

Global Reach for Global Power/Strategic Airlift After Desert Shield

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GLOBAL REACH FOR GLOBAL POWER
Strategic Airlift After DESERT SHIELD

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IN MEMORIAM

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AIRLIFTERS
OF THE
433 MILITARY AIRLIFT WING
U.S. AIR FORCE RESERVE
Kelly AFB
San Antonio, Texas

KILLED IN OPERATION DESERT SHIELD
29 August 1990

EXECUTIVE SUMMARY

GLOBAL REACH FOR GLOBAL POWER

The United States has never acquired a strategic mobility capability equal to its goals and objectives. As a new world order dawns, the nation is still struggling to define an airlift goal. The Congressionally Mandated Mobility Study (CMMS) is no longer viewed as valid since the overall strategic concern about Europe has changed.

In 1990, the Congress directed an updated study, the Mobility Requirements Study (MRS), presently under way. Almost simultaneously, the Military Airlift Command was faced with its greatest challenge ever -- DESERT SHIELD. This operation tested MAC in ways never before accomplished. A look at DESERT SHIELD highlights several findings.

- ▶ Contrary to what some critics said, the U.S. airlift system was not overwhelmed by DESERT SHIELD.
- ▶ The number and capability of aerial ports of debarkation are critical to a smooth and sufficient (as defined by carefully prepared user requirements) airlift flow.
- ▶ Enroute infrastructure must be available that can support slightly greater flow than the theater needs.
- ▶ The Civil Reserve Air Fleet (CRAF) worked well during its first-ever call up. Some modifications of procedures can be expected.
- ▶ The capacity of the airlift system is presently overstated. Programming factors can be shown to be too high.
- ▶ Perceptions of the airlift system must be made more accurate through education and exercises.

The world for which the U.S. military must plan has three theaters that might adequately serve as a planning base for future airlift force requirements: Europe, Southwest Asia, and Korea. The first two appear to be the most volatile and demanding from a strategic viewpoint. The current direction of U.S. policy indicates that MAC should focus on meeting the strategic deployment needs of a Southwest Asian theater.

- ▶ A simplistic analysis of a Southwest Asian base case reveals an airlift requirement of, at least, 58 million ton-miles per day (MTM/D).

- ▶ Present procurement plans yield an airlift force capable of only 39.37 MTM/D in 2010. As a result, C-17 procurement should be increased to, at least, the originally conceived 220 airframes (PAA).

To properly support this airlift fleet, certain other measures are required.

- ▶ The entire deployment system must be routinely and thoroughly exercised.
- ▶ CRAF contracts must preserve a capacity of 18.09 MTM/D and a full wartime capability to carry out military missions.
- ▶ The airlift infrastructure must be made ready for deployments to likely theaters of operation.
- ▶ Europe remains a high priority theater for planning, even though not serving as the base case.
- ▶ The Air Force must develop doctrine for the intratheater use of the C-17.
- ▶ To make the most use of constrained airlift, the Army must: stop "lift growth;" develop doctrine and acquire materials handling equipment to support C-17 direct delivery missions; and, carefully balance land- and sea-based prepositioning.

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PREFACE

I was first assigned to Military Airlift Command (MAC) in 1982. My new colleagues wasted very little time informing me what the Army's definition of a "perfect transport" was:

The airplane is the size of the aircraft carrier Enterprise, flies as fast as the starship Enterprise, and needs no more room to land and takeoff than a UH-1 Huey.

An airlift system based on such an ideal airplane is many years away. Today we have to settle for C-141s, C-5s, KC-10s, a Civil Reserve Air Fleet (CRAF), and soon, the C-17. This paper will focus on what we can do with these more mundane resources over the next quarter century.

As an airlifter, I am prejudiced. I believe airlift is a national resource -- one that must be carefully evaluated and nurtured. I also enjoy flying these airplanes. I would love to fly the C-17; the thought of flying that huge airplane into a valley to land on a 3000-foot dirt runway is exciting. However, a multitude of reasons exists to buy that airplane other than exciting a bunch of airplane drivers.

Our nation's mobility structure, like our strategic nuclear structure, is built upon a triad: airlift, sealift, and prepositioning. This paper is about a single leg of that triad, but this should not imply a lack of concern over sealift or prepositioned resources. No single leg of the triad secures the nation, nor can one leg work in isolation. Airlift provides

speed advantages over sealift and flexibility not offered by prepositioning. However, it is the most expensive asset to buy. Therefore, the balance is hard to determine.

