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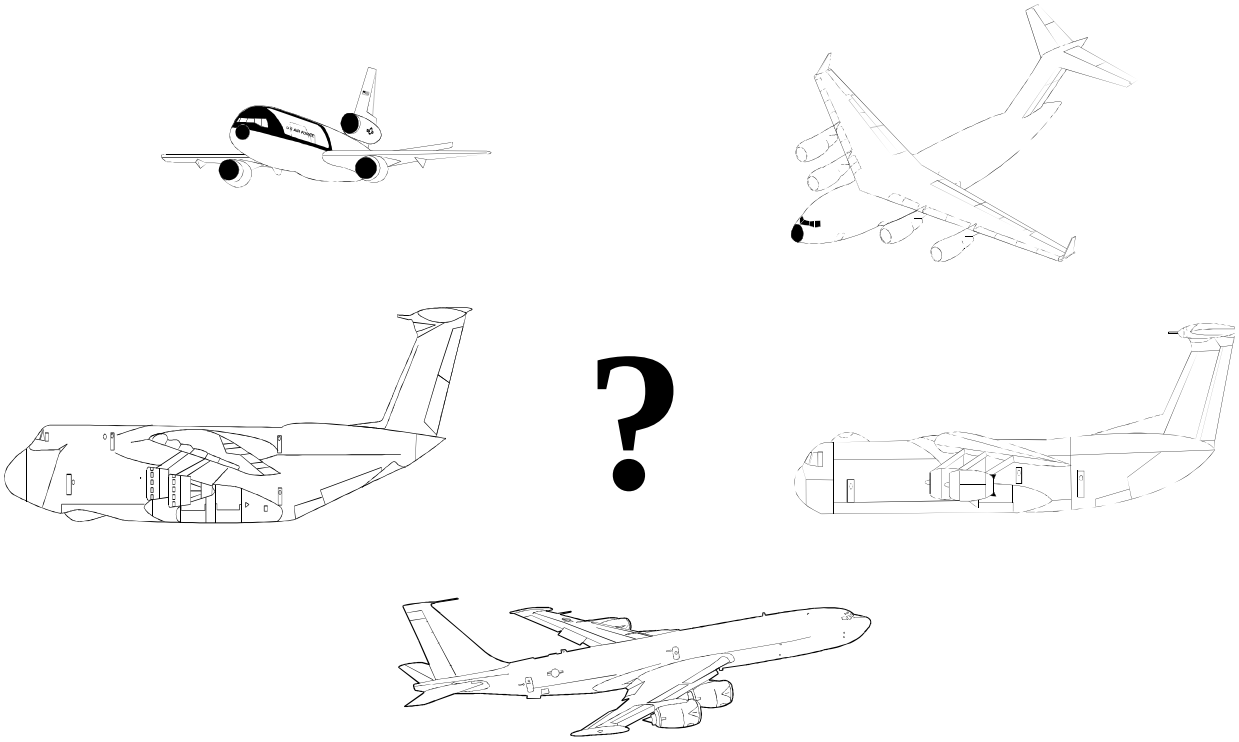

Bedding Down with C-O-T-S:
Leveraging Commercial Industry to Solve the Strategic Airlift Shortfall

By

Christopher J. Bence
Major, USAF

A Thesis presented to the Faculty of the School of Advanced Airpower Studies for completion of graduation requirements.

18 May 99

Disclaimer

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, The United States Air Force, or Air University.

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Major Christopher J. graduated from Washington State University, in 1986, with a Bachelors of Science in Electrical Engineering, and later earned a Masters Degree in Engineering Management. He was commissioned as a Distinguished Graduate from the Air Force Reserve Officer Training Corps in May 1986. Upon completion of his bachelor's degree, Major Bence attended Undergraduate Pilot Training at Vance AFB, Oklahoma, graduating in 1987, and selected to fly the KC-135. He was the outstanding academic performer in his KC-135 initial qualification training at Castle AFB, CA and was then assigned to the 92nd Air Refueling Squadron, Fairchild AFB, Washington. After upgrading to Aircraft Commander in 1991, Major Bence was handpicked by General Lee Butler, CINCSAC, to command Strategic Air Command's elite Command Crew at Offutt AFB, Nebraska. He planned, coordinated, and executed 159 worldwide travel itineraries with state department officials, foreign government officials, and United States embassies. His aerial refueling expertise was sought to conduct test refueling of the B-2 prototype aircraft at Edwards AFB, California. Major Bence was next assigned as a Flight Commander in the 306th Air Refueling Squadron, Altus AFB, Oklahoma. A recognized KC-135 expert, he became a Combat Crew Training School Instructor. Major Bence was instrumental in the standup of the 55th Air Refueling Squadron and the unprecedented move of the KC-135 "school house" from Castle AFB to Altus AFB.

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Abstract

The United States has emerged as the sole superpower. Recognizing the dramatic change in the international environment, the U.S. has adopted a national security strategy of engagement. As such, the U.S. relies on the civilian and military strategic airlift assets of the National Airlift Fleet to influence world events. However, due to changed force structures, cut-backs, and dwindling resources, the U.S. does not possess enough airlift assets to accomplish national goals and objectives. Hence, this paper asks, "In order to meet current and future airlift requirements of the United States, does the Air Force need to procure and field a commercial off-the-shelf (COTS) cargo aircraft?"

The post Cold War strategic environment and the National Security Strategy of engagement dramatically increased the nation's commitments around the world, thus requiring reevaluation of the National Airlift Policy. The United States military currently does not posses the strategic airlift capability required by the Unified Command Plans. The procurement of 120 C-17s to replace 266 rapidly aging C-141s adds increased capability, due to the C-17's ability to carry outsized cargo and operate in and out of small austere locations, but at reduced flexibility due to the reduced number of airframes available to the National Command Authority. Furthermore, the proliferation of weapons of mass destruction dramatically increases the likelihood operating in "hostile" environments, thereby, eliminating the civil reserve airfleet's contribution to strategic airlift. However, commercial airlift aircraft, built for efficiency, represent a fiscally responsible complement to the military's airlift fleet. Therefore, in order to meet current and future force requirements, especially with a continental based force structure, the

United States needs to supplement its strategic airlift fleet with a commercial off-the-shelf airlift aircraft.

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Chapter 1

Introduction

> *At the onset of war, time is the supreme factor. Do not let us forget that the aggressor is also concerned with the time factor; he is ready, otherwise he would not have provoked armed conflict; he inevitably hopes and plans for a quick decision, since no one would wish for a long war if it could be avoided; moreover he wants a decision before his opponent has had time to "turn his capacity into the new activities which war calls for."*
>
> Lord Arthur William Tedder, Air Marshal, Royal Air Force

As the deputy supreme commander of Allied Forces in Europe during World War II, Air Marshal Tedder recognized the fundamental need for mobility—the ability rapidly and decisively to react to an adversary's actions. What was applicable over 50 years ago is even more relevant today. The United States possesses the world's most formidable military. Moreover, no other nation, or group of nations, has the technology and equipment to employ decisive combat power like the United States. This capability is, however, useless if the United States lacks the ability to project it when and where needed—in other words, lacks strategic mobility. In fact, civilian and military experts believe that it is the ability of the United States to deploy forces and equipment rapidly around the world that enables it to remain a superpower.[1] Strategic mobility is comprised of the system of personnel, facilities, and equipment necessary for moving military forces and their associated equipment anywhere in the world. Strategic mobility can be broken into two components—strategic sea lift and airlift.

The focus of this paper is the airlift portion of strategic lift. Faced with dwindling resources and increasing world commitments, the United States Air Force must find

[1] Congress of the United States, A Congressional Budget Office (CBO) Study, *Moving U.S. Forces: Options for Strategic Mobility*, (Washington D.C.: February 1997), 1.

efficient but effective ways to bolster strategic airlift. Composed of commercial carriers and organic military assets, the national airlift fleet currently lacks the capacity to support two nearly simultaneous conflicts. Moreover, the United States' strategy of engagement, spreading assets worldwide, has placed enormous burden upon national airlift resources. Furthermore, in the post-Cold War environment, the United States faces asymmetric security threats from rogue states and transnational aggressors.[2] These threats place greater responsibility on military airlift assets since access can effectively be denied to civilian carriers. Put simply, the Air Force needs more airlift planes. But, military aircraft are expensive to develop and manufacture. One way to save resources and achieve economies of scale, is by leveraging commercial industry. Such practice begs the question, should the Air Force procure and organically operate a commercial-off-the-shelf (COTS) cargo aircraft?

Background and Significance

> *We have learned and must not forget that from now on air transport is an essential element of airpower, in fact, of all national power. We must have an air transport organization in being capable of tremendous expansion.*
>
> General H. H. "Hap" Arnold

Since the founding of our great nation, the United States has held close a set of fundamental goals and objectives that ensure the stability and prosperity of the nation. First and foremost is the protection of the United States and its political and domestic values, interests, institutions, and territories. Next, is the protection of American citizens and their property, both at home and abroad. Finally, the United States remains committed to providing for the well being and prosperity of the nation and its people.[3] In order to accomplish these goals, the United States has adopted a national security strategy of engagement.

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[2] Transnational aggressors are those groups who span territorial boundaries such as terrorist organizations, drug cartels, and organized crime units.

[3] William J. Clinton, *A National Security Strategy for a New Century (NSS)*, (Washington D.C.: The White House, October 1998), 1.

President William J. Clinton outlined the three core objectives of the National Security Strategy (NSS): to enhance security with effective diplomatic and military forces; to bolster America's economic prosperity; and to promote democracy abroad.[4] The security environment has dramatically changed since the end of the Cold War. The United States has emerged as the sole superpower and is attempting to avoid the mistakes of isolationism that followed the First World War. Updating the threats to national security, the NSS shifted from containing the Soviet Union to dealing with weapons of mass destruction, ethnic conflict, and transnational aggression. The United States is a nation with global interests. As such, the United States must engage in order to influence world events. President Clinton underscored the imperative of engagement by stating, "Our strategic approach recognizes that we must lead abroad if we are to be secure at home."[5] This strategy, therefore, requires the United States to maintain its world leadership role, while using all instruments of national power in order to ensure the peace and stability of the international security environment. Circumscribing each national instrument of power is the ability to react rapidly to world events, in other words, strategic mobility.

The Department of Defense (DoD) must be prepared to support the national security strategy at all times. In doing so, the DoD has published the *Report of the Quadrennial Defense Review* (QDR) and the *National Military Strategy* (NMS). The QDR and NMS, recognizing the diminished threat of a global war, define the top three national security challenges as: 1) large-scale, cross-border aggression of an aspiring regional power; 2) spread of technology and the proliferation of weapons of mass destruction (WMD); and 3) asymmetric transnational aggression.[6] Furthermore, the NMS requires the military to be able to respond to two near-simultaneous crises as well as support several smaller-scale contingencies at the same time. In order to meet these

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[4] NSS, iii.

[5] NSS, 1.

[6] William S. Cohen, Department of Defense, *Report of the Quadrennial Defense Review (QDR),* (Washington D.C.: May 1997), 7 and John M Shalikashvili, *National Military Strategy of the United States of America* (NMS), (Washington D.C.: The Joint Chiefs of Staff, 1997), 8-10.

challenges, the DoD has developed a strategy called, "Shape, Respond, Prepare Now: A Military Strategy for a New Era."

Comprised of three critical elements, the national military strategy defines how the military contributes to national security by supporting the strategy of engagement. First, the United States military must be prepared to shape the international security environment. The military shapes through deterrence (presence or show of force), engagement (joint and coalition exercises and training programs), and leadership (alliances and coalitions). Next, the military must be capable of responding to any crisis, from the entire spectrum of conflict, when directed by the President. Finally, the military must prepare now for the challenges and uncertainties of the unpredictable future. Accordingly, both the QDR and the NMS outline several "key enablers" for accomplishing these goals and objectives. Of the five key enablers, strategic mobility is paramount. The cornerstone of mobility, due to airpower's inherent speed, range, and flexibility, rests with the Air Force's strategic airlift assets of Air Mobility Command (AMC).

The Air Force, in its vision document, established rapid global mobility as one of its six core competencies; "Rapid Global Mobility provides the nation its global reach and underpins its role as a global power."[7] Air mobility supports national objectives. It is responsible for the rapid delivery of the majority of time-critical forces, equipment, and supplies during crises, whether in peacetime or war. Therefore, strategic airlift is a cornerstone for national security.

For example, during the 1973 Arab-Israeli War, the Air Force flew more than 500 sorties supporting Israel. Within 48 hours of the decision to act, the first airlift sorties landed in Israel delivering critical supplies and equipment to America's ally. In contrast, the first sealift vessel to reach port, although carrying more tonnage than all the airlift sorties combined, arrived 20 days after hostilities erupted but 12 days after the cease fire.[8] No one could have underscored the importance of strategic airlift to the United States or our Allies better than Israeli Prime Minister Golda Meir who said, "For generations to

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[7] Department of the Air Force, *Global Engagement: A Vision for the 21st Century Air Force*, (Washington D.C.: 1997), 12.

[8] John T. Correll, "Anything, Anywhere, Anytime," *Air Force Magazine*, February 1996, 3.

come, all will be told of the miracle of the immense planes from the United States bringing in the materiel that meant life to our people."[9] Airlift is a force multiplier as well as an enabler. Therefore, whether providing aid, showing presence, or projecting combat power, airlift must remain capable of meeting the nation's strategic goals and objectives. The changing world, however, has placed increased demands on this nation's overtaxed military airlift system.

In light of the demise of the Soviet Union, and subsequent end of the Cold War, United States dramatically altered its security posture. The U.S. significantly cut its force structure from its Cold War military levels. Moreover, in an effort to protect and save scarce resources, the U.S. dramatically reduced its overseas presence. Except for a few "key" geographical areas, the military is now a continental (CONUS) based force. Due to the National Security Strategy of engagement, however, military resources extend around the world and are forecast to remain so well into the future.

Shouldering the responsibility of a world leader, the United States has committed to worldwide involvement. In doing so, however, the U.S. is further straining dwindling military resources. Military airlift forces are being called upon to support international and domestic operations other than war. In any one week, AMC typically executes over 2,000 missions in over 40 countries.[10] Additionally, while flying daily training missions, AMC participated in over 225 global Joint Chiefs of Staff exercises, including exercises with former Warsaw Pact nations.[11] Moreover, the nation is so dependent on air mobility today that it is the airlift force, not the combat forces or "shooters," that are the limiting factor in the national military strategy.[12] In other words, airlift is the long pole in the tent of national security. High operations tempo and reduced force structure, added to an

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[9] Kenneth L. Patchin, *Flight to Israel*, Military Airlift Command Office of History, (Scott Air Force Base, IL: 30 April 1974; revised 1 July 1976), 265.

[10] Department of the Air Force, Headquarters Air Mobility Command, *1998 Air Mobility Master Plan (AMMP)*, (Scott Air Force Base, IL: 24 October 1997), iv.

[11] AMMP, 2-2.

[12] Correll, 3.

aging fleet and deteriorating infrastructure, represent a policy-strategy mismatch the United States cannot continue to endure.

Although the post-Cold War strategic environment and the NSS policy of engagement dramatically increase the nation's commitments around the world, the United States military currently does not possess the strategic airlift necessary to support the President's engagement policy or the NMS. The Air Force is currently in the process of replacing the aging C-141 with AMC's newest transport, the C-17. Replacing 266 C-141s with only 120 C-17s, in some ways bolsters airlift capability, due to the C-17's ability to carry outsized cargo and operate in and out of small and austere locations. But the conversion significantly reduces this nation's operational flexibility due to the dramatic reduction in the number of airframes available to the National Command Authority. Hence, military airlift capability is actually reduced. Furthermore, the proliferation of WMD has dramatically increased the likelihood of operating in "hostile" environments around the world. In fact, the QDR determined that the proliferation of WMD could further "destabilize some regions and increase the number of potential adversaries" to the United States.[13] However, due to political and legal constraints, the United States may not fully utilize the civil reserve airfleet's contribution to strategic lift, thereby, eliminating almost half of the nation's total strategic airlift capability. This new environment, therefore, places even greater airlift responsibility on military assets. Hence, at a time when the military is losing airlift capability, it must also bear a greater proportion of national airlift requirements.

Therefore, in order to meet current and future force requirements, especially with dwindling resources and a CONUS-based force structure, the United States needs to supplement its military strategic airfleet. Budget constraints and the general congruence of most commercial and military airlift missions, however, lead to a somewhat paradoxical conclusion. The military should augment its strategic airlift capability with an off-the-shelf commercial aircraft.

[13] QDR, 3-5.

Methodology

Not until terms and concepts have been defined can one hope to make any progress in examining the question clearly and simply and expect the reader to share one's view.

Carl von Clausewitz

This paper examines the feasibility for the Air Force to procure and field a commercial off-the-shelf cargo aircraft in order to meet the current and future airlift requirements of the United States. First, we will explore the evolution of the airlift partnership between the military and civilian sectors. In doing so, Chapter 2 highlights the competition and friction between the two sectors as they vied for increasing shares of the air transportation market. At the heart of the debate is the difference between civilian industry's economically efficient platforms and the militarily specialized platforms required by the armed forces. Realizing cost savings, the nation gradually shifted airlift capacity to the civilian sector, culminating with the creation of the Civil Reserve Air Fleet (CRAF) and the National Airlift Policy in the late 1950s and early 1960s. Since that time, this nation has done little to update its airlift policy. Consequently, although national strategy changed to reflect the new environment, the National Airlift Policy of the United States remains riveted to a Cold War paradigm of total mobilization for war.

With this foundation, Chapter 3 examines U.S. strategic airlift. It highlights the past mobility studies conducted to determine the national airlift requirements and shows how the United States has continually undercut its airlift needs. Focusing next on the fleet, Chapter 3 defines each component of the national airlift system. As such, it examines the current capacity, the three types of cargo, and the total force structure of the Air Force. Finally, Chapter 3 concludes with a description of the current airlift shortfall and why, in the turmoil of the post-Cold War environment, the shortfall is greater than projected and significantly impacts America's ability to achieve national objectives.

Chapter 4 explores five alternatives to increase airlift capacity. First, the United States could ignore the shortfall and simply do nothing. Next, the nation could expand or enhance the CRAF. The third option is to increase the locations and amount of prepositioning around the world, thereby, reducing airlift requirements. Fourth, the military could expand its current military airlift capability through modernization or

enhancement. Finally, the United States could procure and field a commercial off-the-shelf system to increase its airlift capability. Each alternative embraces benefits and drawbacks.

Chapter 5 provides the final recommendation and explores the possible additional benefits, both financial and operational, that inhere in fielding a commercial platform for military service. Although this option has been deemed historically unfeasible due to political and bureaucratic limitations within the National Airlift Policy, times have changed and may now accommodate such a measure.

This study is not a technical feasibility study aimed at attempting to recommend a specific commercial airframe to solve the shortfall. In order to provide comparison data, however, I use the Boeing 767-300 Freighter as an example, thereby, demonstrating the benefits and limitations of a commercial cargo aircraft. Nor is this study a rehash of the 1994 Non Developmental Airlift Aircraft Report published during Phase II, Engineering and Manufacturing Development, of the C-17 acquisition.[14]

Finally, it is important to note that this study is based on two important but fundamental assumptions. First, the United States will maintain its position as a world leader and ensure its national interests and objectives are obtained through the policy of engagement. Second, the United States will remain the sole military superpower for the next 20 to 30 years. Both of these assumptions are consistent with those set forth by the National Security Strategy, the Quadrennial Defense Review, and leading scholars within the national security and foreign policy arenas. If the United States should disengage, forfeiting its influence and leadership or chooses to forgo its military superiority, both technologically and organizationally, then a new strategic environment will emerge that alters the priority for strategic airlift.

Airlift is not a panacea. Airlift is not glamorous. Nevertheless, airlift is the backbone of the United States' diplomatic, economic, and military instruments of national power. Witnessing the events unfolding in Europe almost 60 years ago, Major General H.H. "Hap" Arnold and Colonel Ira C. Eaker wrote,

> There is a greater likelihood that poor strategy will cause the overthrow of nations than poor tactics. … The failure of England and France to prevent

[14] See Chapter 4 for a detailed explanation of the NDAA Report.

> the creation of that German air force, or to build more powerful air forces of their own, were examples of defective strategy.[15]

When viewed from a strategic level of analysis, the United States must reexamine the policy-strategy mismatch within the National Airlift Policy and the national security strategy of engagement. In doing so, the United States will be best prepared to tread the uncertain future with the balanced airlift capability required to ensure accomplishment of America's national security objectives.

