



**STRATEGY  
RESEARCH  
PROJECT**

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Department of Defense or any of its agencies. This document may not be released for open publication until it has been cleared by the appropriate military service or government agency.

**STRATEGIC AIRLIFT: OUR ACHILLES' HEEL**

**BY**

**LIEUTENANT COLONEL JOHN C. BURNS**  
United States Army

**DISTRIBUTION STATEMENT A:**  
Approved for Public Release.  
Distribution is Unlimited.



USAWC CLASS OF 2001

U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050

20010622 059

USAWC STRATEGY RESEARCH PROJECT

**STRATEGIC AIRLIFT: OUR ACHILLES' HEEL**

by

LTC JOHN C. BURNS  
US Army

Prof Thomas W. Sweeney  
Project Advisor

The views expressed in this academic research paper are those of the author and do not necessarily reflect the official policy or position of the U.S. Government, the Department of Defense, or any of its agencies.

U.S. Army War College  
CARLISLE BARRACKS, PENNSYLVANIA 17013

**DISTRIBUTION STATEMENT A:**  
Approved for public release.  
Distribution is unlimited.



## ABSTRACT

AUTHOR: John C. Burns

TITLE: Strategic Airlift: Our Achilles' Heel

FORMAT: Strategy Research Project

DATE: 10 April 2001

PAGES: 35

CLASSIFICATION: Unclassified

Our nation's ability to project and sustain conventional military forces rapidly anywhere in the world is our most evident sign of national power. Today's National Military Strategy requires the ability to respond to nearly simultaneous major theater wars (MTWs) in Northeast Asia and Southwest Asia. Scenarios describing these potential wars have been analyzed since 1994 in both Commander-in-Chief (CINC) deliberate planning and service programmatic processes. The acknowledged shortage of strategic airlift remains the "Achilles' heel" of our nation's power projection capability and is a classic example of a strategy to resource mismatch. In essence, today we have a two MTW strategy supported by a one or less MTW airlift force. This paper examines the purpose, components, and capabilities of the National Airlift System. The examination of the most recent mobility requirements study will show that an airlift shortfall exists. The paper presents three airlift options to alleviate the current airlift shortfall. The analysis will show that additional C-17 procurement and partial upgrade to the C-5 fleet is the most cost-effective solution. Finally, in order to preserve our monopoly on airlift, the author argues for a new airlift policy for modernizing the airlift fleet based upon national requirements.



## TABLE OF CONTENTS

ABSTRACT .....	iii
LIST OF ILLUSTRATIONS.....	vii
<b>THE NATIONAL AIRLIFT SYSTEM .....</b>	<b>2</b>
THE PURPOSE OF THE NATIONAL AIRLIFT SYSTEM.....	2
COMPONENTS OF THE NATIONAL AIRLIFT SYSTEM.....	4
<b>Civilian Airlift.....</b>	<b>5</b>
<b>Military Airlift.....</b>	<b>6</b>
<b>STRATEGIC AIRLIFT REQUIREMENTS .....</b>	<b>7</b>
<b>ALTERNATIVES TO THE AIRLIFT SHORTFALL.....</b>	<b>9</b>
<b>IMPLICATIONS FOR ARMY TRANSFORMATION.....</b>	<b>16</b>
<b>NEED FOR A NATIONAL AIR MOBILITY POLICY .....</b>	<b>18</b>
ENDNOTES .....	21
BIBLIOGRAPHY.....	25



## LIST OF ILLUSTRATIONS

FIGURE 1. COST EFFECTIVENESS.....	13
FIGURE 2. ACQUISITION COST TO ACHIEVE 54.5 MTM/D.....	14
FIGURE 3. RERP COST RECOVERY 27 YEARS.....	15
FIGURE 4. MRS-05 PROGRAMMATIC SOLUTIONS.....	15



## STRATEGIC AIRLIFT: OUR ACHILLES' HEEL

Speed is the essence of war.

—Sun Tzu

Our nation's ability to project and sustain conventional military forces rapidly anywhere in the world is our most evident sign of national power. Strategic airlift is a key enabler of Air Force, Army and Marine Corps power projection operations. Given its critical role, airlift will remain a topic of intense debate during the upcoming Quadrennial Defense Review (QDR).

For many centuries, military commanders have understood the importance of rapidly mobilizing and deploying forces to the battlefield before the enemy gains the initiative. Beginning with the writings of Sun Tzu, military theorists have realized that an effective military force must possess the ability to move rapidly. Mobility is often referred to as the long pole in tent of national security: without it, combat forces remain in garrison and lose the initiative. The Sun Tzu quote is as relevant today as it ever has been. However, the changing nature of our national security strategy and the current readiness of our military have taken on a greater significance for our mobility forces, most notably our air mobility forces.

Today's National Military Strategy requires the ability to respond to nearly simultaneous major theater wars (MTWs) in Northeast Asia and Southwest Asia. Scenarios describing these potential wars have been analyzed since 1994 in both the Commander-In-Chief (CINC) deliberate planning and service programmatic processes. Today, the Air Force would be hard pressed to get everything where it needed to go. If both theater wars erupted at the same time, the Air Force Chief of Staff, General Mike Ryan, acknowledged the airlift fleet could not deliver the troops and equipment needed to halt the enemy's advance.<sup>1</sup> Because of the availability of strategic airlift, Air Force General Tony Robertson, CINC of U.S. Transportation Command (TRANSCOM) and Commander, Air Mobility Command (AMC), stated "his command could meet the mobility requirements for two major theater wars with medium to high risk."<sup>2</sup> The level of risk is not an indicator of whether the United States would lose a war, but whether it would be able to achieve important mobility objectives. The acknowledged shortage of strategic airlift remains the "Achilles' heel" of our nation's power projection capability and is a classic example of a strategy to resource mismatch. In essence, today we have a two MTW strategy supported by a one or less MTW airlift force.

It is no secret that the nation's strategic airlift fleet is inadequate for the stated national strategy. Airlift assets needed to respond to the two-theater war scenario will not be in place

until 2006.<sup>3</sup> The airlift shortfall is identified as one of the unfunded priorities of the Air Force.<sup>4</sup> The C-17 acquisition timeline, retirement of the C-141, and aircraft sustainment problems, primarily with the C-5 fleet, have forced the airlift fleet below the established operational readiness rate.<sup>5</sup> Additionally, the airlift fleet continues to have new requirements placed on it as the services jockey to become more relevant in the battle for limited resources.

In the past two years, the Air Force has reorganized as an "expeditionary force" and the Army has developed an urgent new goal of becoming lighter and more agile, shifting emphasis from heavy armored units, transportable mainly by sea, to lighter forces that can move by air. The Air Force and the Army are not the only customers for airlift, and other users like the Marine Corps have to receive priority when a crisis erupts. Airlift will likely to be called on more frequently in future contingencies as services try to be "more expeditionary" and get to the action faster.

Strategic planners must address such issues as: how much airlift is needed; is our strategic airlift capability sufficient to meet present and future CINC operational requirements; and is our required capability affordable? This paper will focus on the issue of airlift in four distinct areas. First, it will look at the purpose, components and capabilities of the National Airlift System. The examination of the most recent mobility requirements study will show that an airlift shortfall exists. Second, three airlift options are presented that provides the nation the ability to achieve the two MTW strategy. The paper also analyzes the potential options to alleviate the current airlift shortfall. Third, this paper will examine the issue of airlift and its implications for Army Transformation. Fourth, this paper will argue for a new national airlift policy.

## **THE NATIONAL AIRLIFT SYSTEM**

In order to gain a deeper appreciation for the airlift shortfall, one must first understand the elements that our nation uses to create its strategic air mobility – the National Airlift System. This section describes the purpose of this system and examines the national policy that guides its existence. Additionally, it examines the character and causes of the current airlift shortfall.