I am indebted to many for the help they have given me while researching and writing this paper. Richard Ziegler of the Boeing Company put me in contact with Major Jim Bates of the Headquarters, MAC Public Affairs Office. Jim provided a great deal of information, not the least of which was who to meet with at MAC and Headquarters, U.S. Transportation Command (TRANSCOM). Included on Jim's list were several people who provided key data and insights: Lt Col Bill Ewing, MAC Command Analysis Group (XPYS); Lt Col Greg Sahli, MAC Operations Programs Division (XPPP); Major Ron Bean, also of XPPP; Major Mark Fry, MAC Plans, Programs, and Budget (XPPB); Majors Randy Tibbs and Bonnie Page of the TRANSCOM Directorate of Operations and Logistics (J-3/4); and Lt Col Tom Cohoon and Major Dave Barrett, TRANSCOM Directorate of Plans and Programs (J-5).

My special thanks to Maj Gen Vernon J. Kondra, Deputy Chief of Staff for Operations and Transportation at MAC who provided a lengthy interview.

My trip to Scott AFB, Illinois to meet with Maj Gen Kondra and the TRANSCOM and MAC staffers was made possible through the Command and Staff College Foundation. I am very grateful to the Foundation for their help.

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As in any of my writing, I am in debt to my wife, Julie, who is a marvelous editor.

This work is dedicated to the memory of my father, A. Ernest Valliere, who passed away during its preparation.

ABBREVIATIONS

ACRA	Airlift Concepts and Requirements Agency
AOR	Area of Responsibility
APOD	Aerial Port of Debarkation
APOE	Aerial Port of Embarkation
AR	Aerial Refueling
ARC	Air Reserve Components
CFE	Conventional Forces in Europe Treaty
CINCMAC	Commander-in-Chief, Military Airlift Command
CINCTrans	Commander-in-Chief, U.S. Transportation Command
CMMS	Congressionally Mandated Mobility Study -- 1981
CONUS	Continental (or Contiguous) United States
CRAF	Civil Reserve Air Fleet
DCS	Deputy Chief of Staff
DoD	Department of Defense
DRB	Division Ready Brigade
FY	Fiscal Year
JCS	Joint Chiefs of Staff
MAC	Military Airlift Command
MOB	Main Operating Base
MPF	Maritime Prepositioning Force
MRC	Major Regional Contingency
MRS	Mobility Requirements Study -- 1991
MSC	Military Sealift Command
MTMC	Military Transportation Management Command
MTM/D	Million-Ton-Miles per Day
MTM/D/AC	Million-Ton-Miles per Day per Aircraft
NATO	North Atlantic Treaty organization
NM	Nautical Mile(s)
OPCON	Operational Control
PAA	Primary Aircraft Authorized
POMCUS	Prepositioning of Material Configured to Unit Sets
RDD	Required Delivery Date
SAAF	Small Austere Airfield
SAC	Strategic Air Command
SLEP	Service Life Extension Program
SWA	Southwest Asia
TAC	Tactical Air Command
TRANSCOM	U.S. Transportation Command
XOOTA	U.S. Air Force Air Staff Airlift Operations Branch
XPPB	Hq MAC, Budget Division
XPPP	Hq MAC, Operations Program Division
XPYS	Hq MAC, Command Analysis Group

CHAPTER 1

THE CHANGING WORLD

As we search for that correct balance we can neither adopt the unrealistic assumption that nothing has changed, nor adopt the historically naive presumption that everything has changed.

Secretary of the Air Force Donald B. Rice, 1990¹

For decades the United States built its national security strategy focused on two possible wars with the Soviet Union: a sudden nuclear holocaust or Russian hordes streaming through the Fulda Gap onto the German Plain. Countering the first possibility was the responsibility of Strategic Air Command and submarines of the U.S. Navy. The second fell to forces in Europe, U.S.-based reserves, and the mobility forces of the military.

The rule of thumb was that the United States needed to deploy "ten divisions in ten days" to the European continent in the event of war. The mobility triad -- airlift, sealift, and prepositioning -- was responsible for moving six of those divisions. Those units would deploy from the U.S. to join the four divisions "permanently" based in Europe. POMCUS (prepositioning of materiel configured to unit sets) minimized the airlift requirement created by such a mobilization. Sealift could not operate fast enough to play a role in the first ten days.²

¹ Donald B. Rice, "Global Reach, Global Power: The Air Force and U.S. National Security" (A White Paper) (Washington: Dept of the Air Force, June, 1990) p 3.

² Department of Defense, Congressionally Mandated Mobility Study (Washington: DoD, 30 April 1981) v. 1, p. 21.