[15] H. H. Arnold and Ira C. Eaker, *Winged Warfare*, (New York: Harper & Brothers, 1941), 140.

Chapter 2

The Civilian – Military Airlift Partnership: Efficiency Versus Effectiveness

> *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.*
>
> Ronald W. Reagan, 24 June 1987
> National Security Decision Directive Number 280

Since the Wright Brothers' historic flight in 1903, man has searched for ways to exploit the potential of the airplane. Airpower theorists have embraced the airplane has a formidable weapon capable of performing a wide variety of missions: from transporting cargo and personnel, to protecting troops on the front lines, to striking deep into the enemy's rear. It is the inherent flexibility of the airplane that has enabled it to be one of the most formidable tools available to ensure national goals and objectives.

Comprised of civilian and military personnel, equipment, and facilities, the national airlift system represents a unique partnership whose development spans over six decades. President Reagan's statement above highlights the interdependence of our national strategic airlift assets and points to a unique partnership absent from most other military arms. However, this partnership involves confrontation as well as cooperation, as numerous groups and individuals interact, each pursuing their own interests and goals. At the heart of the dispute is the need to balance economic efficiency with military effectiveness.

This section examines the civilian-military partnership of strategic airlift. First, it will highlight the historical evolution of our national airlift system. Next, it will briefly explore the development of the Civil Reserve Air Fleet (CRAF) and the National Airlift Policy. In doing so, we will examine the decisions between military and political leaders as they grapple with the dilemma of efficiency verses effectiveness. Finally, we will examine the post-Cold War era and demonstrate that, based on the strategic environment facing the United States, current National Airlift Policy is inadequate and must be readdressed.

History

> *The airlift [during the Gulf War] was successful because of the teamwork between the Department of Defense's active duty, reserve, and national guard transportation forces, and the civil carriers. … Our success was not a matter of profit or loss for these commercial carriers, it was a mater of national security.*
>
> Donald B. Rice, Former Secretary of the Air Force

Early airpower advocates recognized the tremendous potential of the airplane. Realizing the military viability and highlighting speed, range, and the ability to operate above or around natural or man-made obstacles, military leaders quickly found unparalleled utility in airpower. Moreover, airpower theorists reveled in the numerous potentials for the proper use and application of airpower. Although disagreeing on the best strategy, each theorist recognized and stressed the important aerial partnership between the civilian sector and the military.

The end of World War I left the aviation industry struggling for its proper place in society. Although questions pertaining to the safety and reliability of the airplane nagged peacetime applications of aviation within the United States, early airpower advocates, such as Giulio Douhet and Brig Gen William "Billy" Mitchell, stressed the need for a healthy, strong, and integrated aviation industry. Both Mitchell and Douhet agreed that the key to a nation's progress and prosperity lay in aerial transportation. In 1925, General Mitchell wrote, "transportation is the essence of civilization. Nothing throttles a

people's development more than lack of transportation."[16] Likewise, linking strong commercial aviation assets to national military strength, Douhet advocated,

> There is no doubt that the perfecting of civil aerial means will enhance the military value of the air arm, and that in an eventual conflict the possession of the command of the air will be a greater advantage than command of the sea. To have at one's disposal a large fleet of air transports is the equivalent, in terms of military power, to having large Independent Air Force always ready to defend one's rights.[17]

Thus, the early airpower theorists tied national security to a strong, robust, and fully integrated civil-military aviation industry.[18] Said best by General Mitchell, "The substantial and continual development of air power should be based on a sound commercial aviation."[19]

The inter-war period, however, left the United States struggling due to the strain of the First World War and the Great Depression. Searching for ways to provide national security with dwindling resources, the United States turned to the civilian sector. Realizing that aviation assets could provide economic benefits to society, the military sought to defray costs by providing services to the nation. The U.S. Air Service could be used to map the country, observe the forests, carry the mail, and dust crops in times of peace.[20] In doing so, the United States sought to spark the struggling commercial aviation sector by providing roles and missions—the foundation for expansion. Casting aviation resources, unlike army or naval resources, as virtually transparent to the conditions of peace or war, the vision was to develop a civilian aviation industry capable

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[16] William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power—Economic and Military*, (Originally published New York: Putnam's 1925; reprinted New York: Dover 1988), 77.

[17] Giulio Douhet, *The Command of the Air*, 2nd ed. (Italy, 1927; Originally translated New York: Coward-McCann 1942; reprinted, Office of Air Force History 1983), 79.

[18] It must be pointed out that Douhet and Mitchell had differing views on the integration of civilian aviation. Douhet visualized a large civilian fleet of aircraft that would be taken apart and converted to military aircraft in times of war. Mitchell, on the other hand, visualized a large military fleet of which only a small portion would be used in a military capacity. The majority of the fleet would fly civilian roles and missions. These assets would assemble periodically to conduct military training and maneuvers.

[19] Mitchell, 96.

[20] Mitchell, 98.

of transferring to the military in times of national emergency. Thus, pilots, mechanics, aircraft, and production facilities could convert quickly and seamlessly to wartime applications. This partnership, however, was not immune to growing pains.

As the civilian sector expanded, so too did the competition for business with the government-owned flying missions of the military. The military flying service relied upon these peacetime roles and missions to justify their existence. However, the emerging commercial sector also relied upon government contracts for growth and survival. Hence, increasing revenue was a driving factor for the civil sector, whereas the military, not having to worry about profits, provided services to the nation at very little cost to the government. As civil aviation expanded, therefore, industry found itself in direct but unequal competition with the military. Complaining to Congress and other government agencies, commercial industry found sympathy within the Harding administration.

The Harding administration, realizing this disparity, instituted the Kelly Act in 1925. Working from the premise that the commercial sector should assume responsibility for domestic passenger and cargo travel, the Kelly Act required the U.S. Post Office to contract routes with commercial carriers.[21] In doing so, the administration shifted part of the military's air mail service to civilian carriers. By promoting commercial aviation, the Kelly Act endeavored to provide the economic resources for expansion. Furthermore, expansion would also encourage the civilian sector to design, develop, and operate new aircraft. This not only helped the struggling civilian sector expand but also promoted viable air travel within the United States. Consequently, by the mid-1930s, great strides had been made in the commercial passenger and cargo industries. However, disputes over air mail and passenger travel rates refueled the competition between the military and civilian industry.

The United States lacked a coherent national policy that integrated the civil and military aviation sectors. In 1934, the Baker Board, named for the board president and former Secretary of War, Newton Baker, was formed with the responsibility to determine the proper relationship between civilian and military aviation industries in peacetime and

[21] 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 Center, 1994), 2-3.

war.[22] Noting the great strides made by the civilian sector, the Baker Board was captivated by the efficiency of commercial transport companies. Driven by the need to be economically sufficient, the civilian airline and cargo companies continually improved scheduling and equipment, incorporating the latest technological developments into their aircraft. Advances in speed, range, and payload of commercial transport aircraft enabled companies to increase revenues.[23] Additionally, civilian carriers significantly improved the safety record of commercial transportation, thereby establishing commercial air travel as a viable means of transportation within the United States.

On the other hand, strapped with limited resources, long procurement times, and an isolationist governmental attitude, the military could not afford to pursue technological advancements as rapidly as the commercial sector. Not having to worry about profits and losses, the military focused on bulk effectiveness through cheap labor to maintain its share of the transportation market. Realizing the military could not compete with the expanding civilian market, the Baker Board recommended that the "air corps should whenever possible use converted commercial air transport of acceptable performance for cargo and transport airplanes" instead of military-specific systems.[24] By doing so, the board sought to provide the military with the latest civil-aviation innovations at a price acceptable to the government. Furthermore, in defining the relationship between the civilian sector and the military during peacetime and times of national emergencies, the Baker Board specifically recommended independent but coordinated aviation systems, stating:

> There should be very close liaison between civil and military aviation but the control of the two systems, civil and military, must be separate and distinct. … The granting of government subsidies to provide for the conversion of commercial airplanes to military airplanes is undesirable. The use of commercial airplanes as a reserve of transport and cargo is desirable.[25]

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[22] Charles E. Miller, Airlift Doctrine, (Maxwell AFB AL, Air University Press: 1988), 5.

[23] Ibid., 5.

[24] Final Report on War Department Special Committee in Army Air Corps [Baker Board], 18 July 1934, 75, as cited in Miller, 6.

[25] Baker Board, 59.

Thus, of the many recommendations of the Baker Board, one of the most important set the precedent for the military to mobilize and use commercial assets during national emergencies.

The Baker Board's recommendations, however, were not well received within the military. Maj Gen Benjamin Foulois, the Chief of the Army Air Corps in 1934, adamantly denied the utility of using commercial transport planes for military proposes. In a letter to the Adjutant General of the War Department, General Foulois argued that commercial aircraft were built for efficiency not military effectiveness. "Commercial transports are not designed to carry heavy concentrated loads of bulky articles," he wrote, nor are they "designed to operate in and out of small fields with heavy loads."[26] Accordingly, the unique requirements of the military could be solved only with specifically designed transport aircraft. General Foulois' arguments, however, fell on deaf ears. Congress could see neither the requirement for a "military-specific" transport aircraft nor the need for the military to own and operate transport aircraft that could be drawn from the civilian sector. Committed to leveraging the civilian sector, Congress did not provide the required resources for military transportation assets.

Attempting to dispel the confusion concerning aviation and national defense, General Arnold argued that "an air force is of little value no matter what its size, unless it be kept modernized *(sic)*."[27] As the Air Corps Chief of Supply in 1936, Arnold lamented the scarcity and limited capability of the current transport fleet. Attempting to justify additional transport aircraft, he argued that America's armed power required the organic ability to project and maneuver that power rapidly through the air. In order to accomplish its mission, General Arnold determined the Air Corps needed 149 new transports.[28] However, the new Secretary of War, Harry Woodring, found no sensibility in Arnold's argument.

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[26] Maj Gen Benjamin Foulois, Chief of the Air Corps, to the Adjutant General, War Department, letter, subject: 1st Indorsement Recommendation of Special Committee, Air Corps, 30 November 1934 as cited in Miller, 7-8.

[27] H. H. Arnold and Ira C. Eaker, *Winged Warfare*, (New York: Harper & Brothers, 1941), 252.

[28] Military Airlift Command Office of History, *Anything, Anywhere, Anytime: An Illustrated History of the Military Airlift Command, 1941-1991*, (Scott AFB IL, 1991), 10 and Miller, 16-17.

Instead, Woodring, in 1937, instituted a disastrous program of converting old bombers into transport aircraft.[29] The military undertook several tests and proved the program was impractical. Weight, balance, and structural problems; limited cargo capacity; no emergency exit; and a conversion fee higher than the cost of a new cargo aircraft, all confounded the program. Nevertheless, stating the high price of transport aircraft, Secretary Woodring limited the procurement of transport aircraft to only 36 in 1938 and none in 1939.[30] Although the civilian air transportation industry was expanding, its aircraft were not congruent with military requirements. Lacking funds, compatible designs, and a sense of urgency from policy makers, strategic airlift suffered in the face of an ominous spiral of events in Europe and the Pacific.

Woodring's myopic program left the U.S. Army Air Corps woefully prepared for the transportation challenges of 1941. After the Japanese attacked Pearl Harbor, bringing the United States into World War II, the Air Corps Ferrying Command possessed only 11 four-engine transport aircraft, converted B-24s, that were suitable for long-range operations.[31] Realizing the disparity between the civil and military sectors and the urgency of the situation, the United States turned to the recommendations of the Baker Board. At the time, civilian airlines possessed over 400 aircraft—many of which could make transoceanic flights.[32] Supporting the war effort, the commercial companies initially sold all four-engine aircraft to the military. Invoking his executive power on 13 December 1941, President Roosevelt signed an order authorizing the Secretary of War to "take possession of any portion of any civil aviation system" required for the war.[33] Not wanting to decimate the commercial transportation system, the Army took control of all DC-3s but did not initially activate its reserve pilots. Worried about the economic impact, the military sought to dampen the mobilization ripples. Accordingly, contracts

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[29] *Anything, Anywhere, Anytime*, 10 and Miller, 17-18.

[30] Ibid.

[31] *Anything, Anywhere, Anytime*, 32.

[32] Priddy, 6 and Miller, 31.

[33] Ibid.

were quickly let for crews, additional aircraft, and services, thereby allowing the civil sector to survive, albeit at substantial cost to the government. The commercial transportation industry, by the end of 1942, provided almost 88 percent of military transportation requirements.[34] At the end of the war, however, through production, reorganization, and training, the military reduced the civilian contribution to less then 20 percent.

Although initially unprepared, the United States had mobilized every fiber of muscle for the war effort. By the war's end, Air Transport Command (ATC) had established an unprecedented worldwide air transportation network.[35] A vast system of personnel, equipment, and bases around the world, ATC possessed the resources to project U.S. influence anywhere at anytime. The transportation realities of the war drove home General Arnold's earlier call for a national policy that planned and coordinated the entire air industry, both civilian and military.[36]

The military emerged from WW II convinced of the importance of airlift. In a series of high-level correspondence, the senior Air Corps officers outlined their vision of ATC's future. Two of the key points being: "1) ATC should be a self-contained organization and 2) ATC should be the preeminent airline operator in the world … but it should maintain very close coordination with the U.S. airlines, with ATC as *the* point of contact with civil aviation."[37] As such, the military aspired to remain not only a military but also an economic instrument of national power. However, this vision was not well received in Congress or the civilian industry, and tension once again developed between the military and civilian sectors.

Balancing the concerns over losing ATC's worldwide system of facilities and routes to foreign carriers with the need to demobilize the military, the United States again favored the civilian sector. After being starved by the war effort, civilian transportation

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[34] Ms Betty R. Kennedy, Headquarters, Air Mobility Command Historian, interviewed by author, 18 Dec 98.

[35] *Anything, Anywhere, Anytime*, 55.

[36] Arnold, *Winged Warfare*, 258.

[37] Miller, 69.

companies received ATC's missions, allowing the United States to maintain its influence while simultaneously rebuilding its commercial transportation industry. The military, however, convinced of the military importance of airlift, argued to maintain its organic transportation resources. Realizing that without rapid airlift capability the United States would severely limit her ability to deter others, General Arnold wrote to Lieutenant General "Tooey" Spaatz,

> I firmly believe that an essential component of American airpower is an integrated an autonomous single Air Transport Command, reporting *directly* to the commanding general, Army Air Forces. ... I believe it offers a means of ensuring our capacity to support the immediate worldwide deployment of our Armed Forces; giving essential unity to the Air Forces command. … The Air Transportation Command is *the* Air Force's and *the* War Department's high speed physical connecting link between headquarters and the field commands.[38]

The United States, however, quickly began its demobilization. The commercial sector, rapidly rebuilding its infrastructure, hired many new personnel, ordered new aircraft, purchased several war-surplus aircraft, and vied for ATC's routes and missions.

The competition and tension between the civilian and military aviation sectors soon intensified as a slow air transportation market left the commercial companies overextended. President Truman, in mid 1947, established a special commission to examine objectively the nation's aviation dilemmas.[39] Named the Finletter Commission, the members conducted interviews with virtually every leading military and civilian aviation expert in the United States.[40] Hitting the military hard, the Commission highlighted the transportation duplication efforts of the Army and Navy. After the start of WW II, the navy organized the Naval Air Transport Service (NATS). Although separate and independent, NATS provided the same transportation services as ATC, often

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[38] General Arnold to Lt Gen Spaatz, letter, 6 December 1945 as cited in Miller, 71.

[39] Thomas K. Finletter, et al., *Survival in the Air Age: A Report by the President's Air Policy Commission*, (Washington, D.C.: Government Printing Press, 1948), v-vi and *Anything, Anywhere, Anytime*, 64.

[40] The commission's name came from the Chairman, Thomas K. Finletter, who went on to become the second Secretary of the Air Force in 1950. Defining the urgency and scope, Truman wrote, "The final recommendations of the commission must, however, go beyond the limits of any one phase of aviation. They should be so broad in scope and purpose that they will assist in revising old policies and in framing new ones, and will serve as a guide for formulating a carefully considered national air policy." Per Truman's request, the commission completed and submitted its report in less than 6 months. Ibid.

over many of the exact same routes. Additionally, not only did ATC and NATS duplicate efforts, but the military also mirrored commercial carriers, since many military facilities were either co-located with, or near, civilian airports. Furthermore, although ATC and NATS flew as much cargo as all domestic carriers put together, the civilian and military transportation assets combined did not provide the United States enough airlift capability to handle another national emergency.[41] Hence, during a period of rapid demobilization and intense competition between the military and civilian industries, the nation recognized the importance of airlift and the need to bolster air transport assets. Acknowledging this national dilemma, the Finletter Commission strongly recommended expanding the commercial transportation sector.

Establishing the Civil Reserve Air Fleet and the National Airlift Policy

> *As for the planes themselves, even in military aviation circles the misconception is held that civilian planes cannot be used for war purposes because the two types of airplane must have different characteristics. … No one will dispute the fact that, in the absolute sense, a plane which must meet both the civil and military requirements cannot be the perfect machine for either purpose. But the absolute does not exist.*
>
> Giulio Douhet

The Finletter Commission's recommendations highlighted the national need to establish a coherent, integrated, and robust airlift policy. Publishing its report in January, 1948, the Commission made three important recommendations to the President. First, the nation's air transportation fleet, consisting of ATC and NATS, should be consolidated.[42] In doing so, a single military command responsible for all airlift assets would be best able to eliminate duplication and manage transportation requirements for the nation. Second, realizing the airlift shortfall, the Commission recommended that no cuts be made in military airlift. Rather, they called for expanding the commercial sector to fill the airlift gap. The military still had its worldwide network of routes and facilities. Expanding the

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[41] *Anything, Anywhere, Anytime*, 65.

[42] Finletter, 32.

civilian industry would ensure a viable, healthy, and robust domestic and international transportation network would be available to the nation in times of need. Finally, highlighting the lack of coordination between the military and civilian sectors, the Commission strongly recommended a "contractual" relationship between the two.[43] In doing so, there would be established procedures outlining the number, type, and time line for transfer of civilian assets to the military during national emergencies. Furthermore, they recommended that this "pool" of aircraft should be called the "Civil Reserve Air Fleet" (CRAF). Although this recommendation was not implemented for over a decade, the commission established the foundation for what amounts to almost half of today's strategic airlift capability.[44]

The Soviet blockade of Berlin and the Korean conflict marked the start of the Cold War era and tested the first of the Finletter Commission's recommendations. Just prior to commencing the Berlin Airlift, the military consolidated ATC and NATS, creating the Air Force's Military Air Transportation Service (MATS). MATS emerged from both crises aware of two important concepts: the importance of strategic airlift and MATS' dependence on the commercial aviation sector. Civilian carriers dramatically helped the fledgling transport service. Although not flying directly into Berlin or hostile areas in Korea, the commercial aviation assets alleviated several domestic and international logistical responsibilities of MATS. MATS, therefore, shifted its assets to cover the nation's crises. This, however, only exacerbated the tension between the two transport sectors, as commercial carriers fought to keep their new routes and missions. The United States still lacked a coherent policy defining the roles and responsibilities of the two airlift sectors.

In March 1951, President Truman took another step towards resolving this problem by issuing an executive order, requiring the Department of Commerce (DoC) and the Department of Defense (DoD) to formulate the plans for mobilization of civilian air assets.[45] Within nine months, DoC and DoD signed a memorandum of understanding,

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[43] Ibid.

[44] For a more detailed discussion of the Civil Reserve Air Fleet, see chapter 3.

[45] Priddy, 15.

outlining for the first time a national policy for activating civilian assets for national emergencies. Officially adopting the Finletter Commission's name, the concepts outlined in 1952 contain essentially the same main characteristics of the current CRAF program.[46] Establishing the procedures for mobilization, however, did little to resolve the conflict and tension between the two sectors competing for government missions.

The 10 years after the Korean War marked a decade of commissions, hearings, and testimonies due to intense conflict between the commercial carriers and the military. MATS soon found itself fighting for existence. Commercial carriers argued that MATS' standard military routes were better suited for the civilian system.[47] Built for profit, the civilian carriers could move cargo cheaper than the military. This "efficiency" argument quickly found support within Congress. Further supporting the civilian cause was the 1954 Air Coordinating Committee report and the 1955 Hoover Commission findings. Both panels recommended that the government should adjust its policies to "rely on" and use the "unutilized capacity" of the commercial sector for products and services.[48] The Air Force, on the other hand, continued to argue that the commercial transport sector lacked the capacity to carry heavy military loads. Furthermore, the military argued that the missions flown by MATS were a cost-effective way of training personnel during peace. The Air Force, therefore, continued to maintain the position that the civilian airlift industry, though complementary, could not replace the military system.