### **THE PURPOSE OF THE NATIONAL AIRLIFT SYSTEM**

The commercial air carrier industry will be relied upon to provide the airlift capability required beyond that available in the organic military airlift fleet. It is therefore the policy of the United States to recognize the interdependence of military and civilian airlift capabilities in meeting wartime airlift requirements, and to protect those national security interests contained within the commercial air carrier industry.<sup>6</sup>

The National Airlift System represents a unique partnership whose development spans more than six decades.<sup>7</sup> More importantly, it represents the desire of this nation to maintain a monopoly on airlift as part of our national policy. President Ronald Reagan's above statement highlights the interdependence of our national strategic airlift assets and points to a unique partnership absent from other military arms.<sup>8</sup> However, this partnership involves confrontation as well as cooperation, as numerous groups and individuals interact, all pursuing their own interests and goals. At the heart of the dispute is the need to balance economic efficiency with military effectiveness.

President Reagan's 1987 National Airlift Policy Statement captures the overriding purpose of the National Airlift System: "The national defense airlift objective is to ensure that military and civilian airlift resources will be able to meet defense mobilization and deployment requirements in support of U.S. defense and foreign policies."<sup>9</sup> Our airlift objective is relatively clear; however, it leaves a few questions unanswered. Should the National Airlift System prepare primarily for peacetime or wartime operations? Should the National Airlift System be organized for peak efficiency or maximum effectiveness? The 1987 National Airlift Policy attempted to maximize all of these variables by stating that the airlift system should be developed "efficiently and effectively to meet established requirements for airlift in both peacetime and in the event of crisis or war."<sup>10</sup> This policy guidance can become quite confusing in terms of force structure planning because the most effective wartime airlift force could quite possibly prove to be the most inefficient in peacetime and, quite possibly, in times of war.

When the National Airlift Policy statement was disseminated in 1987, the tension between wartime and peacetime requirements was clear since the Cold War environment stressed the airlift system's wartime role. Today, the tension between peace and war is more crucial. The post-Cold War environment is more fluid and challenges the U.S. with increased opportunities and demands to use aircraft in Military Operations Other Than War (MOOTW) situations. TRANSCOM and the Air Staff's planning efforts have shifted away from an almost exclusive emphasis on wartime requirements.

The issue of the civilian and military roles in the airlift system creates another policy concern. Since the end of World War II, proponents of the military and civilian components have clashed over who should move military passengers and cargo in times of peace. Military proponents claim that peacetime movement of cargo and passengers on organic military transports is a cost-effective by-product of the need to train and exercise the military's wartime airlift system.<sup>11</sup> Commercial proponents claim that this practice constituted unfair competition

and that airlines should carry most military cargo and passengers since they are more efficient than the military.<sup>12</sup> Current airlift policy attempts to reduce this tension by stating:

"During peacetime, Department of Defense regulations for passenger and/or cargo airlift augmentation shall be satisfied by the procurement of airlift from commercial air carriers participating in the Civil Reserve Air Fleet Program, to the extent that the Department of Defense determines that such airlift is suitable and responsive to the military requirement."<sup>13</sup>

Given the tensions over wartime and peacetime requirements and component roles, current airlift policy aims to develop a compromise airlift system. It is fine-tuned for neither war nor peace operations, but capable of supporting both. It appears the focus of current airlift policy is not to build a military and civilian airlift fleet that can meet a specific requirement, but to acquire the most generally capable airlift with funds available.<sup>14</sup> Based on fiscal realities, the ultimate goal of the National Airlift System is to provide the greatest possible reserve of wartime airlift capacity in any emergency. At the same time, the policy attempts to maintain an efficient and effective airlift capacity to fulfill Department of Defense (DOD) peacetime airlift requirements. Likewise, the policy must recognize that other non-DOD agencies, like the White House, Departments of Justice, State and Transportation, dozens of nongovernmental and private volunteer organizations, the United Nations, and many allies place significant peacetime requirements on our airlift system.

Bearing the responsibility of a world leader and sole superpower, the United States has committed significant resources around the world in support of our national security strategy. Our engagement strategy preserves the ability to influence world events. The United States has pledged to aid those in need. Whether responding to a natural disaster or for humanitarian assistance, the first to arrive and support these small-scale contingencies are airlift forces. Because of our monopoly on airlift, our nation is able to remain engaged despite the fact that we have reduced our forward-deployed forces and overseas presence by two-thirds since the height of the Cold War.

## COMPONENTS OF THE NATIONAL AIRLIFT SYSTEM

The National Airlift System consists of military and civilian components. The success of the airlift system depends on more than just the aircraft and crews. The National Airlift System depends on the proper management and operation of aerial ports, logistics and maintenance organizations. Likewise, Command, Control, Computers, and Communications (C4) systems and dedicated professionals make the system work. The following section will focus on the aircraft and crews that move the passengers and cargo.

## **Civilian Airlift**

The large number of civilian aircraft operated by U.S. civil air carriers represents a vital source of our total U.S. national airlift capability, both in peace and during war. The National Airlift System has two methods of tapping into this airlift reservoir: (1) the Civil Reserve Air Fleet (CRAF) and (2) civilian contract airlift.

The government and airline industry combined to establish the CRAF program in 1952 to provide a system for augmenting military aircraft with commercial aircraft in an emergency. Under this program, US civil carriers voluntarily enter into a contractual agreement requiring them to contribute some of their passenger or cargo aircraft in the event the military is unable to fulfill the airlift requirements of a contingency or wartime situation. In exchange for this commitment, CRAF participants receive priority access to a large portion of DOD's peacetime passenger and cargo airlift business. This concept, thus, creates a large potential airlift capability, and the only cost to the government is the compensation provided to the carriers as they carry out routine DOD contract airlift business. The CRAF program could potentially provide up to half the nation's strategic airlift capability, without requiring government purchase of aircraft, personnel expenditures, or flying and maintenance of civilian aircraft in peacetime.<sup>15</sup>

Based on the extent of augmentation required, activation of the CRAF is incremental, based on three stages. Stage I (Committed Airlift Expansion) is activated to support expanded peacetime military airlift requirements when AMC's military airlift capability cannot meet both the deployment and other airlift requirements simultaneously. It consists of 82 long-range international aircraft (e.g., Boeing 747, DC-10). Stage II (Defense Airlift Emergency) is activated to support a defense airlift emergency and consists of 273 aircraft. Stage III (National Emergency) is used to support a declared national mobilization and consists of 723 aircraft. All three stages can be enacted by CINC, U.S. Transportation Command, with approval of the Secretary of Defense. Activation of Stages I and II requires CRAF response time within 24 hours of assignment, whereas Stage III response time is 48 hours. Carriers are called up for a minimum of 30 days with a guaranteed per day payment based on the type of aircraft required. DOD gives carriers fifteen days notice before release from CRAF activation. Overall, the CRAF program provides the National Airlift System with a tremendous capability to augment the military airlift component.<sup>16</sup>

The other civilian component of the National Airlift System is civilian contract airlift. Most of DOD's passenger traffic and a significant portion of its cargo airlift requirements are fulfilled

by civil air carriers through contract operations. According to the AMC CRAF contracting office, civilian air carriers airlift an average of 30 percent of DOD's peacetime cargo requirements and 90 percent of its passenger requirements.<sup>17</sup> In order to be eligible to bid on a DOD contract airlift mission, a civil carrier must be a member of the CRAF and meet the minimum CRAF participation requirements. The allocation of the contract airlift is accomplished through a mathematical apportionment process. This process divides the contracts among the civil carriers based upon the amount and type of airlift each carrier makes available to the CRAF.

### **Military Airlift**

The military component of the National Airlift System employs aircraft and crews from the active Air Force, Air Force Reserve, and the Air National Guard. Military airlift provides national leaders with unique airlift capabilities that cannot be duplicated in civilian airlift assets. Military airlift assets have several desirable characteristics:

- Not all DOD cargo will fit in civilian aircraft. Few CRAF aircraft will carry oversized cargo and none will carry outsized cargo.<sup>18</sup> Military airlift is necessary to permit the movement of these types of cargo.
- Civilian air carriers will not always be able to lift passengers and/or cargo to the desired locations. Operations into hostile areas and to some "less prepared" airfields will likely remain the domain of military airlift.
- Military aircraft provides a greater ability to conduct classified operations.
- Military airlift provides the unique ability to conduct airborne operations.
- On short-notice, time-critical missions, military planners can easily redirect and reprogram enroute military aircraft or launch standby military crews often permitting a quicker response that could be obtained with civilian aircraft.