The huge mobility requirement resulting from NATO reinforcement plans was never fully satisfied -- in all likelihood it never could have been satisfied. In the late 1970s, the entire mobility program was found to be awry. The subsequent critiques and suggested alternatives led to the Congressionally Mandated Mobility Study (CMMS) in 1981. This report set a "fiscally constrained" airlift goal at 66 million ton-miles per day (MTM/D). This capacity was well short of the computed European requirement. At the time, however, Military Airlift Command (MAC) possessed capability equalling less than half of the constrained goal.³ The resulting program to increase airlift capability was not complete when the nature of the world order changed.

The Fall of the Iron Curtain

The 1985 rise of Mikhail Gorbachev to power in the Soviet Union is generally viewed as the beginning of a dramatic change process. Ultimately it tore down the forty-year-old Iron Curtain from Stettin to Trieste. In only six years the map of Europe was once again changed: Germany was reunited -- The Warsaw Pact disbanded -- Democratically elected officials governed Poland, Czechoslovakia, Hungary, and other East European nations. In addressing the sensational changes, President George Bush put it this way.

[The] world is now changing. The decades-old division of Europe is ending -- and the era of democracy --

³ Government Accounting Office, "Military Airlift: Air Force Analysis Supports Acquisition of C-17 Aircraft," (Washington: GAO, March, 1987) p 2.

democracy building -- has begun. In Germany -- the divided nation in the heart of a divided continent -- unity is now assured as a free and full member of the NATO Alliance. The Soviet Union itself is in the midst of a political and economic transformation that has brought unprecedented openness -- a process that is at once full of hope, but let's face it, still full of uncertainty. [Emphasis added.]⁴

The world has certainly changed, but how? At Aspen, President Bush reminded us of the "uncertainty." While many have claimed U.S. victory in the long struggle with the U.S.S.R. that followed World War II, others are reluctant to do so. Among these restrained voices is General Cohn Powell,

Now I am neither a Cold Warrior nor do I want to pronounce the Cold War won. In fact, these and other similar shorthand terms no longer reflect the complex relationship that exists between the superpowers. We are not going to eliminate superpower competition from the world, and we must understand that...."⁵

The nature of these changes must underlie any thinking about strategic mobility and I will examine this at some length later. For now, it is sufficient to say that the world is changing and to accept some of the givens seen by others.

U.S. strategic airlift requirements have...been driven by scenarios involving conflict with the Soviets... [W]ithout the specter of Soviet Warsaw Pact threat, one could postulate that our current and future airlift forces would differ quite significantly from those we have and those we plan for the future.⁶

The stunning capitulation of communist authority that has swept through Eastern Europe and to a lesser extent in the Soviet Union...makes a significant

⁴George Bush, Remarks to the Aspen Institute Symposium, Aspen, CO. 2 August 1990.

⁵ This undated quote is contained in a collection of statements by senior military leadership distributed by U.S. Air Force Public Affairs officials.

⁶ Lt Col Neil A. Youngman, USAF, "Strategic Airlift Requirements After Conventional Armed Forces in Europe (CFE) Reductions," Paper to the Army War College, Carlisle Barracks, PA, 2 April 1990, p 2.

reduction in U.S. strategic and tactical programs inevitable.⁷

[We concluded]...that the U.S. could undertake a prudent, phased series of steps to reduce modestly our force presence in Korea, as well as Japan and elsewhere....⁸

As the faceoff among major world powers lessens, the potential for better-armed Third World countries to engage in short but highly intensive conflicts that, while not on the grand scale of a world war, are no less deadly for those involved. In many cases, these same conflicts will threaten United States' interests and will demand massive and immediate response.⁹

A Methodology

My study of airlift began with three basic questions:

- What will U.S. force structure look like in 2015?
- What will the most demanding, "base case," operations plan dictate as a deployment scheme for that force structure?
- What strategic airlift force best meets the needs of this base case plan?

To answer the questions I have set out to show where the strategic airlift force is today. A brief look at where MAC and its fleet of airplanes came from is useful in determining how today's force will evolve in the changing world. A current case study, airlift support DESERT SHIELD, follows the historical review.¹⁰ I will use this case study to analyze USAF assump-

⁷ Michael Mecham, "Democratic Progress in Eastern Europe Foreshadows Cuts In Strategic Spending," Aviation and Space Technology, Vol 132, No 12, March 19, 1990, p 64.

⁸ Lt Gen George I. Butler, USA, "New Direction in American Military Strategy," Speech to the Center for Defense Journalism, The National Press Club, 27 September 1990.