Throughout the 1950s, the nation debated the proper balance between military and civilian airlift capabilities. In 1957, for example, Congressman Daniel Flood (D-PA), after reviewing the previous year's report highlighting the underutilization of the commercial sector, called MATS "the billion dollar boondoggle."[49] Congress, keenly aware of public perception of wasteful practices, continually searched for ways to trim the budget. Looking at the military, they steadily shifted national resources to the civilian

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[46] The original document was titled "The Department of Defense Plan for the Civil Reserve Air Fleet." It was published with a gray cover and nicknamed the name the "Gray Book." See Priddy, 16.

[47] *Anything, Anywhere, Anytime*, 89.

[48] *Anything, Anywhere, Anytime*, 89-91 and Priddy, 17-18.

[49] *Anything, Anywhere, Anytime*, 95.

sector. Congress, in 1958, directed the military to contract 40 percent of all passenger and 20 percent of all cargo requirements to U.S. commercial carriers.[50] Additionally, the powerful House Subcommittee on Military Operations weighed into the fray, dramatically influencing the future of military airlift.

The Holifield Committee, throughout the late 50s and early 60s, annually reviewed the peacetime airlift activities of the military. Carefully tracking the debate between the commercial and military sectors, their recommendations set the foundation for the first national policy on airlift. One of the first directives established the military's industrial-basis fund, requiring MATS to operate in a "business-like" manner. Additionally, recognizing the age of the military airlift fleet, the committee stressed the need to modernize and specifically sponsored "hard-core" military requirements.[51] These included the ability to accommodate wheeled vehicles in a drive-in configuration, handle "bulky" cargo not suited for commercial carriers, and a high wing design to reduce damage at remote locations.[52] The committee also recommended, however, that the military shift a larger portion of its cargo market to the commercial carriers in order to encourage the modernization of the CRAF. Hence, the Holifield Committee not only recognized the military's vital role in national defense, but also solidified the civilian sector's contribution as well.

President Dwight D. Eisenhower, acting on their recommendations in 1960, instituted nine "Presidentially Approved Courses of Action," thereby establishing the first national airlift policy. Contained in the DoD report, "The role of Military Air Transport Service in Peace and War," Eisenhower defined the military's peacetime mission as "to insure its capability to meet approved military hard-core requirements" and "other military requirements as cannot be met adequately by commercial carriers on a timely basis."[53] Following President Eisenhower's lead, President John F. Kennedy issued

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[50] Ibid.

[51] Priddy, 22.

[52] These recommendations led to the development and procurement of the C-141 Starlifter. The C-141 was the first jet aircraft designed specifically for military requirements and has been the core airlift aircraft of the Air Force for over 30 years.

[53] Hard-core requirements were defined "as those which must move in military aircraft, manned and operated by military crews, because of special military considerations, security, or because of limiting

Executive Order 10999 in February 1962, implementing several Holifield Committee recommendations. In doing so, Kennedy officially shifted the nation's peacetime airlift responsibility to the civilian sector.

A Policy-Strategy Mismatch for the New Strategic Environment

> *Air power may be defined as the ability to do something in the air. It consists of transporting all sorts of things by aircraft from one place to another, and as air covers the whole world there is no place that is immune from influence by aircraft.*
>
> William "Billy" Mitchell

Implemented at the height of the Cold War, this nation's airlift policy remained unchanged for the next 25 years. As the United States struggled through the Vietnam War, the strategy of flexible response increased demands for national airlift. The military increased the number of aerial ports and prepositioned personnel located overseas in an effort to increase the efficiency of its enroute structure.[54] The military also joined the commercial sector in capitalizing on new engine technology by adding the C-141 and C-5 "jet" cargo aircraft. Abiding by national airlift policy mandates, the civilian sector also benefited from the Cold War expansion as more routes and missions were contracted to the U.S. commercial carriers.

President Ronald Reagan updated the National Airlift Policy for the first time in 1987 by issuing National Security Decision Directive 280 (NSDD 280).[55] Maintaining a persuasion for the commercial aviation industry, President Reagan reemphasized the nation's commitment to a robust national airlift fleet. With the Cold War still on, this policy underscored the "interdependence of military and civilian airlift capabilities in

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physical characteristics such as size or dangerous properties. Included in this category are special military deployments involving nuclear retaliatory forces, the SAC post-strike recovery mission, tactical deployments, movement of missiles, special munitions, etc." See Priddy, Appendix B, for more details and the complete list of the Presidentially Approved Courses of Action. Priddy 25 and B-1.

[54] *Anything, Anywhere, Anytime*, 145.

[55] For a complete description of the National Airlift Policy, see appendix A.

meeting wartime airlift requirements."[56] Furthermore, NSDD 280 directed the "minimum utilization" of military assets commensurate with what was necessary to maintain operations and training. As such, DoD was to:

> Determine which airlift requirements must move in military airlift manned and operated by military crews because of special military considerations, security, or because of limiting physical characteristics such as size, density, or dangerous properties; and which airlift requirements can be appropriately fulfilled by commercial air carriers.[57]

President Reagan's policy, therefore, redefined the "hard-core" requirements of the military, placing the emphasis for national airlift on the commercial sector. Acknowledging this emphasis, NSDD 280 pledged to "protect those national security interests contained within the commercial air carrier industry."

Since air transportation's inception, the United States has continually recognized the civilian airlift industry as a vital national resource. Although marked with tension and competition, the civil cargo industry has proved invaluable to the military and the nation. The past few years, however, have brought rapid and dramatic change, threatening the nation's reliance on the civilian airlift sector.

The fall of the Soviet Union and the subsequent end of the Cold War, brought a dramatic change in the United States' defense posture. The United States responded to the changing global environment by dramatically reducing its force structure. Cutting the defense budget by over 35 percent, the U.S. military has lost over one-third of its cold war military strength.[58] Moreover, in an effort to protect and save national resources, the United States has dramatically reduced its overseas presence. The Air Force alone has reduced its forward-deployed bases by over two-thirds of those at the height of the Cold War (see Figures 1 and 2 next page). Except for a few "key" geographical areas, the military is now a continental (CONUS) based power. The national security strategy of engagement, however, requires the United States to be involved around the world.

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[56] Ronald W. Regan, *National Airlift Policy*, National Security Decision Directive Number 280, (Washington D.C.: 24 June 1987), 2.

[57] Ibid., 1.

[58] QDR, iii.

Therefore, with a CONUS based force and the security strategy of engagement, the U.S. is even more dependent on strategic mobility to influence world events.

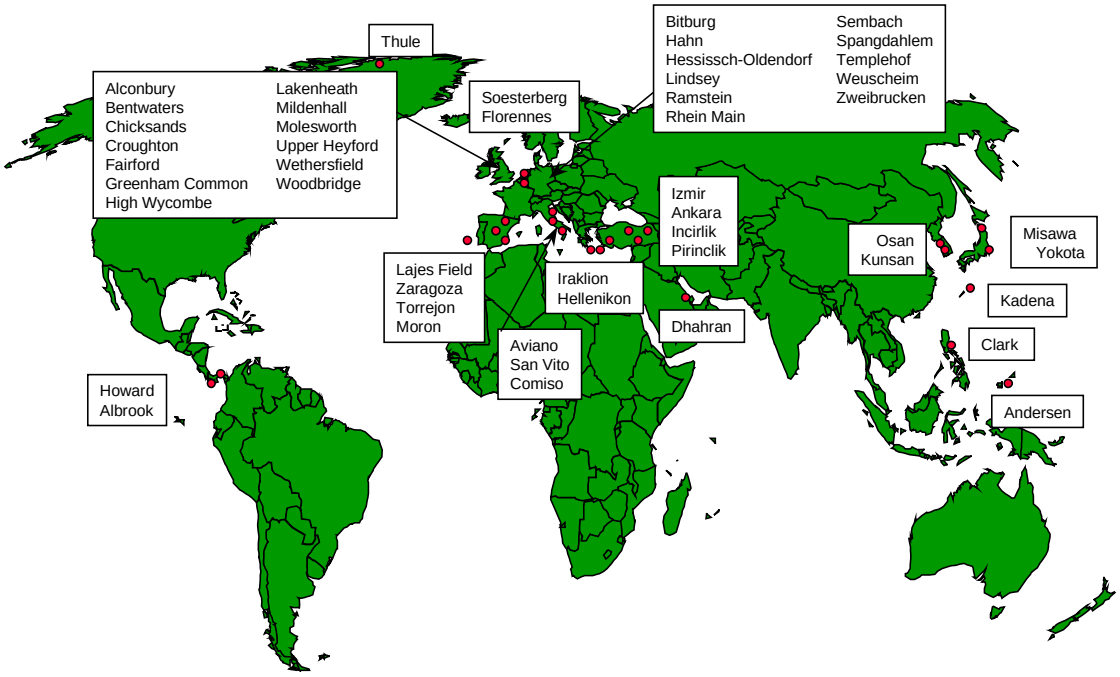
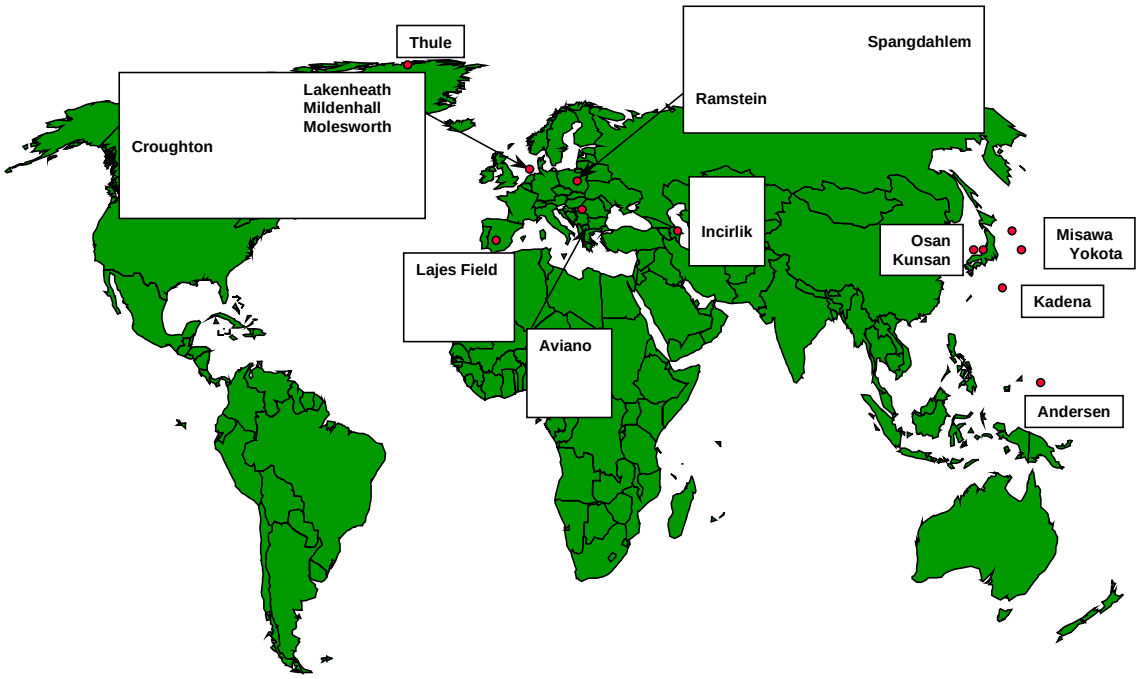


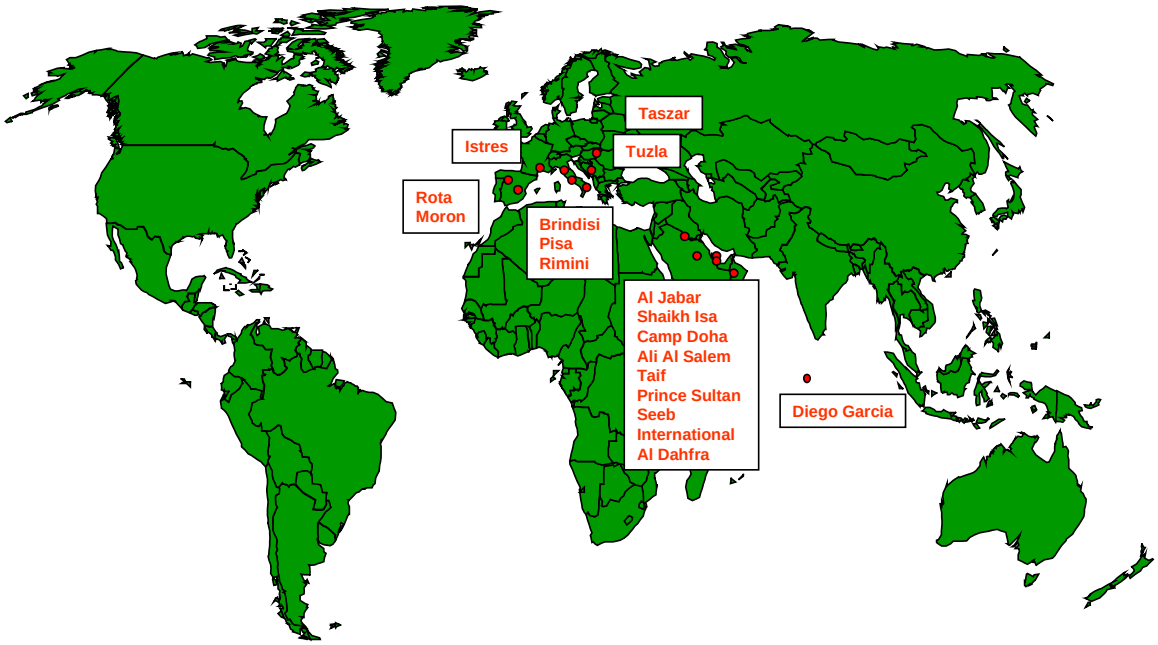
Figure 1. Air Force Overseas Bases Cold War Environment



Source: Maj Gen Don Cook, "Evolving to an Expeditionary Aerospace Force," lecture, School of Advanced Airpower Studies, Maxwell AFB, AL., November 1998.

Figure 2. Air Force Overseas Bases Post Cold War Environment

Bearing the responsibility of a world leader and the sole superpower, the United States has committed resources around the world. Figure 3 below highlights the "temporary" infrastructure that is required to support the ongoing contingencies in Bosnia and Southwest Asia alone due to the dramatic cutback in overseas locations. As such,



Source: Maj Gen Don Cook, "Evolving to an Expeditionary Aerospace Force," lecture, School of Advanced Airpower Studies, Maxwell AFB, AL., November 1998.

Figure 3. Current "Temporary" Infrastructure

the military is experiencing a dramatic increase in operations other than war. Operations such as peacekeeping, counter drug, antiterrorism activities, natural disaster relief, and humanitarian assistance have further strained airlift forces. For example, Air Mobility Command (AMC) averaged over 1640 missions per week in 1998, an over 10 percent increase in 1997 and an almost 19 percent increase over 1995.[59] Additionally, the AMC contracted almost $700 million of business to the civilian sector, including $298 million

[59] Department of the Air Force, Headquarters Air mobility Command, *1997 Air Mobility Master Plan* (AMMP), (Scott Air Force Base, IL.: October 1996), 2-1 and General Charles T. Robertson Jr., "Global Mobility: The Keystone of America's Defense Strategy," lecture, Air Mobility Symposium, Robbins AFB, GA., 30 January 1999.

of cargo and $205 million of passenger business.[60] The United States simply does not possess enough airlift assets to meet combined national responsibilities.

The post-Cold War environment offers several other challenges to the nation's airlift forces. First is the proliferation of weapons of mass destruction (WMD). Former Secretary of Defense William J. Perry wrote, "Today, countering the proliferation and use of weapons of mass destruction (WMD) has become a new absolute priority and the single greatest challenge for the United States Department of Defense (DoD)."[61] This new threat spans the globe and threatens U.S. personnel, facilities, and equipment. Operating in "hostile" environments is the duty and responsibility of the military and should not be asked of civilian counterparts. Although no one can be assured protection everywhere, it is politically infeasible to expect commercial air carriers to operate in potential hot areas.

Additionally, with the fall of the Soviet Union, the threat of another "world war" has dramatically diminished; however, the threat of conflict has increased. The world is potentially volatile due to aspiring regional powers and transnational aggressors. The Quadrennial Defense Review predicts the United States is likely to be militarily challenged by an aspiring regional power.[62] This challenge may come in the form of a large-scale border crossing or a threat to U.S. facilities around the world. Furthermore, threats from transnational organizations such as drug cartels, terrorist groups, and religious extremists have placed U.S. personnel and facilities at risk. Compounding these threats with the proliferation of WMD, an adversary can effectively deny access to U.S. strategic mobility assets. This is a formidable task, especially if access is denied to civilian airlift for reasons previously stated.

Finally, the United States is committed to uphold the democratic principles that ensure peace and prosperity. As such, our nation has pledged to aid those in need. Whether responding to a natural disaster or for humanitarian assistance, the first to arrive

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[60] James Thomas, GM-15, HQ Air Mobility Command Contracting, interviewed by author, 15 January 1999 and Captain John D. Lamontagne, Civil Reserve Air Fleet Plans Officer, HQ Air Mobility Command Civil Air Division, interview by author, 17 Dec 1998.

[61] Peter L. Hays, et al, *Countering the Proliferation and Use of Weapons of Mass Destruction*, (New York: McGraw-Hill, 1998), viii.

[62] QDR, 3.

and support these small-scale contingencies (SSC) will be the airlift forces of AMC. Yet, this nation's national security strategy dictates the need to be prepared to support two near-simultaneous theaters of conflict while continuing to support other SSCs. Once again, in such a scenario political and legal realities place the airlift responsibility squarely on the shoulders of the military.

The world has changed. The United States faces a dramatically different strategic environment than ever before. Recognizing this change, the U.S. has adopted the national security strategy of engagement. Exercising the responsibilities of a world leader, engagement strategy preserves United States' ability to influence world events. Yet, the national airlift policy remains riveted to a Cold War paradigm of total mobilization for war. The U.S., therefore, is faced with a policy-strategy mismatch it cannot afford to ignore.

Chapter 3

Airlift Requirements, Current Capabilities, and the Shortfall

> *I have directed prompt action to increase our airlift capacity. Obtaining additional airlift mobility—and obtaining it now—will better assure the ability of our conventional forces to respond with discrimination and speed to any problem spot on the globe at any moment's notice. In particular it will enable us to meet any deliberate effort to avoid or divert forces by starting limited wars in widely scattered parts of the globe.*
>
> President John F. Kennedy
> State of the Union message, 30 January 1961

Addressing the nation, President Kennedy stressed the importance of airlift to national security. The new national strategy of Flexible Response required the nation to posture its forces, ready to respond anywhere in the world at a moment's notice. Fundamentally altering national security strategy, President Kennedy strove to deter "all wars" large or small, nuclear or conventional through rapid mobility.[63] Paramount to this strategy was a robust airlift system, capable of quick reaction to all corners of the world. Accordingly, strategic airlift became a key element of this nation's ability to influence world events. Throughout the next 35 years, however, the United States has wrestled with the political and fiscal realities of balancing military and domestic programs. In doing so, the United States has continually reallocated or cut funding for national airlift assets, creating an unacceptable airlift shortfall that undermines U.S. national security strategy.

Policy makers can no longer ignore the growing strategic airlift shortfall. Limited by fiscal realities, national leaders have tailored the airlift force structure to meet

[63] Charles E. Miller, Airlift Doctrine, (Maxwell AFB AL, Air University Press: 1988), 276.

budgetary and political constraints instead of what national requirements dictate. The United States possesses the world's most formidable military. This capability, however, is useless if the United States lacks the ability to project when and where it is needed. The post Cold War environment is also placing higher demands on the national airlift system. No longer posturing against a peer threat, the United States' National Security Strategy of Engagement depends on rapid reaction to world events and Air Mobility Command's ability to enact Nathan Bedford Forrest's axiom, "firstest with the mostest."

How does the United States determine its national mobility requirements? What are the components of the United States' national mobility triad and what is airlift's role? What have recent airlift requirements studies concluded? Is there a shortfall? Chapter 3 deals with these questions herewith.