The military airlift component operates four types of strategic airlift aircraft – the C-5, C-141, C-17, and KC-10. All except the KC-10 were designed to conduct the unique missions that civilian carriers were either unable or unwilling to carry out. These military unique missions include airdrop, austere airfield operations, in-flight refueling, and special operations. With the exception of the KC-10, the strategic airlift fleet comes with military unique design features. These features include the following: T-tail to facilitate loading and airdrop; large cargo doors and ramps to accommodate over and outsized cargo; and high wings and unique landing gear configurations to permit operations at austere fields and improve ground maneuvering. Although these features make it possible for the C-5, C-141, and C-17 aircraft to conduct their unique missions, they cannot move passengers and smaller cargo as efficiently as civilian

aircraft. Therefore, it is uncommon to find these design features on aircraft operating in the profit motivated civil aviation environment. AMC's other strategic airlift, the KC-10, was purchased primarily for use in refueling operations, but it does possess a significant cargo capability. In order to gain a better appreciation for the status of our strategic airlift fleet, it is important to examine the factors that resulted in our airlift shortfall.

AMC planners hoped to retain the C-141 fleet until the 2010-2015 timeframe. Unfortunately, this option proved too expensive following Desert Storm and resulted in an earlier-than-planned C-141 retirement schedule. All active duty C-141s are now scheduled for retirement by 2003, and the reserve C-141s by 2006. The C-17 will replace the C-141 on nearly a one-for-two basis. In essence, AMC will replace 266 C-141s with only 135 C-17s. This acquisition strategy somewhat bolsters airlift capability due to the C-17's ability to carry outsized cargo and operate in and out of small austere locations. However, the conversion significantly reduces this nation's operational flexibility due to the dramatic reduction in the number of airframes available. Additionally, reductions in the original C-17 acquisition program from 210 to 120 aircraft resulted in slower-than planned addition of much needed C-17 airlift capability. C-17 production will be unable to compensate for the accelerated losses of C-141s.<sup>19</sup>

Our nation's unique ability to deploy personnel and equipment rapidly anywhere in the world is an essential enabler of our national security strategy of engagement. The United States relies heavily on both civilian and military components of the National Airlift System to meet our global security commitments. Yet, the national airlift policy remains riveted to a cold war paradigm of total mobilization for war. The United States is faced with a policy-strategy mismatch that it cannot afford to ignore. The next section of this paper will examine our strategic airlift requirements based on our most recent mobility requirements study.

## **STRATEGIC AIRLIFT REQUIREMENTS**

The deployment for Operation Desert Shield/Desert Storm ranks among the largest in history. From 7 August 1990 (C-day, commencement) to 10 March 1991 (R-day, beginning of redeployment), USTRANSCOM moved to the United States Central Command (USCENTCOM) area of responsibility - a distance of about 8,700 nautical miles - nearly 504,000 passengers, 3.6 million tons of dry cargo, and 6.1 million tons of petroleum products. This equates to the deployment and sustainment of two Army Corps, two Marine Corps expeditionary forces, and 28 tactical fighter squadrons.<sup>20</sup> However, Operation Desert Shield revealed that strategic deployment of US forces was too time-consuming and offered our adversaries a chance to achieve their military goals if they acted quickly.<sup>21</sup>

After Operation Desert Storm, the Congress directed DOD to determine strategic mobility requirements in response to the changing world environment and change in our National Military Strategy. The 1992 Mobility Requirements Study and the follow-on 1995 Mobility Requirements-Study Bottom-Up Review Update (MRS-BURU) correctly concluded that the military could only increase its deployment through an investment in sealift, airlift, equipment prepositioning, and deployment infrastructures. As a result, DOD decided to acquire 120 C-17 aircraft, twenty large medium-speed roll-on/roll-off ships (LMSRs), and to preposition ground equipment both ashore and afloat to allow for rapid transition to decisive operations.<sup>22</sup>

The halt phase requirements of the CINC theater campaign plan proved to be the most demanding on airlift and planners used this as the determinant for airlift capacity.<sup>23</sup> Additional sealift or prepositioning assets would not meet CINC operational timelines for the halt phase and were not an acceptable option to mitigate the risk. Mobility planners and analysts determined an airlift requirement of 49.7 million ton miles/day (MTM/D).<sup>24</sup> Planning models at the time of the study predicted a current airlift throughput capability of 47.6 MTM/D. This airlift requirement was to be supported by organic military aircraft (e.g., C-5, C-17 and C-141), as well as civilian passenger and cargo aircraft under the provisions of the CRAF. AMC has been unable to fulfill the 1992 requirement, and TRANSCOM analysts now claim that the current airlift fleet supplemented by CRAF Stage III (National Emergency) could only generate about 36.2 MTM/D resulting in a continued shortage in airlift resources to meet our two MTW strategy.<sup>25</sup> Additionally, a May 2000 study by the General Accounting Office estimates that AMC is short 29 percent of the needed military airlift capability primarily due to the retiring C-141 fleet, low mission capable rates for an aging C-5 aircraft, and an overall spare parts shortage.<sup>26</sup>

The National Military Strategy has continued to evolve since DOD conducted its last comprehensive mobility study in 1995. Although the ability to prosecute overlapping MTWs remains the cornerstone of US defense strategy, the past five years of experience has sharpened the focus on small-scale contingencies, peacetime presence and engagement missions, and threats from weapons of mass destruction.<sup>27</sup> All of these have serious implications for our national power projection capabilities. The Deputy Secretary of Defense, John Hamre, directed a reexamination of the strategic mobility system in 1998 because of the changing international environment and military force structure.<sup>28</sup> DOD chartered the Mobility Requirements Study -2005 (MRS-05). The MRS-05 study identified additional improvements were needed in our air mobility programs. The study determined that 1995 MRS-BURU requirement of 49.7 MTM/D is not adequate to meet the full range of missions. This is primarily due to newly identified intra-theater lift requirements and the full consideration of missions

additional to those directly supporting the two MTW scenarios.<sup>29</sup> Neither a detailed intra-theater analysis nor the additional missions were considered in previous mobility studies.

The airlift analysis considered a wide variety of missions. First, it reviewed the missions directly supporting the warfighting demands of two nearly simultaneous MTWs. From this assessment, the study identified a need for a minimum of 51.1 MTM/D of airlift capability. Second, the study observed that there are likely to be other demands on the airlift system during peak periods of operations early in major theater campaigns. Some of these other demands may be closely associated with the conduct of theater operations and thus were considered as additive requirements. Third, the study also evaluated a number of planning assumptions that could affect the availability of airlift in those critical peak periods. The missions and variations in assumptions examined in the study generated a range of airlift demands up to 67 MTM/D. Three missions were judged to warrant highest priority as additions to the 51.1 MTM/D capability needed for major theater warfighting demands. These high-priority missions - conducting special operations, deploying missile defense systems to friendly nations, and supporting other theater commanders not directly engaged in the theater campaigns - would yield a total airlift requirement of 54.5 MTM/D, when combined with the demands associated with the major theater wars.<sup>30</sup>

The Joint Chiefs of Staff unanimously agreed to the establishment of 54.5 MTM/D of airlift capability to support the National Military Strategy. This capability, however, still leaves the threat to our national military strategy at a moderate level of risk.<sup>31</sup> In order to establish an airlift objective within the range defined by the analysis and to develop a program to achieve that objective, DOD will have to consider the appropriate balance between capability and risk in light of overall defense priorities. It will also have to examine alternative means to provide the desired capability commercial sources or other short-term surge measures. Additionally, DOD will need to closely examine mobility programs in the context of refinements to the defense strategy to be made in the upcoming QDR.<sup>32</sup> The following section will analyze potential programmatic solutions and alternatives to the airlift shortfall.