⁹ Air Force News Center, "Airlift Enhancement" (Kelly AFB: AF News Center, undated.) p 1.

¹⁰ I have chosen to lump all of MAC's operations in connection with the Iraqi War as "DESERT SHIELD." Hopefully, this will eliminate confusion between DESERT SHIELD, DESERT STORM, DESERT EXPRESS, and other operations surrounding the crisis in Southwest Asia [SWA].

tions concerning airlift capability and to determine exactly where the force is today. Finally, I will lay out the requirements to be fulfilled in the future. From these, I will describe an airlift fleet needed by 2015.

Definitions

Before continuing, certain terms must be defined as many do not have standard definitions, or the present definitions are currently evolving.

Strategic Airlift. Traditionally, strategic airlift has involved the movement of troops and materiel from a major airport in the contiguous U.S. (CONUS) to a major airport in the theater of operations, that is, from aerial port of embarkation (APOE) to aerial port of debarkation (APOD). With the advent of the C-17, large, long-range aircraft capable of flying from APOE to APOD also have the capability to land on small airfields closer to the front. Thus, strategic airlift can move its loads directly to an operating location. MAC calls this "direct delivery."

Realistically, strategic deployment by air has always included some delivery by aircraft to the ground force's operating location. A certain portion of deploying personnel and equipment flew on intratheater airlifters from major APOD to operating location. Prepositioned and seaborne cargo has been transferred forward in the same way.

For the purposes of this paper, "strategic airlift" is more accurately, "strategic deployment by air." It includes all

aerial legs from home base to final operating location. Thus, in looking at requirements, we must consider some of the functions traditionally called "tactical airlift."

Airports. This paper will address three types of airfields: aerial ports of embarkation (APOEs), main operating bases (MOBs), and small austere fields (SAAFs). "A MOB is an airfield that because of a combination of air traffic control, instrument approach aids, runway length and width, load bearing capacity, taxiway width and location, and parking area can sustain the flow of all types of aircraft."¹¹ In this paper, MOB will be used to denote an airfield with these capabilities in the theater of operations or one used for refueling operations outside the U.S. enroute to the theater. APOE will mean an airport with these capabilities in the CONUS used to onload troops and materiel.¹²

A SAAF "is an airfield that contains one or more restrictions which prohibit the flow of C-5s, C-141s, KC-10s, or CRAF aircraft but could sustain a flow of C-17s or C-130s."¹³ For our purposes, a SAAF is located in the theater of operations, reasonably close to the "front."

Measurement.¹⁴ The movement of cargo and personnel by air cannot be simply measured in terms of tons of cargo and numbers

¹¹ Lt Col Robert F. Ewart, USAF, "Wartime Airlift for 2000 and Beyond -- Today," Paper to the Army War College, Carlisle Barracks, PA, 23 May 1983, p 16.

¹² Most major CONUS-based military units with a requirement to deploy overseas rapidly are located nearby a suitable APOE.

¹³ Ewart, p 16.

¹⁴ For greater detail, see Appendix I, Statistical Analysis.

of passengers. The very reason airlift is used in a given situation, as opposed to sealift, is speed. How long it will take to move a unit of given size is dependent on the size of the airlift fleet, the capacity of individual aircraft, the speed of the planes, and the distance from APOE to APOD.

Airlift fleet capacity, therefore, is measured in terms of "million ton-miles per day (MTM/D)." A fleet capable of moving one ton of supplies a million miles in one day is said to have a capacity of 1 MTM/D. To measure airlift production during a given action, one simply multiplies each cargo weight (in tons) times the number of nautical miles flown and sum all flights flown. When divided by one million, the result is production in MTM. The average daily lift is total MTM divided by number of days of activity.

$$[(BlkSpd) \times (FlyHrs) \times (Pyld) \times (PF)] \div 1,000,000 = MTM/D/AC^{(1-1)}$$

$$(PAA) \times (MC\%) \times (MTM/D/AC) = MTM/D \quad (1-2)$$

Predicting fleet capacity is more complicated, and is for many reasons only an estimate. Each model of aircraft is assigned a "block speed," the predicted average groundspeed the airplane will maintain from takeoff to landing on each flight. An "average load" is assigned based on the aircraft's "allowable cabin load (ACL)," i.e. what can actually be carried given fuel load, center of gravity, etc. Average load is also based on an airplane's maximum payload and known patterns of equipment loading. The "productivity factor" is usually about 0.47 for

all airplanes (that is, slightly less than one half) to account for the plane flying empty on a return leg from APOD to APOE for reload. Perhaps the number most controversial in predicting fleet capacity is "utilization ('ute') rate." This is the average number of hours an airplane is expected to fly out of any 24-hour period. The product of block speed, average load, productivity factor, and ute rate is the predicted MTM/D for a single aircraft of a single type (MTM/D/AC). (See Equation 1-1.) This is multiplied by fleet size, or the number of "primary aircraft authorized" (PAA) to obtain fleet capacity.¹⁵ (Equation 1-2.)¹⁶