Determining National Mobility Requirements

One of the difficult aspects of discussing airlift needs, shortfalls, and problem areas is obtaining consensus on what the airlift requirement really is during wartime. More than 150 studies in the last 15 years have proclaimed shortfalls in both intertheater and intratheater airlift and most people now recognize that we don't have enough airlift capability to deploy, employ, and resupply the combat forces this country possesses.

Major James Crumley, Jr.
Winter Issue Airlift Operations Review, 1983

Trying to answer the unanswerable, the United States has wrestled with the question of, "what is the national mobility requirement?" As Major Crumbly pointed out in 1983, numerous studies since 1968 have attempted to quantify the amount of airlift this nation requires to support national objectives. Yet, despite continual shortfalls throughout those years, the United States has reduced procurement of every major airlift system and cut funding to commercial airlift enhancement programs.[64] Fiscal and political reality has left airlift advocates frustrated in attempting to compete with domestic and "front-line" military systems such as fighters, bombers, tanks, and ships, which carry higher national priority.[65] More recently, the Department of Defense (DoD)

[64] James Crumley, Jr., "What's the Requirement?" *Airlift Operations Review*, Winter 1983, 21.

[65] Robert C. Owen, "The Airlift System: A Primer," *Airpower Journal*, Fall 1995, 5.

has conducted three major mobility requirement studies, each yielding the same results—not enough airlift to meet national needs. Additionally, the sole new airlift weapon system designed for the military in the last 20 years, the C-17, has also been delayed and procurement cut from an original purchase of 220 to 120 aircraft.[66] In order to understand this paradox and its implications, one must first be familiar with the components of the U.S. mobility triad and the factors that determine national mobility requirements.

The Strategic Mobility Triad

Comprised of sealift, airlift and prepositioned materials, each leg of the strategic mobility triad balances the strengths and weaknesses of the other, thereby, providing the necessary capability to meet national objectives.[67] Airlift provides speed and flexibility but has limited capacity and a higher delivery cost per mile. Sealift offers greater quantity or bulk at a reasonable cost but at an extremely slow delivery rate, normally weeks compared to hours for airlift.[68] Sealift is also constrained by port facilities that may be many miles from where supplies and equipment are needed. Unless collocated, resources must be delivered from the port to the crisis area by truck, rail, or air assets. Airlift's flexibility, on the other hand, enables it to utilize the airfield nearest the crisis, thereby, reducing and sometimes eliminating these additional transportation requirements. Prepositioning supplies and equipment around the world combines the speed of airlift with the bulk of sealift. Material is prepositioned either on land or afloat at sea. Prepositioning reduces transportation requirements and time since personnel can quickly be married with in-place equipment. The United States has prepositioned materials in Europe, the Middle East, and Korea and afloat in the Pacific and Indian Oceans.[69] Land prepositioning, however, relies on host nation support, is susceptible to

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[66] Military Airlift Command Office of History, *Anything, Anywhere, Anytime: An Illustrated History of the Military Airlift Command, 1941-1991*, (Scott AFB IL, 1991), 175.

[67] Congress of the United States, A Congressional Budget Office (CBO) Study, *Moving U.S. Forces: Options for Strategic Mobility*, (Washington D.C.: Government Printing Office, February 1997), xi.

[68] Ibid.

[69] Ibid., 35-40.

seizure by hostile forces, and requires planners to forecast conflict by geographic area. Prepositioning at sea reduces some of the "sailing" time, but is still constrained by port facilities. In either case, unless the crisis is collocated where the prepositioned materials are stored, additional transportation assets, albeit reduced, are still required. Furthermore, whether on land or at sea, prepositioned material must be continually maintained and is extremely difficult to upgrade for assurance of compatibility with current technology. Combined, however, each leg of the mobility triad provides the nation with a unique set of capabilities able to respond to various stages and types of scenarios.

Determining the airlift portion of the nation's mobility triad is an extremely difficult and complex task. A new national security strategy, a new strategic environment, new technology, changing national priorities, and political factors, all affect the assumptions and conditions that determine the proper balance of airlift assets. Planning factors, such as time, distance, load configurations, and the conformation and composition of the destination airfield can greatly influence the flow of airlift in response to a crisis.[70] The military procurement process also compounds this airlift dilemma. System design engineers focus their attention on firepower, speed, stealthiness, and agility but rarely consider whether the new system will fit into a standard cargo bay. Not accounting for airlift cargo constraints wastes precious space by not allowing side-by-side loading or forces the military either to disassemble part of the system or use its largest, but limited, transport aircraft; aircraft that are already in high demand.

Further complicating the airlift requirement equation is the increasing evolvement of U.S. forces in military operations other than war (MOOTW). How does one quantify the annual requirements required to respond to the entire MOOTW spectrum, from humanitarian assistance, to natural disasters, to peacekeeping operations? In addition, due to cutbacks, drawdowns, and restructuring, the services and most government agencies, are relying more and more on airlift as the preferred crisis response mechanism.[71] With today's smaller CONUS-based force structure, airpower's inherent speed and flexibility makes airlift the primary option available to react to world events.

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[70] Owen, 3-4.

[71] Ibid., 4.

Combined, all this has placed increasing demands on the airlift portion of the strategic mobility triad.

The Determinants

DoD determines the proper mix of airlift aircraft based on two types of capabilities: the ability to deliver cargo and personnel into a major theater war (MTW); and the ability to perform aerial delivery missions (the capability to airdrop personnel, supplies, and equipment into an area after flying long distances).[72] Cargo and personnel can be airlifted by both military and civilian aircraft, but currently only two military strategic airlift aircraft are certified to perform airdrop missions.[73] Additionally, national airlift requirements are estimated and planned by quantifying requirements in million ton miles per day (MTM/D).[74] MTM/D is a complex formula that accounts for aircraft factors such as speed, payload capacity, and maintenance reliability (see Appendix B for details). Quantifying airlift requirements by MTM/D provides planners with a quick comparison tool; however, MTM/D also includes several limitations. MTM/D, for example, ignores airfield infrastructure constraints, differences in types of cargo, and the wide range of mission scenarios.[75] MTM/D, therefore, is simply an unconstrained measure of airlift effectiveness. Nevertheless, MTM/D remains the mainstay of requirements planning since it provides national leaders with a quick quantifiable mechanism of comparison for airlift.

The strategic airlift fleet's ability to deliver cargo to a region also depends on the type of cargo required and how it is loaded onto or off of each aircraft. Cargo is classified as bulk, oversize, or outsize and is categorized as normal, rolling stock, or

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[72] CBO, 17-18.

[73] Currently, only the C-141 and the C-17 are certified for airdrop; however, AMC is in the process of certifying 33 C-5 aircraft for airdrop. Due to design constraints, none of the tanker or civilian aircraft are capable of airdropping cargo or personnel. For a more detailed explanation of mobility aircraft, see National Airlift Fleet, this chapter. Department of the Air Force, Headquarters Air Mobility Command, *1998 Air Mobility Master Plan (AMMP)*, (Scott Air Force Base, IL: 24 October 1997), 2-31.

[74] AMMP, 2-26 – 2-28.

[75] AMMP, 2-26. For a better discussion on MTM/D limitations and alternative airlift planning factors, see Adam J. McMillian, "Measuring Airlift Effectiveness in the New Millennium," (master's thesis, School of Advanced Airpower Studies, Maxwell AFB, AL.: 1999).

special cargo.[76] Bulk or general cargo is typically loaded on standard (463L) pallets or in cargo containers. Bulk cargo dimensions cannot exceed 88 inches wide, 104 inches long, and 96 inches high (7'4" x 8'8" x 8'). Any military or civilian transport aircraft can transport bulk cargo. Oversize cargo exceeds the dimensions of bulk cargo but is no more than 117 inches wide, 1,090 inches long, and 105 inches high (9'9" x 90'10" x 8'9"). Outsize cargo exceeds the dimensions of oversize cargo and is limited only by the cargo compartment or the aircraft's cargo loading door dimensions; it includes large bulky items such as an M1A tank or an attack helicopter. Most military aircraft and some civilian cargo aircraft possess the ability to transport oversize cargo while only two military aircraft can transport outsize cargo.[77] Finally, special cargo requires unique preparation and/or handling procedures; it includes hazardous materials, highly sensitive or classified equipment such as satellites, and nuclear weapons.[78] Special cargo requirements, as discussed in Chapter 2, dictate the requirement to be transported by organic military assets.

The method for loading cargo onto an aircraft is also a key factor when determining airlift requirements. All commercial wide-body transportation aircraft, as well as the military's aerial refueling aircraft, require special material handling equipment (MHE). MHE is used to elevate the cargo high enough to reach the cargo loading door located on the side of commercial aircraft. According to General Walter Kross, former Commander in Chief U.S. Transportation Command, the current complement of MHE is "the weakest link in the air mobility system."[79] Moreover, AMC's MHE is old, unreliable, and lacks the high-reach capability required for today's commercial and the

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[76] AMMP, 1-20 – 1-21.

[77] Oversize cargo is transportable on all military transport aircraft and the KC-10 tanker aircraft. Due to loading and weight constraints, civilian cargo aircraft can transport varying degrees of outsize and oversize cargo depending on the type of aircraft. For example, a Boeing 747-400 and a MD-11 freighter can carry 8% and 3% of the outsize and 72% and 54% of the oversize cargo requirements respectively. Smaller civilian cargo aircraft are even more limited. Mr. David L. Merrill, Senior Analyst, Requirements Division, Headquarters Air Mobility Command, Scott AFB IL., interviewed by author, 16 December 1998.

[78] AMMP, 1-21.

[79] Ibid., first page of Commander's Intent.

military's KC-10 aircraft. Recognizing this critical shortfall, AMC's second acquisition priority, behind the completion of the C-17 procurement, is the 60K or Tunner loader.[80]

The Tunner loader has the ability to lift 60,000 pounds and easily reach all civilian and military aircraft. AMC has funded over 250 Tunner loaders this year and has programmed the funds for the full procurement of 318 total loaders.[81] The Tunner loader is also fully transportable, enabling it to be airlifted into austere locations by military aircraft to facilitate mobility operations.

In contrast, the military's organic cargo fleet is equipped with internal loading ramps located in the nose or tail of the aircraft. These ramps reduce or eliminate the need to elevate cargo using special MHE.[82] Rolling stock cargo consists of wheeled or tracked pieces of equipment. By utilizing an aircraft's ramp system, rolling stock can be driven or rolled directly into the cargo bay of a military transport aircraft. This not only facilitates loading and unloading but also increases operational "throughput" by allowing more aircraft to be handled in a given time period. Possessing internal ramps, therefore, allows military transport aircraft to be processed more quickly as well as operate out of austere or remote locations that would otherwise be unavailable to commercial transport aircraft due to the lack of MHE.

Mobility Requirements Studies

In recent years, three major studies have shaped mobility requirements for the United States: the Congressionally Mandated Mobility Study (CMMS) in 1981; the Mobility Requirements Study (MRS) in 1992; and the Mobility Requirements Study Bottom Up Review Update (MRS BURU) in 1995. Each mobility study faced different international environments, security strategies, and force structures, yet each has highlighted two important conclusions. First, the United States' superpower status

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[80] Ibid., iii.

[81] Major Frederick "Fritz" Koennecke, Branch Chief, Mobility Systems Acquisition, Office of the Secretary of the Air Force, telephone interview with author, 14 January 1999 and AMMP, 5-79.

[82] Some MHE, such as a forklift or truck, is required to load palletized cargo but the internal ramps do not require the cargo to be lifted into the cargo compartment of the aircraft. More importantly, no MHE is required to off-load cargo since it can be pushed down the ramp on to the airfield if need be.

depends upon its ability to project military forces rapidly around the world. Second, there is great political and fiscal tension between funding strategic mobility assets or accepting the risk of focusing national resources on domestic or other "higher priority" military programs.[83]

Faced with an ongoing Soviet buildup of military forces in Eastern Europe and an unstable Middle East, in 1981 Congress stipulated the need to examine U.S. mobility requirements.[84] Completed by the Defense Department, the CMMS examined mobility needs based upon four "likely" scenarios in the Middle East and European theaters, one of which entailed conflict in one theater and a precautionary reinforcement of the other. Airlift was evaluated against a 1986 force structure that included enhancement programs of military and CRAF aircraft.[85] Concluding the nation did not possess enough mobility capability to meet these scenarios, the CMMS recommended a minimum 66 MTM/D of airlift, a figure well above the existing capability.[86] This figure, however, did not represent the "true" airlift requirement since the least demanding scenario studied required 83 MTM/D of airlift capacity.[87] To Congress, this amount of airlift was well beyond fiscal reality. The CMMS recommendation, therefore, was predicated upon what was deemed affordable vice what was actually required to achieve national security objectives. Nevertheless, the 66 MTM/D figure, although never achieved, became the mainstay of strategic airlift requirements throughout the Cold War.

The aftermath of the Cold War dictated the need to reexamine national mobility requirements. The 1991 Defense Authorization Act again tasked DoD to determine future mobility needs and to develop an integrated mobility plan.[88] The focus of MRS shifted national security strategy from a Soviet-dominated threat to an emphasis on major

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[83] CBO, 10.

[84] Anything, Anywhere, Anytime, 175.

[85] Miller, 371.

[86] MAC estimated the 1986 airlift capacity would be 46 MTM/D. *Anything, Anywhere, Anytime,* 175 and John T. Correll, "Anything, Anywhere, Anytime," *Air Force Magazine*, February 1996, 3.

[87] Miller, 373.

[88] Department of Defense, Joint Chiefs of Staff, *Mobility Requirements Study (MRS) Volume I* (U), (Washington D.C.: 1992), ES-1. (Secret) Information extracted is unclassified.

regional contingencies. Incorporating lessons from the Gulf War, as well as other factors such as coalition participation, overseas basing rights, and defense budget pressures, the MRS stressed the importance of maintaining the ability to react to an unpredictable environment stating:

> The uncertain and dangerous future world **will require more capability than the United States *possesses today*** to project a powerful force quickly to overseas crisis areas. … To support national interests, deployment capability must increase through expanded investment in sealift, prepositioning, and transportation infrastructure in the United States and in ***sustained investment in airlift.*** [emphasis added].[89]

Targeting the projected capability in 1999, MRS evaluated the ability to respond to two concurrent MTWs, beginning sequentially, and included a "moderate risk" caveat for mobility requirements.[90] Not facing the massive Soviet threat, the United States could utilize forward-deployed forces; personnel and equipment could now be moved from their European or Pacific bases to the crisis area instead of from the CONUS. By using deployed forces, the United States could lower mobility requirements. Incorporating all these factors and assumptions, MRS reduced the baseline airlift requirement to 57 MTM/D.[91] This minimum recommended amount of airlift capacity again fell well short of current capabilities at the time, but was deemed fiscally acceptable. The study also cautioned, however, that mobility capability prescribed might not be adequate to support national security objectives in some of the "worst case scenarios."[92] Attempting to reduce some of the risk, the following year, DoD completed a bottom-up review. This review included additional prepositioning equipment in the Korean and the Persian Gulf regions, the two most likely areas for conflict. Additionally, the bottom-up review emphasized a changed security strategy assumption, from concurrent MTWs to two

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[89] Ibid., ES-1 – ES-2.

[90] Ibid., ES-4.

[91] Ibid., IV-5.

[92] Ibid., ES-4.

nearly simultaneous conflicts.[93] Nevertheless, the national airlift target capacity remained at 57 MTM/D.

MRS BURU set the current mobility standard in 1995. It had two objectives: to determine if the United States possessed the strategic mobility assets to "execute and win two nearly simultaneous" MTWs; and determine what changes would be required in the strategic mobility triad.[94] Incorporating extensive computer simulations and a parallel warfare strategy, MRS BURU evaluated the force projection requirements based on four scenarios and a projected 2001 force structure.[95] Fully aware of defense cutbacks and drawdowns, the study team also examined three warfighting phases: halting, buildup, and counterattack. Due to its speed and flexibility, the dominant factor during the halt phase was airlift, since sealift "could not arrive in time to affect the halting phase of the fight."[96] A robust strategic airlift capability, therefore, was deemed essential for the time-critical opening phase of conflict. Once again succumbing to fiscal pressures, however, MRS BURU recommended a "moderate cost solution" to mobility requirements and lowered the national airlift requirement to between 49.4 and 51.8 MTM/D.[97] After analyzing the Army's ability to preposition equipment and supplies for two nearly simultaneous MTWs, DoD set the national airlift target at 49.7 MTM/D.[98]

National decision makers are once again faced with the dilemma of deciding how to bolster strategic airlift. Figure 4 below illustrates the current and programmed total (military and civilian) national airlift capacity and the levels dictated by the mobility requirements studies.

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[93] CBO, xv.

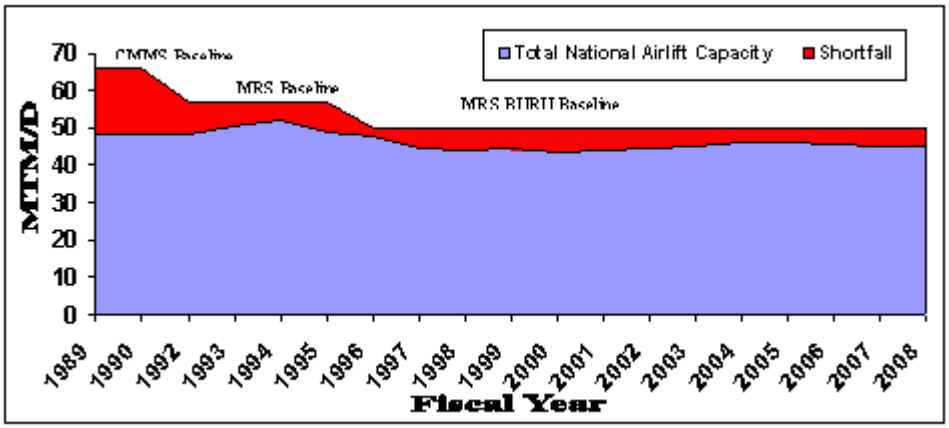
[94] Department of Defense, Joint Chiefs of Staff, *Mobility Requirements Study Bottom Up Review Update (MRS BURU)* (U), (Washington D.C.: 1995), ES-1. (Secret) Information extracted is unclassified.

[95] Ibid., ES-1 – ES-2.

[96] Ibid., ES-2 – ES-3.

[97] Ibid., ES-6.

[98] AMMP, 2-29.



Source: Studies and Analysis Flight, HQ AMC Plans and Programs

Figure 4. History of Mobility Requirements

If history is an indicator, this nation is at risk of letting one of its primary mechanisms of national power atrophy. The combined military and commercial airlift fleet cannot meet current or projected national needs. Resources are tight. The world has changed. Some would say that the airlift shortfall is not that big, after all, how is being a few MTM/D short going to affect the United States? Remember, however, that the mobility requirements studies determined the minimum capacity this nation requires in order to achieve national objectives. Before exploring the airlift shortfall in more detail, one must understand the strengths and weaknesses of the military and commercial components of the National Airlift Fleet.

National Airlift Fleet

> *Within a given airlift requirement, the characteristics of individual loads, distances flown, nature of destination airfields, and times available to complete or "close" specific movements usually vary greatly. ... No single aircraft type can efficiently carry all these loads, over all routes, into all possible terminals. An efficient airlift fleet, therefore, must be composed of several types of aircraft.*
>
> Colonel Robert C. Owen
> Former Chief, Joint Doctrine Branch, Headquarters USAF

Recognizing the tremendous need for a balanced air mobility network, the United States has built a National Airlift System comprised of civilian and military components. This system not only includes aircraft and crews, but also encompasses a worldwide enroute network. Consisting of command, control, communications, and computer systems, aerial ports, logistics and maintenance organizations, and military and civilian personnel, U.S. airlift assets depend on this robust enroute architecture for sustainment.[99] The focus of this section, however, is the diverse fleet of national airlift aircraft.

The United States' current airlift fleet is comprised of organically owned and operated military aircraft and commercially contracted domestic civilian aircraft participating the Civil Reserve Air Fleet (CRAF). In the opening paragraph of the National Airlift Policy, President Reagan outlined the purpose of the nation's airlift fleet:

> The national defense airlift objective is to ensure that military and civil airlift resources will be able to meet defense mobilization and deployment requirements in support of US defense and foreign policies. Military and commercial resources are ***equally important*** and ***interdependent*** in the fulfillment of this national objective [emphasis added].[100]

This statement highlights the synergistic contributions of both components of the nation's airlift fleet. Focusing on maximizing profits, the commercial airlift fleet is built to efficiently move large amounts of bulk cargo and personnel over long distances.[101] The military airlift fleet, on the other hand, consists of aircraft built specially for "military-specific" missions (see previous chapter). The National Airlift Policy, as discussed in Chapter 2, stipulates the use of commercial air carriers for all suitable military airlift needs. Although more flexible, military aircraft do not possess the cargo capacity or the cost effectiveness of civilian carriers.[102] Military aircraft, therefore, sacrifice efficiency for military

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[99] For a detailed study of these portions of the National Airlift System, see Christopher A. Kelly, "The Airlift System—It's More Than Just Hauling Trash," Research Report no. 86-1360 (Maxwell Air Force Base, AL: Air Command and Staff College, 1986).