## **ALTERNATIVES TO THE AIRLIFT SHORTFALL**

While our need for airlift is increasing, the age and condition of our current airlift fleet leaves many decision makers in a state of quandary. Strategic airlift is the most discussed subject by the regional CINCs and is among their top five priorities.<sup>33</sup> To alleviate the strategy to resource mismatch in our two MTW strategy, the most relevant alternatives available to

strategic planners to bridge the current airlift gap are to: enhance the CRAF program; upgrade the C-5 fleet; or procure additional C-17 aircraft.

The experiences of World War II, the Berlin Airlift, and the Korean War provided the motivation for the creation of CRAF.<sup>34</sup> During these operations, it became clear that the military's airlift resources were insufficient to meet all possible requirements. In the Korean War, it was necessary to support the movement of personnel and equipment into Korea, but first the military had to receive operational control of the commercial aircraft. However, there was no established process for doing so and significant delays resulted. Based on the executive order from President Truman in 1952, DOD and the airline industry developed a memorandum of agreement to initiate the CRAF program.<sup>35</sup> This presidential action represented the first time that our nation monopolized airlift as part of our national policy.

During the Cold War, our nation never activated the CRAF, and if it had been, the risk to commercial aircraft and their crews would have been limited.<sup>36</sup> Commercial carriers would have been able to fly safely into allied airfields, far from the enemy lines. During the Cold War period, the airline industry perceived the activation and the physical risk as low. Accordingly, CRAF incentives changed very little over the years. During the 1970s, DOD implemented a CRAF Enhancement Program that subsidized the modification of commercial wide-body aircraft for potential military use.<sup>37</sup> However, modified commercial aircraft were about eight percent heavier, and the airlines felt that the one-time compensation payment offered by DOD to offset the fuel cost of the increased weight was inadequate, particularly given increases in fuel prices. In addition, funding by Congress for the program was limited. In 1983, when the modification program first gained legislative approval, appropriations were \$7.5 million, less than half the cost of converting a single aircraft. Congressional leaders were also concerned about government liabilities and access to these planes in the event of a carrier bankruptcy. These fears were realized with the Pan American bankruptcy and the Air Force lost access to the largest number of modified aircraft. The Air Force discontinued the modification program in 1991, having failed to attract significant airline interest or support from Congress.<sup>38</sup>

CRAF's contribution was evident during Desert Shield/Desert Storm when the United States activated it for the first time. CRAF flew 20 percent of the strategic airlift missions in the Gulf War. It moved 62 percent of the passengers and 27 percent of the cargo during deployment and 84 percent of the passengers and 40 percent of the cargo during redeployment. The total cost of the CRAF contribution in Desert Shield/Desert Storm was \$1.3 billion.<sup>39</sup>

The Air Force has worked hard to fix the problems the Gulf War revealed about CRAF.<sup>40</sup> The CRAF program reached a major milestone during the Persian Gulf War because it exposed

some significant problems. CRAF's first activation showed problems with such basic issues as insurance. CRAF carriers were eligible for government-sponsored liability coverage to replace commercial policies that did not cover wartime situations. Additionally, it was also not clear whether some routes, such as short hops within the U.S. itself, were covered. The government could not entirely replace aircrew life insurance cancelled because of the Desert Storm call-up. In 1995 CRAF officials obtained U.S. government approval to close the gaps in its liability and aircrew insurance coverage.<sup>41</sup> The Pentagon authorized the use of defense business operating funds to pay for any large CRAF insurance loss.<sup>42</sup> Additionally, operational issues such as the lack of proper ground handling equipment, incompatible communications systems, and the lack of chemical protection gear were identified during the Gulf War.

Perhaps the biggest obstacle that Air Force officials continue to struggle with is how to develop alternative incentives to encourage airlines to make a real commitment to the program. The Air Force has worked extensively over the last five years for every opportunity they could to bolster the peacetime business for CRAF carriers. CRAF carriers now get preferential treatment when applying for non-defense government business as well. The Pentagon worked with the General Services Administration to link the government's civilian flying business to CRAF participation. This initiative has induced airlines to reenter the CRAF program.<sup>43</sup>

Given the current good health of the CRAF program, the question is why can CRAF not alleviate the current airlift shortfall? AMC studied this issue extensively during MRS-05 and identified five reasons why more CRAF assets will not work.<sup>44</sup> First, CRAF will not fly in a chemically contaminated theater of operations and probably radioactive or biologically contaminated areas as well. Second, CRAF cannot perform the Special Operations mission. Third, CRAF cannot deliver Patriot missiles and launchers required in the initial phase of the crisis. Fourth, many theater CINC support missions involve unique outsized and oversized cargo that CRAF is not able to carry based on aircraft configuration. CRAF aircraft are not suitable for austere or politically sensitive destinations that require specially trained aircrews. Fifth, CRAF assets tend to congest constrained airfields more than organic lift because of long ground times, materiel handling requirements, less ramp maneuverability and high fuel demands. Most importantly, planners cannot use the full CRAF capacity apportioned for most of the critical halt phase in MRS-05.<sup>45</sup>

Additional CRAF oversize/outsize capability could be realized by a proposal now called Commercial Application of Military Airlift Aircraft (CAMAA).<sup>46</sup> CAMAA is an innovative US Government and Boeing initiative to develop a commercial version of Boeing's C-17, the backbone of AMC's airlift fleet. The commercial variant is part of a unique plan to expand the

commercial outsize and oversize airlift market. Additionally, it would gain more wartime and contingency capabilities to deploy and sustain U.S. military forces. Under the plan, a commercial operator will initially get a certain percentage of guaranteed military airlift business plus up-front funding. In exchange, DOD would have guaranteed use of the cargo aircraft when needed (CRAF-like arrangement). This would significantly increase both the capability and flexibility for transporting oversize/outsize cargo normally unsuited for CRAF carriers. As MRS-05 revealed, the theater commander desperately needs this capability in the halt phase of the theater campaign plan.<sup>47</sup>

The poor reliability of the C-5 fleet appears to be the chief culprit behind the airlift shortfall.<sup>48</sup> C-5 mission capability (MC) rates for fiscal years 1997 through 2000 averaged 55 percent largely due to structural and engine problems. The C-5 aircraft fleet falls short of the 75 percent AMC wartime mission capable rate and results in an additional 3.5 MTM/D shortfall in airlift contribution to the two MTW scenarios. This shortfall is equivalent to 21 aircraft. During recent contingencies in the Southern Balkans, the C-5 fleet experienced less than a 50 percent on-time departure rate.<sup>49</sup>

The C-5 fleet consists of the "A" model and the "B" model. The "A" model entered service in 1969 and is found in Air National Guard and Air Force Reserve units. The "B" model was introduced in 1986 and is found only in Air Force active duty squadrons. The C-5 fleet has a history of low reliability and high operating and support costs. The Air Force developed the Capital Investment Plan (CIP) to improve reliability and cost. As part of that effort, the Air Force contracted Lockheed-Martin to validate the CIP and recommended steps for further improvement. Those recommendations, combined in the C-5 Reliability Enhancements and Re-Engining Program (RERP), are briefly as follows:<sup>50</sup>

- CIP - replace the high-pressure turbine in the GE-TF 39 engines (HT-90) and modernize the cockpit avionics through the Avionics Modernization program (AMP).
- System and structural modifications - fuel, hydraulic, environmental, electrical, flight controls, landing gear and repair or replacement of parts of the airframe and skin.
- Replacement of the 4000 lbs thrust TF-39 engines with CF6-80C2 power plants derated to approximately 50 lbs as well as new nacelles and pylons.