Having seen the methodology for computing MTM/D, what does it really mean? To move a single M-1 tank from Fort Knox, Kentucky, to Germany requires approximately 0.25 MTM. Four Abrams moved in one day to Europe, thus, takes 1 MTM/D capability.

Why is MTM/D used as the standard measure of airlift capacity? This measurement allows planners to plan for the "time value of military power." That is to say, a given unit of strength is more valuable on the first day of a crisis than on the fifteenth. As the 1981 Congressionally Mandated Mobility Study pointed out, "classic attack-defense ratios" cause planners to desire three times as many forces, or at least force

¹⁵ PAA is not the total number of aircraft of a given type purchased by the Air Force. It is, rather, the number assigned to the airlift mission. For example, the Major Aircraft Review of 1990 recommended 120 C-17s be purchased. Eighteen of these aircraft will be used for training crews and as "spares," aircraft available for airlift use in the event an accident eliminates another. Thus, the C-17 has an ultimate PM of 102.

¹⁶ The Air Force has effectively used a mission capable rate (MC%) of 100 percent in these calculations. For more on this see Chapter 4 and Appendix I.

equivalents, to regain territory lost to an enemy. If airlift can place a force in position soon enough to conduct a defense, the overall lift requirement may be cut be two-thirds.¹⁷ Thus, planners need to know how long it will take to get forces lifted to a given theater. Knowing MTM/D and the distance from CONUS (or other onload locations) to the given theater, planners can quickly estimate how long this will take for a given force.

Strategic airlift forces have a given capacity to deliver troops and materiel to a theater's various airports. This capacity and the doctrine controlling it has taken nearly the entire history of flight to develop.

¹⁷ CMMS, vol 1, pp 17-19.

CHAPTER 2

A BRIEF RETROSPECTIVE

The concept of a flexible, deployable, largely CONUS-based force -- a concept today advocated by many strategic analysts -- is not actually new. Studies in the early 1960s strongly advocated such a force posture to reduce the costs associated with overseas forces and increased U.S. flexibility. The result was the development of a true strategic airlifter -- the jet-powered C-141A Starlifter.

USAF Position Paper¹⁸

What has come to be viewed as "strategic airlift" did not simply burst forth a few days after the Wrights' success at Kitty Hawk. Indeed, it was until the 1960s that airlift concepts came to resemble those employed today. The evolution of airlift doctrine over the twentieth century is significant to any projection we are to make into the twenty-first century. This second chapter provides that background.¹⁹

The reader should note that throughout the history of military airlift in the United States resources have failed to match requirements. Doctrine, highlighted throughout the chapter, conceives operations far beyond the capability of MAC or any of its organizational predecessors. Some have said this mismatch results from the "white scarf syndrome." Airlift airplanes are not elegant, no white scarf can be seen blowing in

¹⁸ This is from a draft USAF position paper, "The Case for the C-17: An Air Force Perspective," (Washington: Department of the Air Force (SAF/OSX), September, 1990) p 11.

¹⁹ I will rely heavily on the best history of airlift I have run across, Lt Col Charles E. Miller's Airlift Doctrine (Maxwell AFB, AL: Air University Press, 1988). Sponsored by MAC, Lt Col Miller's work is partisan at times, but it is succinct and clearly written.

the wind. The imagination of the nation has been caught by fighters and bombers, just as sports cars and limousines catch the eye. The long-haul truck is viewed as a necessary inconvenience. The recurring questions have been: Who defines the necessity and how much inconvenience can we tolerate.?

Pre-World War II

In the early days of aviation, airplanes were too small to serve as strategic cargo and personnel carriers. While some units had "transport" missions, capacity didn't develop until the 1930s. Regardless, arguments already existed concerning the best way to utilize transport aircraft. These disagreements were largely wrapped up in other debates ongoing at the time. Interestingly, an early Army War College paper on airlift was actually an argument against bombers, "concluding that airplanes were good for nothing except transportation."²⁰

Commercial aviation, the budding airlines of the day, would actually lead development of transport aircraft. In the mid-1930s, former Secretary of War Newton Baker was asked to conduct a study of the Air Corps, especially its relationship to commercial aviation. The Baker Board would conclude the Air Corps should procure transports already developed for commercial aviation. Air Corps chief, Maj Gen Benjamin Foulois attacked this conclusion with arguments still heard today.