[100] Ronald W. Reagan, *National Airlift Policy*, National Security Decision Directive Number 280, (Washington D.C.: 24June 1987), 1. See appendix A for the complete National Airlift Policy.

[101] Sanford S. Terry, *Strategic Airlift: Military Versus Commercial Aircraft*, CRS Report for Congress 94-455 F (Washington D.C.: May 1994), CRS-1.

[102] Ibid.

effectiveness. Combined, however, these assets provide the United States one of the prime sources of national power, rapid global mobility, which underpins her role as a world leader.

The Military Airlift Fleet

The current military strategic airlift fleet is comprised of the C-5, C-141, and the new C-17 cargo aircraft as well as air refueling tanker aircraft, the KC-10 and the KC-135. The KC-10 and KC-135, although primarily tankers, have a limited cargo capability. The end of the Cold War reduced the requirement for refueling long-range nuclear bombers, thereby, allowing some tanker assets to be used in an airlift role.[103] In this dual tanker-airlift role, each aircraft can carry their respective cargo capacity at the expense of an equal amount of fuel, consequently reducing their air refueling off-load capability.[104] The three main cargo aircraft, the C-5, C-141, and the C-17, were specifically built for the hard-core military missions outlined in the National Airlift Policy. Each aircraft possesses distinct military design features such as a "T-tail" and high-mounted wings (see fig. 5 next page). The T-tail helps facilitate loading by allowing cargo to be longitudinally loaded straight down the fuselage using an internal ramp system. Commercial aircraft, on the other hand, require cargo to be elevated into the air, loaded sideways through the side-mounted cargo door, then rotated to align with the fuselage (see fig. 8). This limits the size and length of cargo to the dimensions of the door area. The T-tail design also permits the military aircraft to perform the airdrop mission by moving the tail assembly out of the way of cargo and personnel. The high-mounted wing raises the wing and engine components in order to have better clearance over ground obstacles. This enables military aircraft to operate at austere airfields and improves ground maneuvering. More importantly, the high wing design lowers the aircraft's fuselage and cargo deck, thereby, allowing cargo to be loaded directly from a

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[103] AMMP, ix.

[104] However, due to the increased requirements placed on the tanker fleet by a CONUS-based force, removing these assets from the air refueling role can have a detrimental impact on combat and combat support operations required during war or for military operations other than war.

truck or other common loading platform directly onto the aircraft.[105] These unique design specifications, however, cost the military efficiency by adding weight, reducing cruise speed, and increasing fuel consumption.[106] Military aircraft, therefore, take longer to fly to an area and use more fuel than their civilian counterparts.

C-5

Figure 5. The C-5 Galaxy

The C-5 Galaxy is the largest military airlift plane and one of the largest aircraft in the world.[107] It can carry an average payload of 65 tons, up to 36 standard 436L pallets, and haul all types of cargo. Designed to move the largest pieces of military equipment, the C-5's nose and aft doors open to the full dimensions of the cargo compartment. The C-5 is also equipped with fore and aft cargo ramps and has the unique ability to lower its fuselage by "kneeling" (see fig. 5).[108] Also, the Galaxy's range can be extended through air refueling. The fleet consists of 76 older C-5A model and 50 newer C-5B model aircraft.

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[105] Timothy M. Zadalis, "Expanding the National Airlift Fleet: The Quest for a Civil-Military Transport" (master's thesis, School of Advanced Airpower Studies, Maxwell AFB, AL.: May 1997), 16-17.

[106] Fuel consumption is increased due to added weight and aerodynamic design penalties. For example, the C-5 ramp system alone adds 12,000 pounds to the aircraft. The added weight, combined with the military unique design features, adds an average fuel penalty of 15 to 20 percent over similar commercial aircraft. Mr. R. Steven Justice, Engineering Program Manager, Advanced Concepts Team, Lockheed Martin Aeronautical Systems, Marietta GA., interviewed by author, 11 March 1999.

[107] USAF Fact Sheet, *C-5 Galaxy*, on-line, Internet, 13 March 1999, available from http://www.af.mil/news/factsheets/C_5_Galaxy.html.

[108] CBO, 13.

C-141

Figure 6. The C-141 Starlifter

The C-141 Starlifter is the Air Force's primary core airlift aircraft. Built between 1963 and 1967, the C-141 was the first jet aircraft designed for "hard-core" military missions.[109] With an average payload of 23 tons, the C-141 can carry a maximum of 13 standard 436L pallets. The C-141 also has the ability to airdrop personnel and equipment.[110] The C-141 can carry bulk and oversize cargo but not outsize. The Starlifter's range can be extended through air refueling. The C-141 is being replaced by the newest airlift aircraft, the C-17. Final retirement for the C-141 is 2003 for the active duty and 2006 for the guard and reserve.[111]

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[109] USAF Fact Sheet, *C-141B Starlifter*, on-line, Internet, 13 March 1999, available from http://www.af.mil/news/factsheets/C_141_Starlifter.html.

[110] CBO, 13.

[111] AMMP, 5-22.

C-17

Figure 7. The C-17 Globemaster III

The C-17 is the newest most flexible airlift aircraft. The C-17 can carry an average payload of 45 tons (up to 18 standard 436L pallets) and has the ability to airdrop cargo and personnel.[112] Possessing the unique ability of backing-up and turning around via a 3-point turn, the C-17 can carry all types of cargo, including outsize, to small austere airfields around the world.[113] The C-17 also has the ability to be air refueled. The first Globemaster III was delivered in 1993 and the full procurement of 120 aircraft is due to be completed by 2005.

[112] CBO, 13.

[113] USAF Fact Sheet, *C-17 Globemaster III*, on-line, Internet, 13 March 1999, available from http://www.af.mil/news/factsheets/C_17_Globemaster_III.html.

KC-10

Figure 8. The KC-10 Extender

The KC-10 is a swing role tanker/airlift aircraft that can be used simultaneously to support aircraft refueling deployment and cargo transport.[114] A modified McDonnell Douglas DC-10 commercial aircraft, the KC-10 can carry 170 tons of fuel or an average payload of 55 tons of cargo (27 standard 436L pallets).[115] Some KC-10s may be air refueled but none can perform the airdrop mission. As with commercial cargo aircraft, the KC-10 requires special MHE in order to lift cargo high enough to reach the side loading door (see fig. 8 above). In the event of a conflict, DoD plans to use 37 of the 54 KC-10s for airlift missions.[116] Since the KC-10 is a modified commercial aircraft, it is an efficient and highly reliable aircraft. Designed with a service life of 30,000 hours, the KC-10 is programmed until 2043.[117]

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[114] USAF Fact Sheet, K*C-10A Extender*, on-line, Internet, 13 March 1999, available from http://www.af.mil/news/factsheets/C_10A_Extender.html.

[115] When used in the dual role, the KC-10's total payload, fuel and cargo, cannot exceed 170 tons. CBO, 13.

[116] Ibid.

[117] AMMP, 5-54.

KC-135

Figure 9. The KC-135 Stratotanker

The KC-135, the core air refueling aircraft, is a military version of the Boeing 707.[118] The KC-135 can carry 15 tons of cargo (6 standard 436L pallets) or 100 tons of fuel, not to exceed a combined weight of 100 tons.[119] The oldest strategic mobility aircraft, the KC-135 first entered the inventory in 1955 and is projected to remain active for another 15 to 25 years.[120] As shown in figure 6, the KC-135 also utilizes a side-loading cargo door which requires special MHE for loading and unloading operations. A highly efficient and reliable weapon system, the KC-135 boasts an 88 percent mission capability rating, the highest of all strategic mobility aircraft.[121] Consisting of over 500 aircraft, the versatile, efficient, and reliable KC-135 fleet has also been used for conversion to numerous other weapon systems, including the RC-135 reconnaissance

[118] USAF Fact Sheet, K*C-135B Stratotanker*, on-line, Internet, 13 March 1999, available from http://www.af.mil/news/factsheets/KC_135_Stratotanker.html.

[119] Ibid.

[120] The predicted service life span of 70,000 hours would allow the KC-135 to remain active for another 25 years. However, recent evidence of structural corrosion may reduce the life span of the fleet. AMC will conduct a study in FY 2000 with a target replacement date of 2013. AMMP, 5-51.

[121] An aircraft's mission capability (MC) rating is the percentage of time an aircraft is able to fly its mission—from takeoff to landing. General Charles T. Robertson Jr., "Global Mobility: The Keystone of America's Defense Strategy," lecture, Air Mobility Symposium, Robbins AFB, GA., 30 January 1999.

aircraft, the E-3 AWACS aircraft, the E-8 Joint STARS aircraft, and the Navy's E-6A TACAMO aircraft.[122]

The People

The training, operations, and maintenance of the air mobility fleet is the responsibility of Air Mobility Command. AMC operates under a "total force" concept, integrating active duty, guard, and reserve personnel into one effective team. As previously stated, the post Cold War environment has placed increased demands on this airlift team; AMC averaged 1490 missions per week in 1997 and 1643 missions per week in 1998, 10.2 percent mission increase in just one year.[123] In fact, AMC cannot accomplish its mission without the support of guard and reserve personnel and equipment. According to the Commander, Air Mobility Command, General Charles "Tony" Robertson, AMC relies on the Air National Guard and Air Force Reserve to provide 57 percent of all airlift assets.[124] As the single agent for U.S. global airlift, this synergistic team continually balances national mobility requirements for peacetime operations with those imposed by war.

The Commercial Airlift Fleet

Completing the United States' national airlift capabilty is the Civil Reserve Air Fleet. Created in 1952, CRAF is a voluntary program between the DoD and domestic passenger and cargo commercial air carriers. In exchange for incentives, civilian air carriers agree to supply aircraft and crews to supplement the nation's airlift capability during national emergencies.[125] In return for their evolvement, CRAF participants are

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[122] Susan H.H. Young, "Gallery Of USAF Weapons," *Air Force Magazine*, May 1998, 139-162.

[123] Robertson.

[124] Approximately 60 percent of the airlift aircrews, 54 percent of the tanker aircrews, and 55 percent of the entire maintenance force are guard and reserve personnel. See Robertson lecture and AMMP, 3-9.

[125] Lt Col Robert Halbert, Division Chief, Civil Air Division, Headquarters Air Mobility Command, Scott AFB IL., interviewed by author, 17 December 1998.

Figure 10. The CRAF

awarded DoD's peacetime passenger and cargo contract business.[126] This not only provides a source of revenue for the domestic commercial air carrier industry, but also relieves the military of having to own, maintain, and operate a large airlift fleet. Built for efficiently moving passengers and bulk cargo over long distances, the CRAF provides the United States with a diverse airlift capability which, handsomely complements the military's airlift fleet.

CRAF members earn Mobilization Value (MV) points based on the passenger or ton-mile capability of the aircraft they contribute to the program.[127] This allows for a fair comparison between commercial air carriers by normalizing the various types of commercial aircraft each company contributes to the CRAF. MV points, therefore, determine the carrier's "fair share" of the contract business they are awarded.[128] The more a commercial carrier contributes to the CRAF, the more DoD contract business they receive.

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[126] AMC contracted almost $700 million of business to commercial carriers during FY 98. This large contract business is only available to CRAF participants. Mr. Thomas James, Contracting Division, Headquarters Air Mobility Command, Scott AFB IL., E-mail to author 15 January 1999 <james.thomas@scott.af.mil>, and Halbert interview.

[127] The baseline aircraft is a Boeing 747-100 wide-body aircraft with the following characteristics: block speed of 465 knots and payload of 78 tons or 320 passengers. Halbert interview.

[128] Halbert.

The CRAF is implemented incrementally in three stages by the Commander in Chief, U.S. Transportation Command with Secretary of Defense approval.[129] Stage I provides the military with up to 82 long-range international passenger and cargo aircraft.[130] Once activated, civil carriers agree to respond within 24 hours. Stage II, normally associated with partial national mobilization due to an MTW, currently provides 274 aircraft and also includes a 24-hour response time. Finally, Stage III, activated in case of an extreme national emergency, has a 48-hour response time and provides the entire CRAF of 712 aircraft.[131] Since its inception in 1952, the CRAF was activated for the first time ever during the Gulf War. Stage I provided 17 passenger and 21 cargo and Stage II provided 77 passenger and 39 cargo aircraft to the Air Force during the Gulf War conflict.[132] CRAF Stage III has never been activated. For a more detailed description on the organization of the CRAF, see appendix C.

Commercial aircraft, as previously indicated, are designed to carry large payloads over long distances at the least cost, but are not as flexible as military cargo aircraft. Commercial aircraft cannot perform the airdrop mission nor are they designed to operate out of small austere airfields.[133] Aerodynamically efficient, commercial aircraft normally require longer runways to takeoff and land than military aircraft. The cost-efficient civilian airframes also require special MHE that elevates cargo in order to reach the side-mounted loading door. Commercial aircraft, therefore, are limited to airfields where equipment is available or require the military to deliver MHE before operations begin. Built for efficiency, however, the commercial fleet can carry more cargo longer distances when compared to military aircraft. They fly faster than their military counterparts and also comply with the latest International Civil Aviation Organization (ICAO) navigation and communications standards. Since ICAO standards drive industry requirements,

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[129] AMMP, 5-55 – 5-56.

[130] Participation in CRAF fluctuates. The numbers shown here represent the aircraft under CRAF contract as of 1 January 1999. Headquarters Air Mobility Command, "Civil Reserve Air Fleet (CRAF) Capability Summary," AMC HQ Form 312, (Scott AFB, IL., 1 November 98), 2 and Halbert interview.

[131] CRAF Capability Summary and AMMP, 5-55 – 5-56.

[132] CBO Study, 15.

[133] Terry, CRS-3 – CRS-4.

commercial aircraft are better equipped to use the world's air route system. Combined, therefore, the civilian and military national airlift fleet provides the United States with "global reach," enabling her to remain engaged as a world leader.

The Shortfall

> *Our basic national security strategy recognizes the importance of strategic lift and the need to reduce current shortfalls. The broad purpose of this directive is to provide a framework for implementing actions in both the private and public sectors that will enable the U.S. efficiently and effectively to meet established requirements for airlift in both peacetime and in the event of crisis or war.*
>
> President Ronald Reagan, National Airlift Policy

If the United States depends upon the strategic airlift assets as one of its prime sources of ensuring national goals and objectives, one must ask why is there an airlift shortfall? As Figure 4 indicated, the combined military and commercial CRAF airlift assets cannot fulfill national security requirements. National leaders have struggled with the political and fiscal realities of constrained budgets. Domestic program supporters are demanding more of the so-called post Cold War "peace dividend." This "rob Peter to pay Paul" mentality has created deep tension within the nation. Moreover, the world's strategic environment has dramatically changed. No longer inhibited by two superpower nations, tensions and conflicts have risen. Shouldering the responsibility as the sole superpower, the United States has committed resources all over the world. Whether conducting humanitarian assistance in Africa, disaster relief in South America, or enforcing peace efforts through combat operations in the Balkans and the Middle East, the United States has placed increasing demands on its airlift assets.

In an attempt to account for these changing conditions, the latest mobility requirements study incorporated the new defense strategy by placing more emphasis on the ability to execute two nearly simultaneous MTWs.[134] Unfortunately, the new national security strategy acknowledges the need to remain engaged in other smaller-scale contingencies concurrently. Also, MRS BURU did not account for key Defense Planning

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[134] MRS BURU, ES-1.

Guidance (DPG) requirements, such as airlift to support special operations missions. Nor did it include Illustrative Planning Scenarios (IPS) assumptions.[135] In order to correct these shortcomings, the DoD is currently conducting a new mobility study, Mobility Requirements Study 2005 (MRS-05). The final MRS-05 report is scheduled for submission to the Secretary of Defense by December 1999.

MRS-05 is predicated on the programmed FY 2005 force structure and integrates the DPG and IPS shortfalls of MRS BURU.[136] Attempting to find the proper balance between airlift, sealift, and prepositioning, this study will delve deeper into host-nation support and allied coalition factors. MRS-05 will also preserve a moderate risk level for warfighting effectiveness in order to keep requirements fiscally acceptable.

Continuing the three phase strategy of halting, buildup, and counterattack, DoD is also evaluating the impact of WMD and other NCA-directed missions such as a strategic brigade airdrop. MRS-05 is conducting a fort-to-foxhole look at mobility requirements, assessing asymmetric threats from CONUS bases and ports to the theater.[137] Each of these factors places more emphasis on strategic airlift since it is the primary focus of the time-critical halt phase. Preliminary estimates indicate that MRS-05 will recommend a minimum national airlift capacity of 55 to 56 MTM/D.[138] Figure 11 shows the increasing gap between national airlift capacity and national airlift requirements.

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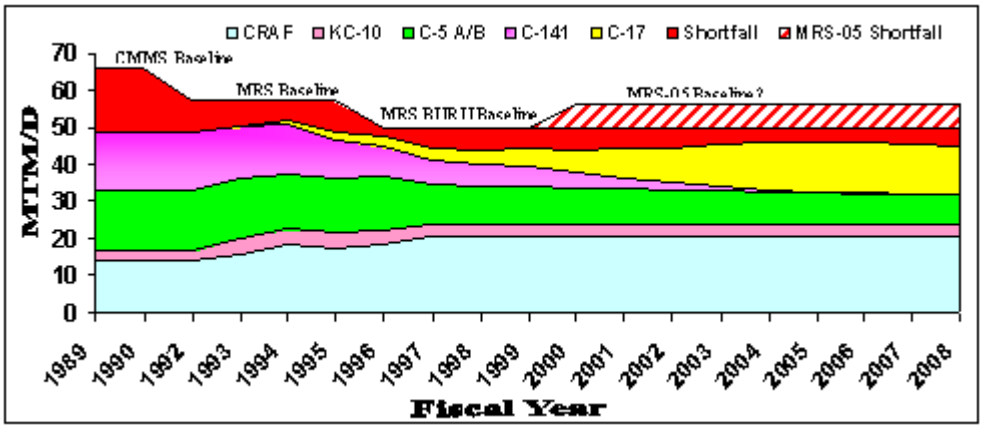
[135] Merrill.

[136] Ibid.

[137] Ibid.

[138] Koennecke and Merrill.



Source: Studies and Analysis Flight, HQ AMC Plans and Programs

Figure 11. Strategic Airlift Capacity

Accepting the national dependence on airlift, and despite drawdowns and cutbacks, this nation cannot afford to ignore the strategic airlift shortfall. The airlift portion of this nation's strategic mobility triad represents the cornerstone of national security. Responding with speed and agility, airlift is the key enabler in the halt phase of conflict. More importantly, airlift assets provide quick global access in order to shape and prepare an ever-changing world. The National Security Strategy requires the United States to remain engaged, thereby peacefully influencing world events. However, competition with domestic and other military programs have produced an airlift gap this nation can no longer afford.

Chapter 4

The Alternatives

For want of a nail, the shoe was lost; for want of a shoe, the horse was lost; for want of a horse, the rider was lost; for want of a rider, the battle was lost.

Benjamin Franklin

Benjamin Franklin's remarks drive home the tough realities facing this nation's decision makers. Competition over resources is intense. Some would say that the United States should take advantage of the "strategic pause" and focus domestically. Others would argue that the military should spend its dwindling resources on more technologically advanced systems such as smart bombs and stealth aircraft. Caught in this "lineman's syndrome," not being the star focus of the team has forced airlift advocates out of the limelight. The Air Force is focused on "high priority" items such as the F-22, the Joint Strike Fighter, and space systems, thus relegating airlift to the back burner. After all, the "airlifters" have the new C-17. The simple truth, however, is that unless the United States is planning to confront Mexico, Cuba, or Canada, no national asset can deploy and sustain operations without the national strategic mobility assets managed by Air Mobility Command.