According to AMC officials, the cost of the C-5 RERP is \$50 million per aircraft. The Air Force believes the C-5 has 80 percent of its structural life left, and that it makes financial sense to invest in refurbishing the fleet with new engines and advanced avionics. They also believe

that our nation should never become dependent on one strategic airlift aircraft and that we need both the C-5 and the C-17. The Air Force developed an Operational Requirements Document for the C-5 RERP; however, the Joint Requirements Oversight Council (JROC) has not approved the document and probably will not until DOD completes the QDR.<sup>51</sup>

AMC conducted an Outsize and Oversize Analysis of Alternatives (AOA) to determine the most cost effective mix of upgraded C-5s and C-17s needed to meet the MRS-BURU outsize/oversize requirement of 27.1 MTM/D. AMC contracted the Institute of Defense Analysis (IDA) to develop reliability and cost estimates to support the AOA. IDA examined three levels of modernization: CIP (baseline); a partial upgrade comprising all proposed modifications except the engines; and the full RERP program. AMC included only the CIP and full RERP in the AOA. Based on the data provided in IDA's report, the incremental cost-effectiveness of partial upgrade, RERP and procurement of additional C-17s is comprised in Figure 1.<sup>52</sup>

### Cost-Effectiveness (AMC/IDA Assumptions)

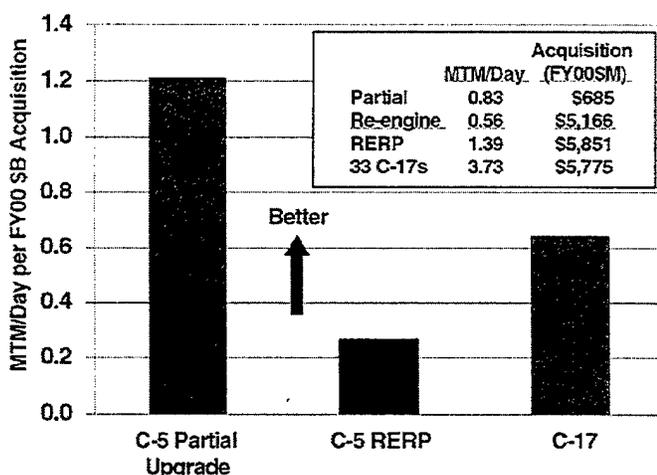


FIGURE 1. COST EFFECTIVENESS.

Figure 1 shows the gain in fleet MTM/D per billion dollars realized from the partial upgrade, the incremental impact of adding new engines and the corresponding gain from an equal C-17 addition. The partial upgrade yields the greatest gain in MTM/D per dollar spent. Buying additional C-17s adds more MTM/D at roughly twice the cost per ton-mile. Finally, MTM/D gained per dollar spent on the addition of new engines is quite small compared with other options. IDA estimates the partial upgrade would increase C-5 fleet average MC rate from

70.7 to 75.1 percent. AMC's target C-5 MC rate is 75 percent. Completion of the RERP was estimated to further increase MC rate to 78.4 percent.<sup>53</sup>

Even with these improvements, reaching the MRS-05 goal of 54.5 MTM/D requires the acquisition of additional C-17s.<sup>54</sup> Figure 2 compares the acquisition cost of the C-5 upgrade options plus the additional C-17s needed to attain that capability. If the RERP option is selected, 35 additional C-17s must be acquired at a total cost of nearly \$12 billion. If only the CIP is performed, 47 additional C-17s must be bought, but the total acquisition costs drops to about \$8 billion. Performing the partial upgrade reduces the number of additional C-17s to 40 and reduces the total cost to about \$7.6 billion. Based on acquisition cost, any option including new engines for the C-5 is not cost effective. The IDA report shows that the C-5 RERP reduces Life Cycle Costs. However, as shown in Figure 3, RERP will not pay for itself for about 27 years.

### **Acquisition Cost to Achieve 54.5 MTM/Day (AMC/IDA Assumptions)**

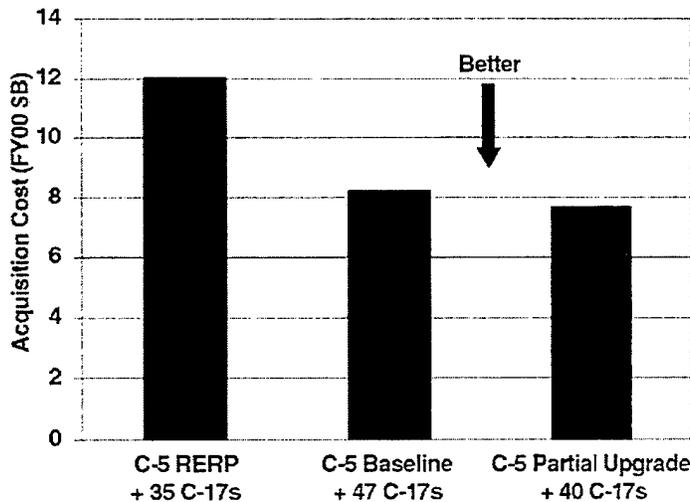


FIGURE 2. ACQUISITION COST TO ACHIEVE 54.5 MTM/D<sup>55</sup>

Figure 3 shows cumulative operations and support options and the time required for the savings to cover the cost of the modifications. The lower area shows savings from the partial upgrade, indicating the break-even point in 2021, 17 years from the start of the program. The upper line shows the combined cumulative savings of the full RERP. The upper area represents savings from the new engines themselves. Even though savings are dramatic, the cost of re-engining is so high (\$5.2B in FY00\$) that break-even will not occur until 2031, 27 years from program start. By 2031, the average age of the C-5As will be 60 years and for the newest Bs, 44 years.

## RERP Cost Recovery Requires 27 Years

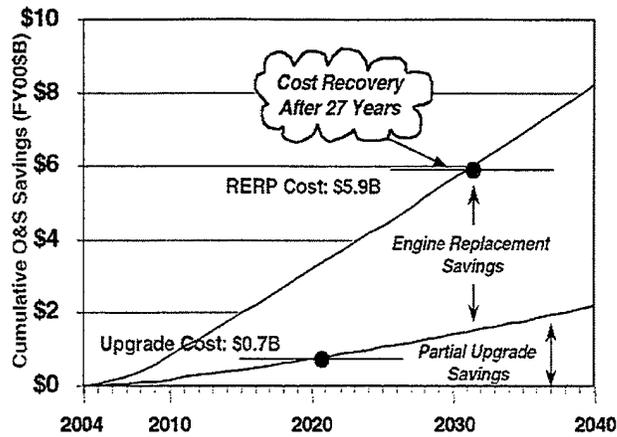
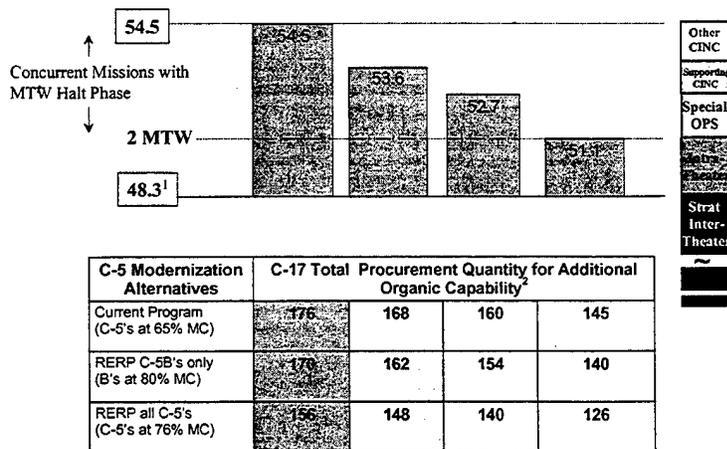


FIGURE 3. RERP COST RECOVERY 27 YEARS<sup>56</sup>

None of the C-5 modernization alternatives satisfies the 54.5 MTM/Day MRS-05 requirement. Other than marginally increasing availability, C-5 modernization does not solve AMC's stated shortage of airframes. The RERP option is least cost-effective in terms of added capability per acquisition dollar spent. Even though the RERP produces operational and support (O&S) cost savings, break-even will not occur until 27 years after program start. Given the history of fatigue and corrosion with the KC-135 and C-141 fleets, there is a high probability the C-5A fleet will not remain airworthy long enough to recoup the RERP costs.<sup>57</sup>



<sup>1</sup> 48.3 represents the 120 C-17 program assuming C-5 at 65% MC and a CRAF contribution of 20.5  
<sup>2</sup> Numbers are illustrative and may change based on actual post-RERP C-5 capabilities

FIGURE 4. MRS-05 PROGRAMMATIC SOLUTIONS.<sup>58</sup>

In summary, Figure 4 illustrates the options to meet the MRS-05 airlift goal of 54.5 MTM/D. The most cost-effective solution in terms of acquisition is to complete the partial upgrade of the C-5 fleet and procure 50 additional C-17s to meet the 54.5 MRS-05 requirement. If the Air Force insists on proceeding with RERP, then only the C-5B/C aircraft should be re-engined. Finally, the Air Force should make all efforts to develop an acquisition strategy for ten BC-17 aircraft as part of the CRAF program.