²⁰ Miller, p9.

- Commercial transports are built primarily for high speed passenger carrying with every attention paid to the comfort of the passengers.
- They are not designed to get in and out of small fields with heavy loads.
- Commercial transports are not designed to carry heavy concentrated loads of bulky articles which require large openings in the fuselage for loading and unloading purposes.
- The military cargo airplane should be designed primarily to carry heavy and bulky loads of freight with the comfort of the passengers distinctly a secondary matter.
- The military cargo airplane to be of real value to air units under service conditions must be capable of getting into and out of small fields which, in time of peace, would be considered only as emergency fields. This requirement called for lowering landing speeds, quick take-offs and the ability to clear obstacles safely, immediately after leaving the ground, during both daylight and night flights.²¹

Even at this early stage, fighters and bombers were seen as better investments for the Air Corps. Writers in both 1934 and 1937 could provide little rationale for buying new transport aircraft. Only 36 were purchased in 1938, none in 1939. Old bombers were converted to provide some transportation capability. Airlift was the "third child" receiving hand-me-downs: Its doctrine failed to reflect Gen Foulois' judgments.

World War II

The impact of World War II upon airlift was tremendous. At last, the Air Corps and the Army as a whole were forced to look

²¹ Miller, pp 5-7. Gen Foulois' comments are found in a more extensive quote from a letter to the adjutant general of the War Department.

at the capability available and to try to apply it to the situation at hand. The transition was dramatic:

In 1941, in fact, the concept of air transport as one of the principal channels of supply for the military forces in the field had not been fully grasped. Probably no one then foresaw that a network of long-range transport routes, supporting the daily movement of hundreds of tons of supplies and thousands of passengers, would spread over the world and that daily flights to such remote areas as the Aleutians, Australia, the Philippines, India, and China would become commonplace. Indeed, a limited view of the role of long-range air transportation in the war persisted for some months after the United States became an active belligerent. Not until the spring and summer of 1942, when large backlogs of supplies awaiting air shipment to the front began to build up at ports of embarkation and when it became clear that almost unlimited demands would be made in the future for air cargo space for the rapid movements of urgently needed materials and personnel, did the idea of air transport as a major instrument of logistics begin to take shape.²²

The realities and immensities of World War II insured the United States a vast airlift system. The development of this system also set in place several aspects that would remain characteristic of airlift for years to come. First, and foremost, air logistics was seen as an Army Air Force mission to support the Army Air Force first. Air Transport Command (ATC) ran a logistics mission -- long-range delivery of airplanes and cargo. It was quite different from "troop carrier units" who carried out tactical support for combat forces under the auspices of General Headquarters, Air Force. Occasionally ATC would augment tactical movements, but it was clearly a secondary

²² Air Transport Command historian, John D. Carter, quoted in Miller, p 30.

role. This split of missions paved the way for later developments and prioritization of airlift.²³

Arguments for a single-manager of airlift emerged during World War II as well. Some theaters were able to claim a disproportionate share of airlift simply because they got their point across. No central allocation by priority existed.²⁴

The system in place at the end of the war was one that still relied to a great extent on civilian aviation. General of the Army Henry H. Arnold gave his view of postwar airlift.

The size of the Air Transport Command should be such that, together with its reserve in the airlines themselves, it can pick up and carry one Army Corps to either Alaska or Iceland. With this concept of airpower, the Air Force must, at all times, be ready to utilize civil aviation -- personnel, aircraft, and facilities. This, therefore requires that civil aviation be kept as strong as possible and coordinated with the Air Force. [Emphasis added.]²⁵

The preceding quote is interesting from two perspectives: Firstly, it represents the attitude that would affect airlift for years to come; namely, military airlift works in conjunction with civil aviation. This reliance on commercial airlines would at times restrict military airlift development. The restrictions were put in place to prevent competition with the civilian market. While some of these decisions were sensible, airlifts progress would be hamstrung by the attitude.

²³ Miller, p 32.

²⁴ Miller p 41.

²⁵ General Arnold wrote in a 5 December 1945 Letter quoted in Miller, p 70.