A recent Air Mobility Symposium, sponsored by Georgia Tech University, highlighted the national dependence on airlift. Representatives from each service and the geographical CINCs overwhelmingly stressed the need for a robust, viable, and diverse airlift fleet.[139] Each stated their respective missions could not be accomplished without airlift. Despite repeated complaints, however, national leaders have ignored the growing

[139] The Geographical Commanders-in Chiefs represent the warfighting commands of the United States. Each CINC is given an area of responsibility to plan and prepare for conflict.

airlift shortfall. In order to examine this dilemma, this chapter explores five options, with their respective strengths and weaknesses, available to the United States. A table at the end of the chapter summarizes each option with respect to the following criteria:

-- Achieve National Objectives
-- Procurement Costs
-- Operations & Maintenance Costs
-- Upgrade Cost
-- Reaction Time
-- Speed and Range
-- Operational Flexibility (missions, type cargo, etc.)
-- Available Locations
-- Operational Risk
-- Impact on U.S. Economy.

Do Nothing

The United States could continue its present course and ignore the airlift shortfall. National leaders could assume more risk by accepting the airlift gap, after all, the deficit in Figure 11 is not that big—or is it? MRS-05 is currently attempting to validate national assumptions. Preliminary indications point towards an increase in the overall national airlift requirement. The nation's strategic airlift capability, however, may actually fall well short of the projected levels, further limiting the United States' ability to achieve national goals and objectives.

Historically, DoD's planning assumptions have been overly optimistic. MRS BURU assumed adequate warning time would exist for decision makers to begin airlift if a crisis should erupt.[140] Timely notice is critical, especially early in a conflict during the time-critical halt phase of operations, in order for national assets to be assembled, loaded, and sent. However, events such as the Gulf War highlight the uncertainties when dealing with an adversary. Iraq's invasion of Kuwait caught the national command authority off guard. Moreover, in a region like Korea, where North Korean troops are massed on the DMZ, adequate warning of an invasion may be far from reality. Assuming that decision makers would receive ample warning of a potential crisis is a poor assumption, especially for a nation whose strategy so highly depends upon airlift in the first few days of conflict.

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[140] Congress of the United States, A Congressional Budget Office (CBO) Study, *Moving U.S. Forces: Options for Strategic Mobility*, (Washington D.C.: Government Printing Office, February 1997), xvi.

Without adequate warning, planned airlift capacity may not be available, thereby limiting U.S. options.

The current operations tempo further exacerbates the airlift shortfall. The United States is and will remain engaged around the world. As previously mentioned, this strategy has quadrupled AMC's global taskings. Without ample warning, the Air Force would still not be able to provide critical airlift early since crews and aircraft would be unavailable for the first few days due to "routine missions" scattering them around the world.

Another time-limiting factor is AMC's total force structure. With over 55 percent of AMC's aircrews and maintenance personnel in the guard and reserve, AMC cannot perform its mission with active duty forces alone. Active duty personnel and equipment account for less than half of the military's total MTM/D capability, currently at approximately 23 MTM/D.[141] In the past, the military has relied on guard and reserve "volunteers" to fill airlift roles before presidential activation. However, due to increased commitments, guard and reserve forces are already heavily tasked, albeit voluntarily, worldwide. Activating the reserve component is a major presidential decision due to the impact on society. In fact, during the Gulf War, guard and reserve forces were not activated until 16 days after initializing the deployment.[142] Without ample warning, therefore, the United States may not be able to react fast enough to influence events.

The national airlift shortfall is also affected by the Air Force's Expeditionary Aerospace Force (EAF). Through this concept, the Air Force provides joint force commanders with an Aerospace Expeditionary Force (AEF), a tailored air and space force package capable of delivering decisive power within 48 hours of the decision to react.[143] As such, the AEF acts as the principle halting force, especially for short-notice crises. Able to respond to the full spectrum of conflict, the AEF provides the nation with a quick-reaction force for peacetime engagement to major theater war. According to

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[141] Department of the Air Force, Headquarters Air Mobility Command, *1998 Air Mobility Master Plan (AMMP)*, (Scott Air Force Base, IL: 24 October 1997), 2-29 – 3-9.

[142] CBO, 90.

[143] Major General Don Cook, "Evolving to an Expeditionary Aerospace Force: Concepts and Implementation," lecture, School of Advanced Airpower Studies, Maxwell AFB, AL., 26 November 1998.

Major General Don Cook, Director for EAF Implementation, the AEF concept requires the "full" support of U.S. strategic airlift forces.[144] Decision makers, however, must realize that strategic airlift is a national resource that is required by other services and governmental agencies, many of which carry a higher priority.

The problem, therefore, rests with the tendency to assume airlift will always be available for Air Force operations.[145] Light, lean, and lethal, the AEF depends on agile logistics and precision effects in order to influence an adversary. Through packaging, the Air Force hopes to reduce the total amount of airlift required to deploy when compared with today's procedures. Nevertheless, AEF units will require a significant amount of airlift to deploy, thereby reducing the overall amount available to the nation. Moreover, relying on just-in-time logistics further increases AEF strategic airlift needs since high-tech precision munitions and equipment require CONUS-to-theater sustainment airlift.[146] However, due to increasing global commitments and competing priorities, the required airlift assets may not be available to the AFE. Additionally, in order to reduce the high operations tempo of today's military, the EAF concept calls for rotation of forces every 90 days. Swapping forces adds a significant new airlift requirement not accounted for by national contingency plans. Since national assets are thinly stretched, especially tanker and airlift, an adversary could take advantage and commence hostilities during an AEF rotation. Ongoing studies are trying to determine the full impact EAF has on airlift, especially if a crisis should erupt during an AEF swap-out.[147] The bottom line, however, is that the EAF further taxes national airlift assets, thereby degrading an already deficient resource.

Next, overly optimistic planning assumptions, not accounting for the "fog and friction" of crisis execution, have also contributed to the overestimation of national airlift capacity. A RAND Corporation study based on the Gulf War, estimates the Air Force

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[144] Ibid.

[145] Major Kyle E. Garland, Chief, War Plans Integration, Headquarters USAF, Washington D.C., interviewed by author, 11 March 1999.

[146] Due to security and technology considerations, precision munitions and equipment cannot be prepositioned or stored overseas.

[147] Garland.

"may actually have as much as thirty percent less airlift capability that it thinks it does."[148] For example, planning factors called for a C-141 wartime payload of 25.6 tons; however, the C-141 only averaged 19 tons during the Gulf War.[149] This is common since Air Force aircraft tend to "cube-out" before reaching maximum payload capacity due to bulky military cargo. The study also indicates that by improving scheduling and increasing efficiencies, the Air Force can make up some, but would still not produce enough airlift to meet the nation's needs.

Further complicating the "inefficiency" issue is the reduced operational flexibility associated with the new C-17. Replacing over 260 C-141s with only 120 C-17s, significantly reduces the ability to respond to multiple taskings.[150] Being able to respond to multiple taskings is a requirement of the national security strategy. Thus, losing 146 "tails" in the system equates to about a 55 percent reduction in available airframes, thereby dramatically influencing where and when this nation can respond to rapidly changing world events.

Finally, national airlift capabilities are further reduced due to basing requirements on MTM/D. The MTM/D calculation used by DoD assumes optimum conditions, such as no delays due to weather, and does not take airfield capacity or host-nation constraints into account.[151] Realistic constraints by host nations, such as limiting the number of aircraft allowed into a country or restricting aircraft arrival and departure times, will have a dramatic impact on the amount of materiel delivered to a region. Furthermore, MTM/D ignores the physical limitations of airfields such as landing weight limitations and MOG, the maximum number of aircraft an airfield can service on the ground at any one time. This is like planning a commute to an important meeting and not accounting for bumper-to-bumper rush-hour traffic. Unlike rush hour, however, one cannot simple pull an aircraft off to the side and wait if the ramp is full and there is no place to land. This is an

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[148] John A. Tirpak, "Off-the-Shelf Airlift," *Air Force Magazine*, February 1995, 36.

[149] James K. Matthews and Cora J. Holt, *So Many, So Much, So Far, So Fast*, (Washington D.C.: U.S. Government Printing Office, 1998), 70.

[150] AMMP, viii.

[151] AMMP, 2-28.

unacceptable risk for a nation whose strength relies on its strategic airlift ability. Therefore, this nation cannot afford to continually ignore the strategic airlift shortfall.

Expand or Enhance CRAF

Another option available to eliminate the shortfall in strategic airlift is to expand or enhance the CRAF. The CRAF currently provides over 90 percent of the total DoD passenger airlift and 20.5 MTM/D of DoD's cargo capacity.[152] CRAF participants, therefore, comprise over half of the nation's total airlift requirements. The CRAF program is highly successful and efficient. During the Gulf War deployment and redeployment, the CRAF accounted for 62 and 84 percent of all passenger and 27 and 40 percent of all cargo movements, respectively, while flying only 20 percent of all airlift missions.[153] Nevertheless, CRAF expansion or enhancement also carries high risks and associated costs, especially in today's post-Cold War environment.

Although voluntary, the program is subject to the fiscal realities of a free market economy. As such, industry analysts fear loss of market shares to foreign and domestic non-CRAF members that may result from routine use. Growing over 10 percent in 1997 and forecast to maintain at least a 6.7 percent growth rate through 2015, the world cargo market is one of today's fastest expanding industries.[154] Competition is intense for new and existing routes and facilities. Activating the CRAF dramatically influences the carrier's ability to perform day-to-day operations. In fact, RAND determined that "national leaders tend to balk at calling up the maximum CRAF carriers because of potential disruption to the civilian economy."[155] Although motivated by patriotism and peacetime government business, CRAF members caution against too much reliance. Retired Lt Gen Malcolm B. Armstrong, Delta Air Lines Executive Vice President for

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[152] AMMP, 2-31. AMC has 30 MTM/D under CRAF contracts for FY98 but, due to fluctuating participation, only 20.5 MTM/D are used for planning purposes.

[153] Matthews, 37 and Lt Col Robert Halbert, Division Chief, Civil Air Division, Headquarters Air Mobility Command, Scott AFB IL., interviewed by author, 17 December 1998.

[154] Frances Fiorino, "Cargo Business Could Triple Thanks to Global Shipping Boom," *Aviation Week & Space Technology*, 23 March 1998, 62.

[155] Tirpak, 36.

Operations, stressed that Delta "will be there for the nation" but cautioned that the CRAF exists for national emergencies.[156] Activating the CRAF costs millions and could potentially cost Delta billions in lost revenue and market share. Thus, relying on the CRAF to pick up more of this nation's airlift requirements would be detrimental to the industry and the CRAF program.

Another option for eliminating the airlift shortfall is to increase current CRAF capacity through an enhancement program. An enhancement program would subsidize CRAF members for modifying aircraft in order to increase cargo capability. Modifications include heavier flooring and wider cargo doors in order to allow for heavier and oversize military cargo. Past experience, however, has proven enhancement programs extremely costly and inefficient.

The DoD implemented an enhancement program aimed at providing more oversize cargo capacity to CRAF aircraft in the late 1970s. The program consisted of retrofitting, at DoD's expense, wide-body passenger aircraft with a cargo door and a reinforced cargo floor.[157] Issues over funding in Congress, however, delayed the program for over eight years. Funding the cost of modification was one issue. But, due to small profit margins, industry also wanted additional compensation for reducing the fuel efficiency incurred as a result of the added weight of the conversion.[158] The program eventually led to the modification of 19 Pan Am Boeing 747s for a 12-year CRAF commitment. Pan Am was compensated $26.5 million per aircraft, up front, to modify and maintain, including added fuel adjustments, the converted 747s.[159] However, these aircraft were to be utilized only upon Stage III CRAF activation. Essentially, DoD was paying for some of the day-to-day operations in the commercial sector for a service it has never used in the 47-year history of the program. Furthermore, when Pan Am went out

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[156] Lieutenant General (ret) Malcolm B. Armstrong, "Delta Air Lines CRAF Program," lecture, Air Mobility Symposium, Robbins AFB GA., and interview by author, 30 January 1999.

[157] 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 Center, 1994), 32-33.

[158] Halbert.

[159] Priddy, 33.

of business, the aircraft were sold, many to foreign airlines, thereby depriving the Air Force of its investment.[160]

Finally, CRAF participants would not, nor should they, be asked to operate in hostile environments. Whether under peacetime contract or CRAF activation, the proliferation of WMD severely degrades commercial access to crisis areas. Civilian aircrews are not fully trained, nor do they possess the special equipment required, to operate in chemical or biological areas or from airfields where they may be subject to hostile fire.[161] In fact, during the Gulf War, several commercial carriers refused to fly into the area, especially once Scud attacks commenced.[162] There are severe legal and political ramifications associated with sending commercial crews and aircraft into hostile environments. Current AMC policy dictates that no civilian assets be used in potential hostile environments.[163] The bottom line is that this is the mission for military aircrews; operating in hostile environments is what the military is trained and equipped for and expected to do. This does not mean that the CRAF is not a vital part of the United States' strategic airlift capacity. But rather, should the CRAF be expanded to cover the nation's strategic airlift shortfall? As indicated, the risks and limitations associated with further expansion are simply too great for national goals and objectives.

Prepositioning

Prepositioning materiel, both on land and at sea, can save a tremendous amount of airlift sorties. For example, during the Gulf War, the Air Force's prepositioned fuel, ammunition, and equipment in Oman, Bahrain, and aboard three ships, saved over 3,500 airlift sorties.[164] Despite this effort, however, airlift into the region was unprecedented.

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[160] John A. Tirpak, "Airlift Moves Up and Out," *Air Force Magazine*, February 1996, 32.

[161] Today, plans exist for CRAF crews to be provided with protection equipment and chemical warfare "training" as directed by theater requirements. However, these ad hoc procedures do not substitute for the intense training required by military standards. Halbert and Armstrong.

[162] Department of the Air Force, *Gulf War Air Power Survey (GWAPS), Vol 3*, (Washington D.C.: 1993), 114.

[163] Mr. William Jones, Judge Advocate General, Civil and Air Law Division, Headquarters Air Mobility Command, Scott AFB IL., interviewed by author, 25 January 1999.

[164] GWAPS, 2.

Another benefit of prepositioning is cost. A 1997 Congressional Budget Office study estimated the cost of building warehouses or prepositioning ships and the price of protecting and maintaining it, especially with host nation support, would be less than the cost of associated airlift.[165] Prepositioning, however, also has several limitations and additional costs not accounted for by the CBO study.

First, not all material and equipment can be prepositioned. Perishable supplies, items with shelf lives, and certain munitions cannot be stored. Moreover, "technologically sensitive" equipment, in order to protect U.S. innovations, cannot be stored in other countries; the risk of compromise is simply too great, especially when the United States relies so heavily on maintaining an edge in technology. Furthermore, one has to question the "cost savings" associated with prepositioning.

Today's global environment requires the United States to be flexible and capable of rapid response anywhere national interests are threatened. Prepositioned equipment is fixed—both on land and at sea. True, sea-based prepositioning may be moved closer to a hot spot, *if* there is a nearby port facility available. In either case, on land or afloat, prepositioned material and equipment will still have to be moved from warehouses or port facilities to the area it is required, thus incurring additional costs not factored into the CBO study. Furthermore, prepositioned materials pose a lucrative target for potential adversaries. Knowing the strategic importance of prepositioning, adversaries would take great strides to deny its use through direct or asymmetrical means.

Further complicating the prepositioning option is the cost associated with the stored equipment. Where does DoD obtain the equipment—is it taken from current inventories, at the cost of training and readiness, or does one purchase additional equipment, thereby incurring additional costs? Moreover, how does the Untied States perform routine upgrades and maintenance on stored equipment?[166] Additionally, as technology advances, so does the equipment. Whether it is a simple "black box" or a

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[165] CBO, 42-43.

[166] Routine maintenance and upgrades include Time Compliance Technical Orders (TCTO). TCTOs are issued when a discrepancy is discovered that degrades performance or represents a hazard with using the particular piece of equipment. TCTOs require the entire fleet to be either inspected or repaired before resuming operations.

completely new piece of equipment, the costs associated with breaking out the prepositioned equipment for upgrades or replacement further closes the cost gap with airlift.

Finally, prepositioning material on land requires host nation support. Costs for land prepositioning can be reduced *if* the host nation agrees to pay for the buildings or help cover the costs of maintaining and protecting the facilities. Relying on a host nation, however, makes the United States susceptible to external pressures. Prepositioned materials can be used as a tool for host nations to leverage their political or economic interests. For example, during the 1997 crisis in Iraq over UN inspections, the United States found itself isolated. Strictly opposed to direct attacks, Middle East nations lobbied for peaceful solutions. Coincidentally, the prepositioning agreement between the United States and Qatar was up for renegotiation. A threat to cut off support or even a demand for removal of prepositioned materiel would have had dramatic consequences for the United States. All this doesn't say that prepositioning is not necessary; on the contrary, prepositioning is important, necessary, and a vital part of protecting national interests and the strategic mobility triad. The question, however, is whether to preposition more equipment instead of obtaining additional airlift. With today's security environment requiring speed and flexibility, combined with the risks of prepositioned materiel, additional airlift is the best choice for reducing the strategic mobility shortfall.

Purchase Additional Military-Specific Designs

The fourth option is to expand the current fleet of military airlift aircraft. This breaks into three components: purchase the "next generation" airlift aircraft, modify the C-5 fleet, or buy additional C-17s. Currently, industry is pursuing future concepts for airlift aircraft such as hypersonic designs or radically new aircraft shapes that provide the efficiency of commercial aircraft with the effectiveness of military airframes.[167] Although the commercial sector is exploiting current technologies while exploring new concepts, additional benefits are 15 to 20 years away at best. Additionally, the military procurement process, while consuming resources, takes about 15 years to bring a new

[167] Mr. R. Steven Justice, Engineering Program Manager, Advanced Concepts Team, Lockheed Martin Aeronautical Systems, Marietta GA., interviewed by author, 11 March 1999.

weapon system into service and then another 10 to 15 years to complete the full production cycle.[168] Moreover, the Air Force's newest airlift aircraft, the C-17, incorporates existing advanced technologies. Therefore, focusing resources now into the "next generation" strategic airlift aircraft is not feasible because it would not close the strategic airlift gap for a number of years while consuming vital Air Force resources.

Maintaining the unique ability to carry outsize cargo and, more importantly, the ability to airdrop men and equipment is vital to national security strategy. This burden falls on the soon-to-be-retired C-141, the C-5, and the new C-17 aircraft fleet. Currently, 50 percent of AMC's organic airlift capability resides with the C-5 fleet.[169] Since production of the "improved" C-5B ended in 1989, AMC is already looking to upgrade the fleet. However, due to the severe maintenance problems of the C-5, one must question the command's current decision to modify the fleet.

According to General Kross, former Commander, Air Mobility Command, C-5 performance is the worst in the command.[170] The fleet, comprised of 76 A-models, built between 1969-1973, and 50 B-models, built between 1986-1989, is the least reliable and most expensive to operate in the entire Air Force. The current mission capability (MC) rate is 61 percent for the A-model fleet and 70.7 percent for the B-models.[171] This MC rate is well below the minimum Air Force standard of 75 percent and the other AMC aircraft, which average between 80 and 92 percent.[172] Maintaining a high MC rate is extremely important, especially to mobility aircraft making several landings per day around the world. To put this into perspective, think of owning a delivery business with a fleet of vehicles that starts only 60 or 70 percent of the time. After one or two deliveries, one has to call a mechanic for repairs—an extremely poor business practice! In fact, it

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[168] In August 1981, the Air Force announced that McDonnell-Douglas had won the contract for the C-17. Ten years later, the C-17 made its maiden flight and the first production model was delivered to the Air force in June 1993. The first C-17 squadron was declared operationally ready in 1995, almost 14 years after awarding the contract. The full procurement of 120 aircraft is not scheduled to be complete until 2005.

[169] AMMP, Roadmap Section, 7.

[170] William Matthews, "Extend Life of the C-5 Fleet, Kross Urges," *Air Force Times*, 30 March 1998, 32.

[171] AMMP, Roadmap Section, 7.

[172] Ibid., 3-12.

takes "an average of 46 hours of maintenance to get one hour of flight out of the A-model aircraft."[173] More recently, while performing routine inspections, the Air Force discovered structural fatigue cracks in the tail assembly of the C-5.[174] Until the full extent of the problem is understood, the Air Force has placed numerous restrictions on the C-5 fleet, reducing its airlift capability. The problems associated with the C-5 fleet, especially the A-models, are simply too deep to continually spend precious resources for continually diminishing airlift returns.