## **IMPLICATIONS FOR ARMY TRANSFORMATION**

A troubling mismatch exists between Army goals for Transformation and the Air Force's strategic airlift capabilities. General Eric Shinseki's plan to transform the Army seeks to build a deployable and responsive force that is relevant across the spectrum of operations. But do the services, especially the Air Force, have the capability to deploy brigades and divisions within mere days?

In order to achieve this strategic responsiveness, General Shinseki's new vision has established clear deployability goals: "We will develop the capability to put combat forces anywhere in the world 96 hours after liftoff - in brigade combat teams for both stability and support operations and for warfighting. We will build that capability into a momentum that generates a warfighting division on the ground in 120 hours and five divisions in 30 days."<sup>59</sup> Current deployment analysis indicates that only the brigade in 96 hours is achievable with current airlift assets.<sup>60</sup> Additionally, a recent report released by the Army concludes that CRAF will not be able to assist, as only nineteen percent of the Interim Brigade Combat Team vehicles are transportable in Boeing 747s.<sup>61</sup> Significant transformation is required for the Army's objective force to meet the Army Chief of Staff's deployment goals. More importantly, Army transformation programs must be closely linked with Air Force airlift modernization plans. Presently, that synergistic approach is woefully lacking.

The Army and the Air Force should not continue air mobility planning efforts without close coordination. If the Army plans to use air-deployable medium forces and routine nonlinear operations, the Air Force and AMC must consider how they equip, organize, and train the air mobility fleet. This need will become more heightened once theater commanders begin factoring interim brigades into war plans. Additionally, the next generation of our air mobility fleet must focus on concepts that emphasize efficiency.<sup>62</sup> Likewise, as the Army develops and refines the Objective Force concepts, it must review how they relate to the capabilities and limitations of the objective air mobility force. Single service transformation planning may be as 'passe' as single-service warfighting.<sup>63</sup> The general success of future service warfighting

concepts envisioned in Army Transformation will depend on the cooperation of service or functional components.

The Air Force has traditionally under funded air mobility programs. Even though the Air Force has stated a requirement to replace special operations C-141s with fifteen C-17s beyond the original program of 120, yet it has not put funds in the budget to accommodate them. In the Fiscal 2001 budget, the Air Force deleted three C-17s, postponing them for several years. As a result, Congress created the National Defense Airlift Fund to protect C-17 funding. The Air Force continues to prioritize high-profile programs like the F-22 and Joint Strike Fighter over air mobility platforms. Budget testimony by General Ryan in September 2000 clearly demonstrated that the Air Force is willing to sacrifice procurement of lift assets and other mobility programs in order to protect the fighter programs.<sup>64</sup>

Likewise, funds needed to address the airlift shortfall will compete directly with Army Transformation. General Shinseki estimates the Army will have only half of the roughly \$70 billion needed for this program over the next ten years.<sup>65</sup> The Army recently decided to go ahead with a full buy of the Comanche helicopter, even though the purchase is not compatible with transformation in the long run without significantly greater funding. The Army has its eye on an increase in funding and a larger share of the defense budget. Given the new administration's initial forecast for defense spending, the hope that the QDR can make this happen by validating the transformation concept seems very naive.

Finally, the apportionment of airlift needed to support General Shinseki's new deployment goals for Army Transformation mentioned above will compete with the Air Force's requirements for an Air Expeditionary Force. The Air Force currently consumes about 70 percent of the scarce airlift capacity in the first ten days of a crisis-response deployment.<sup>66</sup> Ultimately, it will not be the Army Chief of Staff who determines the airlift priority. The theater CINC will make that decision based on his warfighting concept of operations. It would behoove the Army to make a very strong case to the theater CINC for additional airlift funding.

In light of the current airlift shortfall presented in this paper, the author contends that a new national airlift policy that emphasizes the essential role of airlift in our national security strategy is desperately needed at this time. If we are to maintain our monopoly on airlift, our nation's civilian and military leaders must take appropriate action to protect this national resource. The following section will make recommendations for a new national air mobility policy.

## **NEED FOR A NATIONAL AIR MOBILITY POLICY**

A new and rational approach is needed for developing a national air mobility policy for the United States to address our strategic airlift shortfall. This policy must focus our national efforts on maintaining our monopoly on airlift. We must address the current critical situation of the aging strategic air mobility fleet in light of the new geopolitical order and the declining budget available for airlift forces. According to our national civilian and military leadership, our national security interests depend on our ability to project power rapidly. With the loss of strategic forward bases for U.S. forces, the ability to deploy those forces has become more important than ever. The capability of the current airlift force has become a limiting factor for the range of credible responses the U.S. can launch to crises.

The national airlift policy must address three key objectives. First and foremost, our nation requires a highly versatile airlift fleet without compromise of the following key characteristics: highest reliability the aerospace industry can produce; best maintainability available; highest throughput capability even in austere environments; and maximized flexibility through the range of possible airlift missions. The future airlift force needs to be adequate for the full spectrum of strategic airlift missions.

Second, the national air mobility policy must address the viability of the CRAF program by revising the working relationship with air carriers, proposing incentives that will increase CRAF participation, and removing those disincentives that impact carrier participation.<sup>67</sup> The motivating factor behind CRAF participation continues to be access to peacetime airlift business. Alternative contracting strategies have the potential for long-term contracts to increase CRAF participation. These long-term incentives could involve additional money to haul military cargo or provide subsidies for large transport aircraft purchases. Our national policy needs to encourage innovative initiatives like the Commercial Application of Military Airlift Aircraft in our CRAF program. A properly tailored CRAF Enhancement Program, implemented under a national air mobility policy, would help to ensure the National Airlift System is prepared to accomplish its mission in support of our national security interests.<sup>68</sup>

Third, we must build an airlift force that is operationally compatible with our allied and coalition partners. This will foster continued U.S. aerospace world leadership in a time of rapid globalization. The United Nations continues to look to the United States to provide strategic airlift in support of peacekeeping operations.<sup>69</sup> Given the United Nations' current strategic airlift limitations, this would allow the U.S. to provide airlift in future operations in lieu of contributing troops. This approach would also assist in reducing the military's personnel tempo challenge associated with ongoing peacekeeping operations.

In summary, our nation will decide the composition of the future airlift force for the next ten to fifteen years in the coming months. We must take advantage of airlift options available to address our strategy to resource mismatch in strategic airlift. Airlift is a key to our strategic mobility that gives us the ability to shape and respond. Historically, budget and political realities rather than operational needs have driven the choice of airlift aircraft. In order for the United States to retain a leading role globally, a sound policy for modernizing the airlift fleet, based upon **national requirements**, must be adopted. If the situation is not addressed, the lack of robust airlift fleet will limit the options of the National Command Authority to respond to future world crises.