The second point to be drawn from Gen Arnold's letter is his sizing of airlift capacity based on an Army troop movement. While this seems logical today, the troop carrier mission didn't drive requirements for well over a decade after Arnold wrote the message.

Postwar and Korea

During the postwar years airlift was a microcosm of the "roles and missions" debates going on through the military establishments. Indeed, much time between the end of World War II and June, 1950, was spent arguing airlift's role and its slice of the budget pie.

In 1946, a mission statement was issued for Air Transport Command. While the aim of this statement "was to keep ATC from competing with the emerging civil carriers, it had the effect of reducing ATC to a secondary role -- a role with a distinct... peacetime flavor."²⁶

Maj Gen Robert Webster, then in command of ATC, argued against this relegation. He accurately pointed out that peacetime air transportation could be conducted less expensively by the civil carriers. If ATC did not have a wartime mission specified, its existence could be called into question. The resulting revised statement included a mandate for "provision of

²⁶ Miller p 166.

strategic concentration, and support, by air, for the Army Air Forces and the War Department."²⁷

Despite the more clear cut mission, budgets failed to support airlift. In 1946, the Bureau of the Budget eliminated funds for new transports. The House of Representatives halved fiscal year (FY) 1948 procurement, only 27 C-97s and 36 C-119s were purchased. In 1949, the C-125B was placed on the chopping block in favor of B-36s. Some funds were authorized for continued procurement of the C-97 and C-119.²⁸

By this time ATC had become MATS, the Military Air Transport Service. The new name didn't help get funding.

The ever-tightening budgets of 1949 and 1950 had the net impact on MATS of achieving the mission statement it wanted, but not the resources, with the end result being a grossly unready force....

The [1951] war plan, ironically, was built on capability, not requirements. Since MATS had X number of aircraft, X number were tasked in the war plan. There was as yet not document that said MATS had X, but it needed Y....

The arrival of the Korean emergency showed the fallacy of such a peacetime ultra-economy-minded insistence on "cheap" airlift.²⁹

The early years of the 1950s were marked by the Korean War and beginning of thought concerning strategic deployment of ground forces by air. These two concerns became totally intertwined in airlift community.

²⁷ Miller, p 166.

²⁸ Miller, pp 162-63.

²⁹ Miller p 189.

Just before hostilities began in Korea, the Air Force and Army ran Exercise Swarmer which attempted to apply the lessons of the Berlin airlift to a strategic deployment concept. The war in Korea brought this concept and new technology much more to the fore. The new technology came in the form of the huge C-124 Globemaster.

This was in response to General Henebry's argument that if he had more modern aircraft with greater load capacities, he could do the same job with fewer planes and aircrews and less field congestion. The September [1951] test had a single C-124 make 26 flights to Korea, averaging 34,400 pounds of cargo, twice that of a C-54. Henebry asked for accelerated conversion from C-54s to C-124s, which he got in the autumn of 1952.

C-124s could lift huge amounts of cargo but could operate from only...[five airfields]...in Korea on a routine basis. Generally, the airplane needed a 7,800-foot airstrip, which did nothing for tactical needs. In fact, by replacing the C-54s that could operate into shorter fields, the C-124 put additional pressure on the C-46s and C-47s to pick up the difference, which in turn increased pressure on the redistribution system....

Troop carrier leaders were willing to accept...shortcomings [of the C-124 as an airdrop platform) because they were so dedicated to the idea of strategic deployment of the Army from the United States all the way to combat and because C-124s so enhanced their capabilities to deliver Army heavy equipment and large numbers of combat troops over long distances.³⁰

This evolving thought led General William H. Tunner, MATS commander and airlift legend, to propose a fleet of three types of transports that would bring together Army needs:

- A long-range, heavy-lift airplane for worldwide deployments.
- A medium-range, heavy-lift airplane for heavy equipment loads and airborne operations.

³⁰ Miller, pp 200-01, 212.

- An assault transport to access small, very austere airfields. General Tunner wanted to "create a philosophy...and drive technology to a solution."³¹

The procurement of new transports precluded rapid attainment of this airlift force. Solutions for what Lt Col Miller calls the "overwhelming lessons" for airlift from the Korean War went unfulfilled. While the military might not depend on the responsiveness of the civil airlines anymore, MATS was not given the force structure needed for a responsive peacetime base.³²

Eisenhower and Kennedy

Years of Massive Retaliation. Defense policy during the presidency of Dwight Eisenhower was based primarily upon the nation's nuclear arsenal. "Massive retaliation" became the watchwords -- any nation attacking U.S. interests faced the full power of America's nuclear arsenal.