In striking contrast, the Air Force's newest airlift aircraft, the C-17, is quickly assuming its role as AMC's core airlifter. Able to carry 102 troops, 36 litters of patients, or 18 standard pallets, the C-17 has quickly emerged as the premier airlift platform. During the 1995 Reliability, Maintainability, and Availability evaluation, the C-17 achieved an unprecedented 99.2 percent departure reliability rate and, since becoming operational, continually achieved at least an 85 percent MC rate.[175] The C-17's ability to deliver outsize cargo to small, austere locations or airdrop personnel and equipment makes it extremely well suited for today's strategic environment. Additionally, the C-17's ability to back up and turn around in tight places enables it to be off-loaded quickly, thereby increasing cargo throughput and reducing the amount of time the aircraft is on the ground. In an unconstrained world, the new C-17 is the ideal platform for strategic mobility. However, fiscal reality does have certain limits.

Currently about half of the projected 120 C-17s have been purchased. As such, the number one priority of AMC is to ensure total procurement and continue its transition into the fleet. Utilizing a multiyear buy for the remaining 80 aircraft, AMC reduced the procurement cost from $350 million per aircraft to $225 million per aircraft.[176] However, this is more than twice the cost of a commercial cargo aircraft. Furthermore, MRS

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[173] Matthews, 32.

[174] Message, R 282157Z Jan 99, Air Logistics Center, to Headquarters Air Mobility Command, et al., Horizontal Stabilizer Tie Box Inspection/Restrictions, 28 January 1999.

[175] General Charles T. Robertson Jr., "Global Mobility: The Keystone of America's Defense Strategy," lecture, Air Mobility Symposium, Robbins AFB, GA., 30 January 1999 and AMMP, 5-23.

[176] Tirpak, "Airlift moves Up and Out," 26 - 31. The Air Force is to spend $18 billion for the remaining 80 aircraft.

BURU failed to account for the NCA-directed requirements such as to support special operations.[177] As such, AMC is pursuing an additional 15 C-17s in order to fulfill the special operations mission specified in Defense Planning Guidance. Current projections indicate these aircraft should not cost more than $225 million each. However, the last of the initial 120 C-17s is due off the assembly line 2005. Due to the tight fiscal constraints and the six-year budget process, future money may not be available to keep the production line open. Allowing the production line to close, even temporarily, or providing DoD subsidies to keep the facility operating will increase the cost of any additional C-17s. In either case, the C-17 production contract must be renegotiated and, even if the price can be negotiated for the multiyear purchase price of $225 million per aircraft, the planes would not be available for many years.

Commercial Off-the-Shelf System

The final option available is to supplement the military airlift fleet with a commercial off-the-shelf (COTS) cargo aircraft. This concept, initially called the Non Developmental Airlift Aircraft (NDAA), was originally developed in the early 90s due to poor cost and schedule performance during phase II, Engineering and Manufacturing Development, of the C-17 acquisition. Forty C-17s were being built for phase II and, due to problems, alternatives were sought with respect to the remaining 80 aircraft. Attempting to leverage commercial industry, the NDAA promised a low-cost alternative to the DoD acquisition process. However, since this was an alternative for the C-17, DoD stipulated that the NDAA would have to be a "jumbo" cargo aircraft capable of carrying outsize cargo.

The NDAA study focused on a minimally modified Boeing 747 cargo aircraft. These "minimal" modifications included hardened decks and a flip-up nose and ramp system for ease of straight-in loading versus the side-mounted-cargo-door style loading of the commercial industry.[178] Consequently, the price for the NDAA alternative

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[177] AMMP, 2-29.

[178] Tirpak, "Off-the-Shelf Airlift," 34.

increased from under $150 to about $200 million per aircraft.[179] Nevertheless, after examining several options, the most cost-effective solution was an 86/30 mix of C-17 and NDAA aircraft.[180] This mix, however, did not allow for a full strategic brigade airdrop nor was it optimized for tactical airlift requirements and lesser regional contingencies in support of peace enforcement scenarios. These requirements were better met by the military-specific C-17. Ultimately, the Defense Acquisition Board decided to procure the fleet of 120 C-17s and no NDAA. Moreover, as previously indicated, the C-17s performance has been exemplary. Even with the full fleet of C-17s, however, the United States is still faced with a significant strategic airlift shortfall.

Notwithstanding the NDAA stigmatism, a true COTS aircraft would have several advantages in solving the strategic airlift shortfall. First, adding a fleet of commercial aircraft would not only close the airlift shortfall but would also solve the operational flexibility issue associated with reducing the total number of airlift aircraft available to the NCA. As a complement to the C-17, a wide-body commercial cargo aircraft, such as the Boeing 767-300 Freighter, could carry all bulk and a substantial portion of the oversize cargo requirements.[181] This would allow the C-5 and the C-17 to be used for the military's outsize cargo requirements. Additionally, a COTS aircraft adds flexibility by allowing the military to interface directly with the civilian airlift infrastructure. By operating the identical aircraft, the civilian sector's worldwide network of aerial port facilities and equipment could be tapped on a day-to-day peacetime basis or during times of national emergency. Furthermore, since the aircraft would be owned and operated by the military, airlift would be able to flow into threat areas that are politically and legally denied to our civilian partners.

Next, the aircraft could be immediately available since there would be virtually no research and development required. Truly leveraging the commercial cargo industry, an

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[179] Non Developmental Airlift Aircraft System Program Office, *The NDAA Report: An Application of Commercial Acquisition*, (Washington D.C.: 1994).

[180] Air Mobility Command Analysis Group, *Strategic Airlift Force Mix Analysis (SAFMA): A Tailored Cost and Operational Effectiveness Analysis for an Integrated C-17/Non-Developmental Airlift Aircraft (NDAA) Decision*, (Scott AFB IL., 1 November 1995), 13.

[181] As stated earlier, the Boeing 767-300 Freighter is used for comparison data only; further analysis between different commercial cargo aircraft is required before a true COTS platform can be selected.

aircraft purchased for military service would require only a hardened floor, wider cargo door, and an air refueling system; modifications currently available within the aircraft industry. Availability, therefore, would be limited only by current production schedules of the manufacturer. Incidentally, purchasing a commercial system will also benefit the civilian sector by keeping manufacturing and production lines open longer. Lastly, and most importantly, is the cost associated with a commercial aircraft. The "sticker price" of a new commercial wide-body cargo aircraft is less than half the cost of a military-specific system. Moreover, since the civilian cargo industry is profit driven, daily operating and maintenance costs of commercial aircraft are dramatically less than military aircraft (see the next chapter for a detailed analysis of the cost data).

As previously stated, a commercial aircraft is not without limitations. Built for efficiency, commercial aircraft require slightly longer runways for takeoff and landing compared to military aircraft. Additionally, commercial aircraft require MHE due to the side-mounted cargo door. However, commercial aircraft fly faster and have greater unrefueled range than military aircraft. Furthermore, the military has addressed the MHE requirements by purchasing over 300 Tunner Loaders, which can be lifted into austere locations (as currently planned for the CRAF). More importantly, a commercial aircraft offers great operational flexibility, access to the worldwide cargo infrastructure, and a purchase and operating cost that makes fiscal sense. Furthermore, the Air Force's airlift fleet is facing the long-term consequences associated with today's high operating tempo. Since aircraft age by flight time, the increased use reduces planned service life of military aircraft. In fact, the high operating demands of the Gulf War forced the early retirement of the C-141 fleet. Hence, adding a commercial system would dampen this burden, thereby providing long-term benefits to the Air Force. Therefore, the military would not only bolster national airlift capability with a relatively inexpensive system that complements its current fleet, but would also capitalize on reduced operating and maintenance costs due to the efficiency of commercial aircraft.

Summary

Today's strategic environment poses different criteria for additional strategic airlift. Military organic airlift, C-17 and C-5, has the capability to perform the unique

missions of delivery of outsize cargo and the ability to airdrop personnel and equipment. The problem today is that there is not enough capacity, especially when adding additional Defense Planning Guidance requirements such as the special operations mission. Additionally, the new strategic environment has placed increasing demands on airlift assets, dramatically increasing worldwide airlift operations. Security challenges have shifted from a Soviet-dominated threat to an asymmetrical challenge from non-state actors. The threat of WMD has curtailed half of this nation's strategic airlift capacity. Furthermore, with the reduced numbers of "tails" due to the C-141's retirement, the United States lacks the flexibility required to accomplish national objectives.

Table 1 below summarizes each option with the criteria listed at the beginning of the chapter. Point values for each criteria were assigned according to a 5 point scale:

1 if the option was poor, low, or most expensive

3 if the option was in the middle

5 if the option was best, high, or least expensive

Table 1. Summary of Alternatives

	Do Nothing	CRAF	PREPO	Mil Specific	COTS
Achieve Nat'l Objectives	1	3	2	5	5
Procurement Costs	5	2	3	1	4
Ops & Maint Costs	5	3	3	1	4
Upgrade Costs	5	5	2	1	4
Reaction Time	1	2	2	5	5
Speed/Range	1	4	2	3	5
Operational Flexibility	1	3	1	5	3
Available Locations	1	4	1	5	4
Operational Risk	1	2	3	5	4
Impact on U.S. Economy	2	1	5	4	4
TOTAL	**23**	**29**	**24**	**35**	**42**

As shown, the commercial off-the-shelf alternative yields the best results for the nation. Truly leveraging the commercial cargo industry, a COTS aircraft provides the military an economical solution to the strategic airlift shortfall. In doing so, the Air Force would gain a viable, efficient, and highly reliable cargo aircraft to compliment its current airlift fleet. Therefore, this paper proposes the procurement and fielding of COTS airlift aircraft, one not requiring extensive NDAA-type modifications, as the best solution to the national airlift shortfall.

Chapter 5

Recommendation

Civil industry created the original Air Force. Civil industry must maintain it. … Never follow the Mirage, looking for the perfect airplane, to a point where fighting squadrons are deficient in numbers of fighting planes.

H. H. "Hap" Arnold

If the United States is to maintain its ability to rapidly respond, protect, and engage—to pursue national goals and interests—she must bolster her national strategic airlift fleet. Today's rapidly changing environment requires the quick-reaction capability only airlift can provide. Airlift operations, whether responding for humanitarian assistance, natural disaster relief, or peace enforcement combat operations, have quadrupled within the last decade. Moreover, budget cuts, downsizing, and a CONUS-based force structure has forced the United States to rely more and more on airlift as the primary engagement mechanism. Yet, the post-Cold War world has placed increased demands on the military component of the national airlift fleet, creating a strategic airlift shortfall that is incompatible with U.S. policy and strategy. Hence, the United States must bolster the organic military airlift fleet. The best solution to the strategic airlift shortfall is a commercial off-the-shelf airlift aircraft.

Leveraging the commercial industry will provide the military with an efficient, cost-effective, and highly reliable airlift aircraft. Although not able to perform all of the "military-specific" missions, a commercial airframe would handsomely complement the military's fleet, providing the bulk, oversize, and special cargo capability that constitutes the majority of all airlift requirements. In doing so, the Air Force would be able to shift the C-5 and C-17 fleet to the outsize and airdrop mission scenarios. Moreover, this synergistic team within the military will best be able to respond to the wide variety of

threats and challenges, thereby, providing the United States with the quick reaction mechanism required to achieve national security objectives.

Additional Spin-Off Benefits

> *The military student does not seek to learn from history the minutiae of method and technique. In every age these are influenced by the characteristics of weapons currently available and in the means at hand for maneuvering, supplying, and controlling combat forces. But research does bring to light those fundamental principles, and their combinations and applications, which, in the past, have produced success.*
>
> Douglas MacArthur

Military requirements center on oversize and outsize cargo, however, threat scenarios also drive a need for increased bulk capacity. The most current mobility requirements study, MRS BURU, estimates that during the time-critical halt phase, cargo airlifted to the crisis will be 15 percent outsize, 55 percent oversize, and 30 percent bulk.[182] Moreover, due to the poor reliability of the C-5 fleet and the decrease in airlift airframes from the C-141 retirement, AMC currently lacks the outsize and oversize capacity required by MRS BURU.[183] AMC is in the process of conducting an Analysis of Alternatives study to determine the most cost-efficient solution to this shortfall. Interestingly, of all the alternatives available to solve this dilemma, DoD did not allow AMC to consider a non-developmental airlift aircraft or COTS airframe as an alternative.[184] Hence, AMC's alternatives include modifying some or all of the C-5 fleet, enhancing the C-17, buying more C-17s, or replacing the C-5 by purchasing more C-17s. Report results are scheduled to be presented to the Defense Acquisition Board in November 1999. However, one has to question the motives for disallowing what appears to be a most viable option.

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[182] Mr. David L. Merrill, Senior Analyst, Requirements Division, Headquarters Air Mobility Command, Scott AFB IL., interviewed by author, 16 December 1998. Also, preliminary indications from MRS-05, the on-going study, imply these percentages may change to 40% outsize, 40% oversize, and 20% bulk.

[183] Ibid.

[184] Ibid. Also excluded from the analysis is the procurement of a new strategic airlift aircraft and any modifications or enhancements to the CRAF.

A commercial wide-body cargo aircraft, such as the Boeing 767-300 Freighter, has the ability to deliver efficiently bulk and oversized cargo around the world, thereby allowing other military assets to handle the outsize cargo requirements.[185] The Boeing 767-300 Freighter can carry 121,000 pounds, 60.5 tons of cargo, over 3,700 nautical miles without refueling.[186] In comparison, based on a distance of only 2,500 nautical miles, the C-17 and C-5 can carry 45 and 61.3 tons, respectively.[187] An organic military commercial airframe would, therefore, provide a substantial increase in the military's MTM/D capacity and represent a viable alternative to the strategic airlift shortfall.

To illustrate, Table 2 below contains the strategic planning factors used by AMC to calculate MTM/D capability per aircraft (see appendix B for the MTM/D equation and definitions). This highlights the impact of adding a commercial airframe to complement the military fleet.

Table 2. Strategic airlift planning factors

	UTE Rate (surge)	UTE Rate (sustained)	Blockspeed (knots)	Payload (short tons)	Productivity Factor	MTM/D (per acft)
C-5A	10.0	8.39	409	61.3	.47	.1177
C-5B	11.4	8.39	409	61.3	.47	.1343
C-17	15.15	13.9	410	45	.47	.1314
C-141	12.1	9.7	394	19	.47	.0426
KC-10	12.5	10.0	434	32.6	.47	.0831
CRAF	10.0	10.0	465	78	.47	.1705
767-300	12.5	10.0	465	55	.47	.1503

[185] The author chose the Boeing 767-300 as an example solely for this paper—more research is required in order to examine all possible platforms, their limitations, and availability for military use. Furthermore, additional research is required to determine military specific cargo limitations due to civilian specifications vice military specifications.

[186] This equates to 24 contoured main deck and 7 lower deck pallets. Contoured pallets have rounded corners to fit the curvature of the interior of the aircraft and are the standard pallets used in commercial industry. Using square military-type pallets, 11 main deck pallets measuring 96x125x96 inches can be longitudinally loaded, thus reducing the total number to 18 pallets. Source: "Boeing 767-300 Freighter" http//www.boeing.com/commercial/767-300f/int.html (14 November 1998).

[187] Department of the Air Force, Headquarters Air Mobility Command, *1998 Air Mobility Master Plan (AMMP)*, (Scott Air Force Base, IL: 24 October 1997), 2-26 – 2-28.

NOTE: CRAF and the Boeing 767-300 blockspeed assumed a 3,500 nautical mile distance vice a 2,500 distance for the military airlift aircraft. CRAF payload is based on B747-100 equivalents. The 767s UTE rates were based upon the KC-10, a commercial airframe modified for military use, and the payload capacity reduced by over 6 tons to account for wartime loading constraints.

Source: Department of the Air Force, Headquarters Air Mobility Command, *1998 Air Mobility Master Plan*, (Scott Air Force Base, IL: 24 October 1997), 2-28. See appendix B.

As indicated, commercial aircraft offer greater MTM/D capability per aircraft than military airframes. However, one must remember the limitations, such as MHE, associated with commercial aircraft. Nevertheless, if the military decided to add a 767 Freighter to its inventory, a fleet of 60 aircraft would add 9.0 MTM/D airlift capacity. These four squadrons, coincidentally, would make up the current shortfall as well as help solve AMC's outsize/oversize cargo dilemma. Additionally, adding another one or two squadrons would cover the projected airlift requirements of the MRS-05 study.

Furthermore, one cannot ignore the 767's impressive reliability rate. Built for profit, commercial airframes must remain inservice in order to keep costs low. Of the top two all-cargo companies, United Parcel Service (UPS) is currently using the 767 Freighter.[188] Since UPS launched the 767 Freighter program in 1993, the fleet has maintained a 96 percent mission capability rate.[189] Additionally, commercial aircraft must be fuel-efficient in order to keep operating costs low. Table 2 lists the flying hour costs for four of AMC's mobility aircraft and the 767.

[188] The top two companies are Federal Express and United Parcel Service, each annually transporting more than twice the next closest competitor. "Leading All-Cargo Airlines," *Aviation Week & Space Technology Source Book*, 13 January 1997, 319 – 324.

[189] Mr. Greg Treitz, United Parcel Service, interviewed by author, 8 May 1998.

Table 3. Cargo Aircraft Operating Costs[190]

	HQ AMC FY99 (Cost/Hour)	Altus AFB FY 98 (Cost/Hour)	3rd Qtr 98 Costs (Industry Average) (Cost/Hour)
C-5	$8,965	$6,867	
C-141	$3,434	$3,147	
C-17	$5,081	$4,258	
KC-135	$2,178	$2,260	
Boeing 767			$2,915

Source: HQ AMC FY99 Channel Cargo Planning Factors; 97th Air Mobility Wing, Altus AFB OK.; and *Aviation Daily*, 16 February 1999.

Since the military and civilian sectors use different accounting techniques, direct comparison is difficult. AMC's cost data represents the forecast hourly operating cost based on: aviation fuel and oil, 40 percent of depot engine maintenance costs, cost of flying supplies, Depot Level Reparables (DLRs), and crew travel. Altus Air Force Base is the Mobility Training Center for all four aircraft. Comparing data from Altus normalized environmental and operational flying factors for each aircraft. Altus' data consisted of: aviation fuel and oil, flying consumables, and DLRs. Absent from this data is engine maintenance and, since training crews rarely travel, crew per diem. One can see the impact of high maintenance costs associated with the C-5 by comparing both military columns. The KC-135, though primarily an air refueling tanker, was included since it is a commercial aircraft that has been modified for military use, including airlift. Each Quarter, *Aviation Daily* publishes operating cost data provided by civilian carriers. This data consists of: aviation fuel and oil, rentals, insurance, taxes, airframe maintenance, engine maintenance, maintenance burden, and crew costs. Hence, civilian industry's operating costs are somewhat different and include such factors as insurance and taxes

[190] FY99 Planning Factors (Budget) Sheet, AMC/DORB, 29 September 1998 provided by Capt John D. Lamontagne, Civil Reserve Air Fleet Plans Officer, HQ Air Mobility Command Civil Air Division, AMC/DOF; Lt Col Richard Knapp, Chief of Staff, 97th Air Mobility Wing, Altus AFB OK.; and *Aviation Daily*, 19 February 1999 as provided by Mr. Jerry A. Fergeson, The Boeing Company, E-mail to Author, 6 May 1999.

unknown to and unpaid by the military. Furthermore, commercial air carriers have much higher crew ratios per aircraft and pay considerably more than the military, thereby incurring much higher crew costs. Subtracting the cost for crews, insurance, and taxes from the *Aviation Daily* data, the commercial industry's average hourly operating cost for the 767 is under $2,000.

As the last chapter highlighted, this data confirms the difference between a military airlift aircraft, built for effectiveness, and a commercial aircraft built for efficiency. Capable of longer distances and comparable payloads, but at under half the operating cost of the C-5 and C-17, a commercial aircraft would save the DoD a substantial amount of day-to-day operations and maintenance costs. Fiscal responsibility, therefore, argues for an efficient and reliable platform to complement the military strategic airlift fleet.

Additionally, a COTS aircraft would provide extra cost benefits in the private sector. Since the aircraft is already in full production, research and development costs have already been absorbed by the commercial sector. Moreover, since a COTS aircraft would already be rolling off the assembly line, there is no risk of cost overruns associated with most new systems. To remedy the immediate airlift shortfall, the only time constraint to fielding the COTS system is the current production schedule.