WORD COUNT = 7316



## ENDNOTES

- <sup>1</sup> GEN Michael R. Ryan, Chief of Staff US Air Force, Congressional Testimony, 27 September 2000.
- <sup>2</sup> GEN Tony Robertson, CINC TRANSCOM and Commander, Air Mobility Command, Congressional Testimony, 26 October 1999.
- <sup>3</sup> Bryant Jordan, "U.S. Mobility Falls Short in Two-War Scenario," Defense News, 20 September 1999, p. 64.
- <sup>4</sup> Ryan.
- <sup>5</sup> General Accounting Office (GAO), Military Readiness: Air Transport Capability Falls Short of Requirements (Washington, D.C.: U.S. General Accounting Office, 22 June 2000), 1.
- <sup>6</sup> National Security Decision Directive (NSDD) 280, National Airlift Policy, 24 June 1987, 1.
- <sup>7</sup> Theodore J. Crackel, "Roots of the Civil Reserve Air Fleet," Air Power History 45, no. 4 (Winter 1998): 29.
- <sup>8</sup> Ronald N. Priddy, President, National Air Carriers Association, telephone interview by author, 26 February 2001.
- <sup>9</sup> NSDD 280, 1.
- <sup>10</sup> Ibid.
- <sup>11</sup> Robert C. Owen, "A Structural and Operational Future for Global Airlift," Comparative Strategy 12, no. 4 (October-December 1993): 461
- <sup>12</sup> Ibid.
- <sup>13</sup> NSDD 280, 2.
- <sup>14</sup> Robert C. Owen, "The Airlift System: A Primer," Airpower Journal 9, no.3 (Fall 1995): 21.
- <sup>15</sup> Ira Lewis, "The Civil Reserve Air Fleet: Balancing Risks with Incentives," Transportation Journal 38 (Winter 1998): 32 [database on-line]; available from UMI ProQuest Direct, Bell & Howell.
- <sup>16</sup> COL Bert Halbert, Chief of Civil Air Division, Air Mobility Command, telephone interview by author, 9 November 2000.
- <sup>17</sup> Ibid.
- <sup>18</sup> Oversize cargo is air cargo that exceeds the dimensions of bulk cargo (fits within the dimensions of a 463L pallet and the design height of 96 inches). Oversize cargo is equal to or less than 1,090 inches in length, 117 inches in width, and 105 inches in height. Outside cargo exceeds the dimensions of oversize cargo and requires the use of C-5 or C-17 aircraft.

<sup>19</sup> David Merrill, Senior Analyst for Studies and Analysis Flight, Air Mobility Command, telephone interview by author, 4 October 2000.

<sup>20</sup> James K. Matthews and Cora J. Holt, So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm, (Office of the Chairman of the Joint Chiefs of Staff and TRANSCOM, 1996).

<sup>21</sup> Joseph S. Nye, Jr. and Roger K. Smith, After the Storm: Lessons from the Gulf War, (Lanham, Maryland: Madison Books, 1992), 235-236.

<sup>22</sup> Department of Defense, Mobility Requirements Study, 1992 and Department of Defense, Mobility Requirements Study-Bottom Up Review Update, 1995.

<sup>23</sup> Merrill.

<sup>24</sup> Airlift planners have used the measure Million Ton Miles per Day (MTM/D) for some time to define airlift requirements. The formal definition in the Air Mobility Master Plan for 2000 is provided for your information. "Quantifying requirements and assessing capability is the first step in evaluating force structure. A simplistic method to measure airlift capability or requirements is million ton-miles per day (MTM/D). Using MTM/D allows for a quick comparison; however, recognizing its limitations is critical. MTM/D ignores the wide range of potential contingencies and the requirements for timing, unit integrity, system interactions, infrastructure constraints, and the differences between bulk, oversize and outsize cargo. The equation for MTM/D for one aircraft is: (Objective utilization rate) x (Blockspeed) x (Productivity Factor)/1,000,000 nautical miles"

<sup>25</sup> Merrill.

<sup>26</sup> GAO, 1.

<sup>27</sup> LTG Edward G. Anderson III, Joint Staff J-5, "National Military Strategy," lecture, Carlisle Barracks, PA, US Army War College, 29 September 2000, cited with permission of LTG Anderson.

<sup>28</sup> Department of Defense, Mobility Requirements Study - 05 (MRS-05), January 2001, 1.

<sup>29</sup> Merrill.

<sup>30</sup> MRS-05, 4.

<sup>31</sup> Ibid.

<sup>32</sup> Andrew Koch, "USA Identifies Mobility Needs," Jane's Defence Weekly, 24 January 2001.

<sup>33</sup> GEN Tony Robertson, "Challenges to the Air Mobility Command," speech given at the Defense Week 21st Annual Conference, Arlington, VA, 12 December 2000.

<sup>34</sup> Lewis.

<sup>35</sup> Ronald N. Priddy, "U.S. Civil Aviation's Contribution to Improved Air Mobility," in Air Mobility Symposium: 1947 to the Twenty-First Century, (Washington, D.C.: US Government Printing Office, 1998), 175.

<sup>36</sup> Lewis.

<sup>37</sup> William G. Palmby, Enhancement of the Civil Reserve Air Fleet: An Alternative for Bridging the Airlift Gap, thesis for the School of Advanced Airpower Studies, (Maxwell AFB, AL: Air University Press, March 1996), 18.

<sup>38</sup> Lewis.

<sup>39</sup> Chris Omdal, "Civil Reserve Air Fleet: Critical to Readiness," briefing slides with scripted commentary, Scott AFB, IL: Air Mobility Command, undated.

<sup>40</sup> Priddy, interview.

<sup>41</sup> Ibid.

<sup>42</sup> Peter Grier, "The Comeback of CRAF," Air Force 78, no.7 (July 1995): 52.

<sup>43</sup> Lewis.

<sup>44</sup> Merrill.

<sup>45</sup> Ibid.

<sup>46</sup> U.S. Air Force, "Request for Information: Commercial Application of Military Airlift Aircraft," 18 December 2000; available from <<http://www.pixs.wpafb.af.mil>>; Internet; accessed 20 December 2000.

<sup>47</sup> Merrill.

<sup>48</sup> Sandra I. Erwin, "Airlift Shortfalls Blamed on Aging Aircraft," National Defense, 85, no. 567 (February 2001): 15.

<sup>49</sup> John A. Tirpak, "A Clamour for Airlift," Air Force 83, no. 12 (December 2000): 28

<sup>50</sup> Merrill.

<sup>51</sup> Ibid.

<sup>52</sup> Institute for Defense Analysis (IDA), "IDA Independent Analysis of C-5 Modernization Study," March 2000.

<sup>53</sup> Ibid.

<sup>54</sup> MRS-05, 6.

<sup>55</sup> IDA Study.

<sup>56</sup> Ibid.

<sup>57</sup> Merrill.

<sup>58</sup> MRS-05, 5.

<sup>59</sup> Gen Eric K. Shinseki, The Army Vision: Soldiers on Point for the Nation...Persuasive in Peace, Invincible in War, Vision Statement released at Association of the United States Army Convention, October 1999.

<sup>60</sup> COL Samuel M. Cannon, "Perspectives of Force Projection Initiatives," lecture, Carlisle Barracks, PA, U.S. Army War College, 9 January 2001, cited with permission of COL Cannon.

<sup>61</sup> Lloyd Cato and Owen Spivey, "An Evaluation of the Impact of Deploying Future Military Forces by Civil Reserve Air Fleet (CRAF)," Military Traffic Management Command Transportation Engineering Agency (MTMCTEA), 18 August 2000.

<sup>62</sup> Sandra I. Erwin, "Airlift Shortfalls Blamed on Aging Aircraft," National Defense, 85, no. 567(February 2001): 15.

<sup>63</sup> Robert C. Owen and Todd A. Angle, "Air Mobility Command and the Objective Force: A Case for Cooperative Revolution," Military Review 81, no.1 (January/February 2001): 18.

<sup>64</sup> Ryan.

<sup>65</sup> John Kreul, "Son of QDR: Prospects for the Army," 15 July 2000; available from <<http://www.ansa/ilw>>; Internet; accessed 15 February 2001.

<sup>66</sup> Ibid.

<sup>67</sup> Priddy, interview.

<sup>68</sup> Palmby, 40.

<sup>69</sup> Maj Gen Tim R. Ford, "United Nations Peacekeeping Operations," briefing, New York, NY, United Nations Headquarters, 14 October 2000.

