:USAF, 1992. Electronic on-line. Available at http://www.af.mil/news/factsheets/c_5_a_b_galaxy.html pp1-4

United States Postal Service. "History of the United States Postal Service." Washington, D.C.: USPS, 1997. Electronic on-line. Available at http:/www.usps.gov/history/his3.htm#service.

United States Postal Service. "Postal Service Saving American Taxpayers $6 Billion." Washington, D.C.: USPS, 1997. Electronic on-line. available at http:/www.usps.com/news/press/98/98026new.htm.

REPORTS, THESIS AND MONOGRAPHS

Combined Arms Center. *Conservative Heavy Division Objective.* Ft. Leavenworth, KS: Combined Arms Center, 1997. Electronic on-line. Available at Combined Arms Center common server R/common/fdd/force21/phase 3/divalts/consobj.

Congressional Budget Office. *Moving U.S. Forces: Options for Strategic Mobility. A CBO Study.* Combined Arms Research Library, Kansas; Washington, D.C., U.S. Congress, 1997.

Fellows, James A., Michael H. Harner, Jennifer L. Pickett and Michael F. Welch. *Airlift 2025: The First with the Most.* Maxwell AFB; Al, Air University, 1996. Electronic on-line. Available at http://www.au.af.mil/au/2025/volume2/chap04/v2c4-1.htm.

Director, Operations and Logistics. "Operations and Logistics Update." Scott AFB, Il.: United States Transportation Command, 1998. Photocopied.

Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann. *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 1 Executive Summary.* Combined Arms Research Library, Kansas; Santa Monica, CA,: Rand Corporation, 1995. Text fiche.

Gebman, Jean R., Lois J. Batchelder and Katherine M. Poehlmann. *Finding the Right Mix of Military and Civil Airlift, Issues and Implications Volume 2 Analysis.* Combined Arms Research Library, Kansas; Santa Monica, Ca; Rand Corporation, 1994. Text fiche.

Joint Transportation Corporate Information Management Center, "Defense Transportation System (DTS) Industry Visit Assessment Report." Scott AFB, Il.: United States Transportation Command, 1997, Photocopied.

Lund, John, Ruth Breg and Corrine Replogle. *An Assessment of Strategic Airlift Operational Efficiency.* Santa Monica, Ca; Rand Corporation, 1993.

Walden, David C., ed. *The Near term Gap in U.S. Airlift Capability*, Combined Arms Research Library, Kansas; Carlisle: U.S. Army War College, 1997. Text fiche.