Commercial aircraft also use state-of-the-art navigation and communication technologies. The military's mobility fleet is currently faced with outdated equipment, which does not comply with Federal Aviation Administration (FAA) and International Civil Aviation Organization (ICAO) standards.[191] Environmental and navigation issues, such as noise restrictions and Reduced Vertical Separation Minima (RVSM), are forcing the Air Force to modify its aircraft. With air traffic increasing 5 to 10 percent per year, the Air Force must bring its airlift fleet up to ICAO navigation and communications standards or lose access to the prime global air routes.[192] Commercially available upgrade equipment normally costs the Air Force substantially more due to modifications required for military aircraft. In fact, AMC is planning on spending $5 billion to upgrade

[191] AMMP, 5-8.

[192] AMMP, 5-9.

the C-5 with new engines and avionics.[193] These upgrades are required to bring the C-5 up to noise and ICAO standards and will attempt to increase the reliability of the airframe. Unfortunately, the C-5 is plagued with more problems, such as poor hydraulics, that will require additional funds in order increase its reliability to "acceptable" standards. However, if the Air Force owned and operated a commercial aircraft, not only would the aircraft comply with all standards, future required upgrades would also be commercially available at the minimum cost to the government.

Finally, and best of all, is the price associated with commercial cargo aircraft systems versus military cargo aircraft. Built for competition with domestic and international manufacturers, commercial aircraft cost considerable less than their military counterparts. For example, a Boeing 767s "sticker" price is between $83 and $108 million, depending on the interior options and packages.[194] Without adding all the comforts and frills of the commercial industry but with the minimum military specifications, such as a reinforced cargo floor, industry analysts forecast a commercial wide-body cargo aircraft like the 767 would cost under $100 million per aircraft.[195] Boeing is indeed currently marketing a 767 Tanker-Transport dual-role aircraft with a price tag of approximately $100 million.[196] This non-negotiated price represents less than half of the multiyear C-17 purchase price.

Incorporating a COTS platform also offers several potential benefits and additional cost savings for DoD. First, the worldwide air cargo industry is booming. According to industry experts, long-term air cargo growth will average 6.4 percent per year through 2017.[197] The worldwide cargo infrastructure is rapidly expanding.

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[193] Merrill and AMMP, vi-viii and 5-28 – 5-34.

[194] *1998 Boeing Airplane* Prices, on-line, Internet, 14 December 1998, available from http://www.boeing.com/commercial/Prices/index.html.

[195] Mr. R. Steven Justice, Engineering Program Manager, Advanced Concepts Team, Lockheed Martin Aeronautical Systems, Marietta GA., interviewed by author, 11 March 1999.

[196] Mr. Robert G. Ford, Airlift and Tanker Division, the Boeing Company, Washington D.C., interviewed by author, 11 May 98.

[197] Frances Fiorino, "Cargo Business Could Triple Thanks to Global Shipping Boom," *Aviation Week & Space Technology*, 23 March 1998, 62 and *World Air Cargo Forecast*, on-line, Internet, 14 December 1998, available from http://www.boeing.com/commercial/cargo/index.html.

Moreover, U.S. carriers comprise eight of the ten top all-cargo companies.[198] Adding this growth to the existing industry provides DoD with an excellent market for dual-use contracts with domestic air cargo companies. Based on the CRAF model, MV points could be extended to include sharing of cargo facilities, MHE, and personnel around the world. For example, UPS and Federal Express each serve more than 200 countries and have established transportation hubs in Europe, Asia, Pacific, and Latin America.[199] Using these facilities, especially if flying identical aircraft, may yield considerable day-to-day operational savings. Having these facilities available during crises may also reduce operational constraints associated with airlift. Furthermore, the air cargo industry also provides a worldwide maintenance and logistical network for a COTS aircraft fleet. Especially with today's emphasis on outsourcing and privatization for increased efficiency and cost savings, a COTS aircraft offers a huge contract market available for contract or civil service maintenance organizations.

A COTS aircraft may also reduce training costs and help solve several personnel issues such as retention. With over 60 percent of AMC's aircrews in the guard or reserves, a COTS aircraft fleet would ideally fit the total force concept.[200] Reserve and Guard units would easily transfer from their C-141 airframe to the new aircraft upon its retirement. Additionally, large majorities of guard and reserve pilots are also civilian airline pilots. If the Air Force brings in a commercial aircraft, there would exist a large pool of already certified pilots. Moreover, since the aircraft would be identical, the Air Force can dramatically reduce training costs by recognizing the more stringent FAA certification instead of requiring a second qualification of a military-only aircraft.[201] Additionally, civilian proficiency requirements will also translate directly into military proficiency requirements since most of the activities (takeoffs, landings, etc.) are

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[198] "Leading All-Cargo Airlines," 319.

[199] *Who is FedEx?*, on-line, Internet, 5 January 1999, available from http//www.fedex.com/us/about/facts.html and *UPS at a Glance*, on-line, Internet, 19 March 1999, available from http//www.ups.com/about/glance.html.

[200] AMMP, 3-9.

[201] The FAA requires two physicals and two flight evaluations per year for captains and one physical and evaluation for first officers where as the Air Force requires one physical per year and a flight evaluation every 18 months.

identical. Virtually all of the training requirements for this dual airline/guard and reserve force can be reduced to only the military-specific events such as chemical warfare or air refueling training.

The Air Force is also struggling with poor retention rates. Not only are pilots getting out, but increased operations tempo has also affected the enlisted support personnel required to maintain the airlift fleet. This has dramatically affected Air Force readiness due to the reduced experience level of its personnel. The Air Force has instituted several incentive programs trying to encourage personnel to remain in the military. One such program is called Phoenix Aviator. Specifically targeting pilots, Phoenix Aviator provides senior pilots with funding to obtain commercial airline ratings and guarantees these pilots will fly their last 2-3 years of service in return for their 20-year commitment.[202] This ensures that they will be most qualified to apply for but does not guarantee employment as a commercial airline pilot. However, if the military operated a COTS system, airlines would be guaranteed a fully qualified pilot skilled in the same system the commercial sector operates. Furthermore, this program could also be extended to the maintenance force. In doing so, airlines would benefit by better predicting their hiring and training schedules. Finally, DoD can also gain additional savings by utilizing the COTS airframe for future aircraft applications.[203] As one can see, there are many potential benefits associated with a COTS aircraft that complements the current military fleet as one truly leverages the civilian cargo aircraft industry.

The Barriers

> *It is a doctrine of war not to assume the enemy will not come, but rather to rely on one's readiness to meet him; not to presume that he will not attack, but rather to make one's self invincible.*
>
> Sun Tzu

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[202] Lt Col Craig Vara, Chief of Staff Rated Management Task Force, Director of Training Division, Headquarters Air Mobility Command, Scott AFB, IL., interviewed by author, 7 December 1998.

[203] As the Air Force looks into the future, it must soon address the aging fleet of the C-9 aeromedical aircraft and the KC-135 air refueling aircraft. A COTS derivative for each of these roles would also provide future capability, flexibility, and affordability. As part of Delta's CRAF responsibility, they can configure a 767 into an aeromedical platform. Additionally, with the newest KC-135 being built in the early 1960s, Boeing currently has the plans for a 767 Tanker-Transport aircraft.

Instituting a change of this magnitude requires the removal of several political and bureaucratic barriers. First, and foremost, one must tackle the National Airlift Policy. Inherent within the need to protect and bolster the domestic commercial air industry, the National Airlift Policy stipulates the requirement for DoD to obtain contract business from CRAF participants.[204] Not disputing this objective, many DoD and civilian experts have interpreted this stipulation to imply that the military cannot own and operate a commercial off-the-shelf aircraft. Doing so would place the military in direct competition with the commercial air carrier industry.

Furthermore, the National Airlift Policy stipulates that the military should operate its airlift fleet at the minimum rate commensurate with training and readiness.[205] This ensures the longevity of military airlift resources. Thus, if the military increases the size of its fleet with a new aircraft, even the minimum use rates would require more day-to-day operations. This would increase the military's operating and maintenance budget, but more importantly, decrease the amount of airlift available for contract service.

The National Airlift Policy, however, does stipulate the need for the military to possess enough airlift assets required to perform hard-core military operations.[206] Specifically included in these types are missions that must be flown by military crews due to security threats. As stressed throughout this paper, the post Cold War strategic environment has transformed these threats. No longer a Soviet confrontation, the new challenge to U.S. assets is asymmetrical threats, especially from non-state actors. Bolstered by the proliferation of WMD, adversaries can easily deny commercial access to critical airfields and cargo facilities. To quote AMC's motto, "Anything, Anywhere, Anytime," this is a job for the trained professionals of the Air Force. Furthermore, this new environment has dramatically increased national airlift requirements at a time of reduced budgets. As previously stated, the high operating tempo has increased the military's airlift aircraft's utilization rate. Adding a commercial system to the organic

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[204] Ronald S. Regan, National Security Decision Directive Number 280, *National Airlift Policy*, (Washington D.C.: June 24, 1987), 2.

[205] Ibid., 1.

[206] Ibid., 2.

military fleet provides the military with an efficient, cost-effective system that dampens the use rates, thereby providing longevity to military airlift resources.

Critics of a COTS aircraft also quickly point to the fact that commercial cargo aircraft require MHE to load and unload cargo. This is especially important when operating out of austere locations. However, as previously noted, AMC has addressed this limitation by purchasing over 300 Tunner loaders. Assuming the worst case, where an existing infrastructure is not in place, civilian or military, these loaders are fully transportable. As part of the advanced package, the Tunner loader can be easily airlifted into remote areas on the C-5 or C-17, which, coincidentally, is AMC's current plan for using the CRAF.

Finally, commercial advocates argue that a COTS aircraft purchase would drive some CRAF participants away for fear of reduced contract business. However, according to Mr. Ronald Van Horn, AMC CRAF Program Manager, this is not a concern.[207] The new strategic environment has dramatically increased demand for airlift, and with the boom in the worldwide cargo market, it is projected to remain steady. Currently, AMC has much more passenger and cargo business available than CRAF participants are able to handle. The leading two domestic cargo carriers, Federal Express and UPS, posted annual revenue totals of $13.3 and $22.5 billion last year respectively.[208] Last year's $298 million DoD contract cargo business represents a small fraction for these companies. Moreover, as stipulated by law, DoD contract business cannot be more than 40 percent of a carrier's total annual business. Therefore, smaller cargo companies are also restricted in the amount of government business they can receive. All tolled, obtaining a non-developmental airlift system would enable the military to accomplish its mission without impacting the commercial industry. Adding an organic fleet of wide-body COTS aircraft, therefore, is the best, most cost-effective, and fiscally responsible solution to providing the United States the capacity and flexibility required to achieve national objectives today and well into the future.

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[207] Mr. Ronald Van Horn, CRAF Program Manager, Civil Air Division, Headquarters Air Mobility Command, Scott AFB IL., interviewed by author, 17 Dec 1998.

[208] Who is FedEx?, 1 and UPS at a Glance, 1.

Conclusion

This paper outlined the evolution of U.S. strategic airlift. Emerging in an environment of intense competition, the United States built a synergistic national team. Comprised of efficient civilian resources and effective military assets, the National Airlift Fleet contributed to the U.S. Cold War victory. Recognizing this new strategic environment, the U.S. changed to a national security strategy of engagement. However, the U.S. has also held on to a national airlift policy that is based on total mobilization for war. This policy-strategy mismatch is threatening the key characteristic that allows the U.S. to remain a superpower.

The United State's unique ability to deploy rapidly personnel and equipment anywhere around the world is an essential enabler of the national security strategy. Moreover, the rapidly changing world environment requires the United States to remain flexible, able to respond to the full spectrum of operations. However, this new environment poses higher risks due to the proliferation of WMD. Additionally, regional aggressors and non-state actors that rely on asymmetrical means to counter U.S. power have replaced the threat of "global war." These threats, due to political and legal constraints, deny the use of our civilian airlift partners. Therefore, the U.S. must bolster military organic airlift resources, thereby solving the current strategic airlift shortfall.

The choice is simple. As this paper has shown, of the options available to the U.S., adding a commercial off-the-shelf airlift aircraft is the most cost-effective solution. True, a COTS aircraft does not possess the capabilities of the C-17 and must rely on MHE. But, in today's rapidly changing, resource limited environment, one cannot justify the enormous cost of relying on only military-specific systems. Offering additional benefits of a worldwide cargo infrastructure, commercially available parts, and access to potential threat areas, a commercial platform provides the military the flexibility of a synergistic team. Thus, a COTS aircraft is the perfect complement to the military's current airlift fleet. Combining commercial efficiency with military effectiveness is a fiscally responsible solution to this nation's strategic airlift shortfall.

Appendix A

THE WHITE HOUSE WASHINGTON

June 24, 1987

NATIONAL SECURITY DECISION DIRECTIVE NUMBER 280

NATIONAL AIRLIFT POLICY

The United States' national airlift capability is provided from military and commercial air carrier resources. The national defense airlift objective is to ensure that military and civil airlift resources will be able to meet defense mobilization and deployment requirements in support of US defense and foreign policies. Military and commercial resources are equally important and interdependent in the fulfillment of this national objective.

Our basic national security strategy recognizes the importance of strategic lift and the need to reduce current shortfalls. The broad purpose of this directive is to provide a framework for implementing actions in both the private and public sectors that will enable the US efficiently and effectively to meet established requirements for airlift in both peacetime and in the event of crisis or war. Toward this end, the following policy guidelines are established:

1. United States policies shall be designed to strengthen and improve the organic airlift capability of the Department of Defense and, where appropriate, enhance the mobilization base of the U.S. commercial air carrier industry. An U.S. commercial air carrier is an air carrier holding a certificate issued pursuant to section 401 of the Federal Aviation Act of 1958, as amended.
2. The goal of the United States Government is to maintain in peacetime organic military airlift resources, manned, equipped trained and operated to ensure the capability to meet approved requirements for military airlift in wartime, contingencies, and emergencies. Minimum utilization rates shall be established

within the Department of Defense, which will provide for levels of operation and training sufficient to realize this goal.

3. The Department of Defense shall determine which airlift requirements must move in military airlift manned and operated by military crews because of special military considerations, security, or because of limiting physical characteristics such as size, density, or dangerous properties; and which airlift requirements can be appropriately fulfilled by commercial air carriers.
4. 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.
5. During peacetime, Department of Defense requirements 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. Consistent with the requirement to maintain the proficiency and operational readiness of organic military airlift, the Department of Defense shall establish appropriate levels for peacetime cargo airlift augmentation in order to promote the effectiveness of the Civil Reserve Air Fleet and provide training within the military airlift system.
6. Short-term airlift capability required to meet contingency requirements which might be considered minor surges shall be provided by increased utilization of aircraft in the organic sector, as well as by the increased utilization of the commercial air carriers regularly providing service to the Department of Defense.
7. United States Government policies should provide a framework for dialogue and cooperation with our national aviation industry. It is of particular importance that the aviation industry be apprised by the Department of Defense of long-term requirements for airlift in support of national defense. The Department of Defense and the Department of Transportation shall jointly develop policies and programs to increase participation in the Civil Reserve Air Fleet and promote the incorporation of national defense features in commercial aircraft. Government policies should also support research programs, which promote the development of technologically advanced transport aircraft and related equipment.
8. The Department of State and other appropriate agencies shall ensure that international agreements and federal policies and regulations governing foreign air carriers foster fair competition, safeguard important US economic rights, and protect US national security interests in commercial cargo capabilities. Such agencies should also promote among US friends and allies an appreciation of the importance of intercontinental airlift and other transportation capabilities, and work to obtain further commitments from such countries and foreign air carriers in support of our mutual security interests.
9. United States aviation policy, both international and domestic, shall be designed to strengthen the nation's airlift capability and where appropriate promote the global position of the United States aviation industry.

The Department of State, the Department of Defense, the Department of Commerce, the Department of Transportation, the Federal Emergency Management Agency, and the National Aeronautics and Space Administration shall provide leadership within the executive branch in implementing these objectives.

This directive replaces the Presidentally approved Courses of Action contained in the February 1960 Department of Defense study, *The Role of Military Air Transportation Service in Peace and War.*

/Signed/ Ronald Reagan

Appendix B

CALCULATING MTM/D[209]

The equation for MTM/D for one aircraft is:

$$\frac{\textit{Objective Utilization Rate} * \textit{Blockspeed} * \textit{Payload} * \textit{Productivity Factor}}{1{,}000{,}000 \text{ nautical miles (NM)}}$$

Objective Utilization (UTE) Rate: The average number of hours per day the primary aircraft authorization (PAA) fly and is measured over two periods: surge, the first 45 days of a contingency, and sustained, the time period thereafter. Surge UTE rate is used for MTM/D calculations.

Blockspeed: The average ground speed from takeoff to block-in assuming a 2,000 NM average leg distance.

Payload: The capacity in short-tons each aircraft can carry based on wartime loading.

Productivity Factor: Takes into account the aircraft flying empty from home base to positioning legs to onload locations as well as returning empty from the theater. Productivity factor varies with scenario distance. For a 7,500 NM, CONUS to SW Asia or Korea, the productivity factor is 47 percent (.47).

To illustrate, a 49 MTM/D requirement would equate to possessing the ability to airlift 7,000 short-tons of supplies and equipment a distance of 7,000 NM in one day.

[209] Department of the Air Force, Headquarters Air Mobility Command, *1998 Air Mobility Master Plan* (AMMP), (Scott Air Force Base, Illinois: 24 October 1997), 2-26 – 2-28.

Appendix C

Civil Reserve Air Fleet

- The CRAF is separated into passenger and cargo carriers and organized into five segments:

  - International
    - Long Range Segment: Aircraft with a minimum unrefueled range of 3,500 nautical miles
    - Short Range Segment: Aircraft with a minimum unrefueled range of 1,500 nautical miles

  - National
    - Domestic Segment
    - Alaskan Segment

  - Aeromedical Segment

- The CRAF may be activated in the following three stages:
  - Stage I – Minor Crises (24 hour response time)
  - Stage II – Major Regional Contingency (24 hour response time)
  - Stage I – Total National Mobilization (48 hour response time)

The largest segment of CRAF is the International Long Range. For the breakdown of currently contracted CRAF companies and their contributions to each CRAF stage, see tables C.1 – C.4 below:

Table C.1: International Long Range Segment Commercial Carriers

Long Range Passenger Carriers		Long Range Cargo Carriers	
American Airlines*	Northwest	Arrow Air*	Gemini Air Cargo*
American Trans Air*	Sun Country	Air Transport Int'l/Burlington*	Northwest Airlines*
American Int'l Airways*	Tower Air*	American Int'l Airways*	Trans Continental*
Continental	TWA	DHL	Evergreen Int'l*
Delta	United	Polar Air Cargo*	Tower Air*
North American*	World Airways*	Emery Worldwide	United Airlines
		Federal Express	UPS
		Fine Airlines*	World Airways*

***** Donates 100% of their fleet

Table C.2: International Long Range Passenger Aircraft Type per Stage

Aircraft Type	Stage I	Stage II	Stage III
A300-600ER			8
B757-200ER	11	15	23
B747-100	1	2	12
B747-200	12	28	40
B747-400		2	6
B767-200ER / 300ER	4	19	73
B777-200			3
DC10-10 / 15 / 30 / 40	2	21	80
MD-11	6	18	21
L1011-50 / 100/ 150 / 250 / 500	6	16	19
Totals	**42**	**121**	**285**

Table C.3: International Long Range Cargo Aircraft Type per Stage

Aircraft Type	Stage I	Stage II	Stage III
DC8-51F / 52F / 54F / 55F	1	2	15
DB8-61F / 62F / 63F	9	19	40
DC8-71F / 73F	3	11	30
DC8-62 COMBI		1	6
B747-100F	2	11	25
B747-200F	8	13	21
DC10-10F	1	1	35
DC10-30F/C	6	15	32
MD-11F	8	21	30
L1011-200F	2	4	8
Totals	**40**	**98**	**242**
Long Range Grand Totals	**82**	**219**	**527**

Table C.4: Total CRAF

Aircraft Segment Summary	Stage I	Stage II	Stage III
Domestic Services Cargo		0	0
Domestic Services Passenger		0	57
Alaskan		6	6
Short Range International Passenger		13	75
Short Range International Cargo		11	11
Aeromedical Evacuation		25	36
Long Range International Passenger	42	121	285
Long Range International Cargo	40	98	242
CRAF Totals	**42**	**274**	**712**

Source: Lt Col Robert Halbert, Division Chief, Civil Air Division, Headquarters Air Mobility Command, Scott AFB IL., interviewed by author, 17 December 1998 and Headquarters Air Mobility Command, "Civil Reserve Air Fleet (CRAF) Capability Summary," AMC HQ Form 312, (Scott AFB, IL., 1 November 98).

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