## BIBLIOGRAPHY

- Anderson, Edward G. III, LTG. "National Military Strategy." Lecture. Carlisle Barracks, PA, US Army War College, 29 September 2000. Cited with permission of LTG Anderson.
- Air Mobility Command. Air Mobility Strategic Plan 2000. October 1999; available from <<https://amc.scott.af.mil/xp/xpx/STRATPLAN2000FOUO/stratpln.htm>>. Internet. Accessed 4 October 2000.
- Association of the United States Army. Strategic Responsiveness: New Paradigm for a Transformed Army. October 2000. Available from <<http://www.ausa.org/landwar/item/defense003.htm>>. Internet. Accessed 7 March 2001.
- Bence, Christopher J. Bedding Down with C-O-T-S: Leveraging Commercial Industry to Solve the Strategic Airlift Shortfall. Thesis for the School of Advanced Airpower Studies. Maxwell AFB, AL: Air University Press, November 1996.
- Cannon, Samuel M. "Perspectives of Force Projection Initiatives." Lecture. Carlisle Barracks, PA, U.S. Army War College, 9 January 2001. Cited with permission of COL Cannon.
- Cato, Lloyd and Owen Spivey. "An Evaluation of the Impact of Deploying Future Military Forces by Civil Reserve Air Fleet (CRAF)." Military Traffic Management Command Transportation Engineering Agency (MTMCTEA), 18 August 2000.
- Crackel, Theodore J. "Roots of the Civil Reserve Air Fleet". Air Power History 45, no.4 (Winter 1998): 26-43.
- Department of Defense, Mobility Requirements Study, 1992.
- \_\_\_\_\_, Mobility Requirements Study-Bottom Up Review Update, 1995.
- \_\_\_\_\_, Mobility Requirements Study-2005, January, 2001.
- Dine, Philip. "Commercial Version of Boeing C-17 is Planned," St. Louis Post-Dispatch, 20 December 2000, sec.C, p. 13.
- Erwin, Sandra I. "Airlift Shortfalls Blamed on Aging Aircraft." National Defense, 85, no. 567 (February 2001): 15.
- \_\_\_\_\_. "Next Generation Air-Mobility Concepts Focus on Efficiency." National Defense, 85, no. 567 (February 2001): 16-17.
- Ford, Tim R. "United Nations Peacekeeping Operations." Briefing. New York, NY, United Nations Headquarters, 14 October 2000.
- Gebman, Jane R., Lois J. Batchelor, and Katherine M. Poehlman. Finding the Right Mix of Military Civil Aircraft: Issues and Implications. Santa Monica, CA: Rand Corporation, 1994.
- Grier, Peter. "The Comeback of CRAF." Air Force 78, no.7 (July 1995): 50-53.

- Halbert, Bert, COL USAF, Chief of Civil Air Division, Air Mobility Command. Telephone interview by author, 9 November 2000.
- Hanigan, Ian. "Selling the C-17: Boeing tests interest in civilian cargo jet," Long Beach Press Telegram, 2 February 2001, sec.A, pp. 1,12 and 15.
- Institute for Defense Analysis. "IDA Independent Analysis of C-5 Modernization Study," March 2000.
- Jordan, Bryant. "Overloaded: Can the Airlift Fleet Handle Two Wars at Once? By All Forecasts, No." Air Force Times, August 30, 1999.
- \_\_\_\_\_. "U.S. Mobility Falls Short in Two-War Scenario." Defense News, 20 September, 1999.
- Koch, Andrew. "USA Identifies Mobility Needs." Jane's Defence Weekly, 24 January 2001.
- Kross, Walter. "Strategic Mobility", speech given at the Airlift and Tanker Association Convention, Orlando, FL, October 24, 1998.
- Kruel, John. "Son of QDR: Prospects for the Army." 15 July 2000. Available from <<http://www.ausa/ilw>>. Internet. Accessed 5 February 2001.
- Lewis, Ira. "The Civil Reserve Air Fleet: Balancing risks and incentives". Transportation Journal 38 (Winter 1998): 32-39. Database on-line. Available from UMI ProQuest Direct, Bell & Howell.
- Matthews, James K. and Cora J. Holt. So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm. Office of the Chairman of the Joint Chiefs of Staff and TRANSCOM, 1996.
- Merrill, David, Studies and Analysis Flight, Air Mobility Command. Telephone interview by author, 4 October 2000.
- National Security Decision Directive Number 280, National Airlift Policy, 24 June 1987.
- Nye, Joseph S. Jr. and Roger K. Smith. After the Storm: Lessons from the Gulf War. Lanham, Maryland: Madison Books, 1992.
- Owen, Robert C. and Todd A. Angle. "Air Mobility Command and the Objective Force: A Case for Cooperative Revolution." Military Review 81, no.1 (January/February 2001): 11-19.
- Owen, Robert C. "The Airlift System: A Primer." Airpower Journal 9, no.3 (Fall 1995):16-29.
- \_\_\_\_\_. "A Structural and Operational Future for Global Airlift." Comparative Strategy 12, no. 4 (October-December 1993): 459-470.
- Omdal, Chris. "Civil Reserve Air Fleet: Critical to Readiness." Briefing slides with scripted commentary. Scott AFB, IL: Air Mobility Command.
- Pae, Peter. "Boeing Renews Push for Commercial C-17 Variant," Los Angeles Times, 31 January 2001, sec. C1.

Palmby, William G. Enhancement of the Civil Reserve Air Fleet: An Alternative for Bridging the Airlift Gap. Thesis for the School of Advanced Airpower Studies. Maxwell AFB, AL: Air University Press, March 1996.

Page, Daniel H. Military Transport Aircraft Division, Boeing Aerospace. Telephone interview by author, 4 October 2000 and 9 February 2001.

Priddy, Ronald N. "U.S. Civil Aviation's Contribution to Improved Air Mobility." In Air Mobility Symposium: 1947 to the Twenty-First Century, 171-193. Washington, D.C.: US Government Printing Office, 1998.

\_\_\_\_\_. President, National Air Carriers Association. Telephone interview by author, 26 February 2001.

Robertson, Tony. CINC USTRANSCOM and Commander, Air Mobility Command, Congressional Testimony, 26 October 1999.

\_\_\_\_\_. Speech given at the Airlift and Tanker Association Convention, Anaheim, CA, FL, November 4, 2000. Available from <[http://public.scott.af.mil/hqamc/speeches/ata\\_00.htm](http://public.scott.af.mil/hqamc/speeches/ata_00.htm)>. Internet. Accessed 15 February 2001.

\_\_\_\_\_. "Challenges to the Air Mobility Command," speech given at Defense Week 21st Annual Conference, Arlington VA, 12 December 2000.

Ryan, Michael E. Chief of Staff US Air Force, Congressional Testimony, September 2000.

Shinseki, Eric K. The Army Vision: Soldiers on Point for the Nation...Persuasive in Peace, Invincible in War, Vision Statement released at Association of the United States Army Convention, October 1999.

Shrader, Charles R. "A New Century of Power Projection Begins." December 1999. Available from <<http://www.ausa.ilw>>. Internet. Accessed 15 February 2001.

"Strategic Responsiveness: New Paradigm for a Transformed Army." Available from <[http://www.ausa.org/landwar/item/defense\\_003.htm](http://www.ausa.org/landwar/item/defense_003.htm)>. Internet. Accessed 7 March 2001.

Tirpak, John A. "A Clamour for Airlift." Air Force 83, no. 12 (December 2000): 24-30.

U.S. Air Force. "Request for Information: Commercial Application of Military Airlift Aircraft," 18 December 2000. Available from <<http://www.pixs.wpafb.af.mil>>. Internet. Accessed 20 December 2000.

U.S. General Accounting Office. Military Readiness: Air Transport Falls Short of Requirements. Washington, D.C.: U.S. General Accounting Office, June 2000.

US TRANSCOM Handbook 24-2, Understanding the Defense Transportation System, 1998, 2nd ed.

Wolfe, Frank. "Zinni: Strategic Mobility Centcom's Greatest Need," Defense Daily, 1 March 2000. Database on-line. Available from UMI ProQuest Direct, Bell & Howell.