While this nuclear retaliatory policy was barely credible at its inception, and would soon become incredible, it had the advantage of being economical. As it had been since World War II, the Air Force's Strategic Air Command (SAC) was the primary beneficiary of this concept. The Air Force planned to grow to 143 wings, a large percentage of which were assigned to General

³¹ Miller, p 216.

³² Miller, p 204.

Curtis Lemay's SAC. Even this huge force lacked airlift capability for its wartime missions.³³

The available airlift of the time was required, in large part, by SAC. According to 1960 war plans, during the first 20 days of a crisis, SAC and Tactical Air Command (TAC) claimed some 75 percent of the Air Force's organic airlift capacity.³⁴ SAC needed to have this capability because it was an era of strategic bombers before the B-52 existed. Without the tremendous range the Stratofortress would offer, SAC had to deploy around the world to meet its own requirements. It was only natural that in time of war further dispersal would take place, with a tremendously high priority. The advent of the B-52, the ICBM, and the expansion of the aerial refueling fleet would eventually lessen the requirement.

The 143-wing plan had begun before President Eisenhower took office. His moves to economize in defense spending led to a cut of six wings -- all of which would come from airlift forces.³⁵ Despite a growing concern in the Army that mobility requirements were not being met, little changed. The Army kept putting forward its needs, eventually shaping them around a desire to transport one to two divisions. The Air Force was relatively undisturbed. A July, 1957, report pointed out

The overriding policy objective was to "acquire and maintain in-being military air transport forces which,

³³ Miller, p 221.

³⁴ Miller, p 267. This comes from a Congressional report that found the Army, Navy, and Marine Corps virtually excluded from AF airlift and forced to rely on the Civil Reserve Air Fleet (CRAF).

³⁵ Youngman, p 5.

when augmented by civil air transport resources are qualitatively and quantitatively capable of providing airlift support required for successful implementation of war plans approved by the Joint Chiefs of Staff...."

[The Air Force] would discharge the airlift mission in consonance with its combat mission and within manpower and budget ceilings. That statement reflected the ambivalent position that airlift existed first to serve the Air Force's needs and that meeting greater DoD requirements would be met as budgetarily possible.³⁶

The battle for loosened budget constraints was a stiff one. At the same time the Army was beginning to militate for increased military airlift capability, the airlines were renewing their cry to limit that capacity to avoid competition. The year 1958 would prove important to MATS' future in quest for greater inventories.

During that year the Air Transport Association of America put out a statement suggesting the downsizing of MATS. The group contended that the combined civil airline fleet and MATS constituted a national air fleet. In the event of mobilization, all these airplanes would be available and sufficient. The Lebanon and Taiwan crises of the summer of 1958 proved this argument false. While Lebanon was met by MATS lift alone, cargo backed up enroute to the Pacific. When MATS sought civil bids, they received offers that were too costly. Worse, many airlines refused even to participate. The summer, after all, was the

³⁶ Miller, p 241.

height of the vacation travel business so lucrative to the civil carriers.³⁷

In light of these events, thought on the issue began to change in the Pentagon. Before Congress in May, 1959, Assistant Secretary of Defense for Supply and Logistics Perkins McGuire testified:

We must be ready to both those [Army and SAC) requirements that are compressed into the first few days following D-Day as well as the continuing need for sustained airlift support in the following days of a general war. In addition we must be prepared to meet the requirements for airlift in a limited war and in the emergencies of a cold war.³⁸

Flexible Response. The stage was now set for John F. Kennedy and the new strategy of "flexible response." The new president lost no time in putting forth his ideas on airlift. His first State of the Union address was clear.

I have directed prompt attention to increase our airlift capacity. Obtaining additional transport mobility -- and obtaining it now -- will better assure the ability of our conventional forces to respond, with discrimination and speed, to any problem at any spot on the globe at any moment's notice. In particular, it will enable us to meet any deliberate effort to avoid our forces by starting limited wars in widely scattered parts of the globe.³⁹

Two airplanes came to be viewed as the cornerstones to this new emphasis on airlift -- the C-141 and the C-5. Secretary of Defense Robert McNamara saw the C-141 opening "new vistas" of airlift. Army troops would now be moved "directly to the battle

³⁷ Miller, pp 242-43,251.

³⁸ Mr. McGuire's testimony is quoted in Miller, p 255.

³⁹ President Kennedy's address is quoted in Miller, p 276.

area overseas." Offloading from a strategic airlifter at "an overseas assembly point" and reloading on intratheater airlift planes would not longer be needed.⁴⁰ Of course, history didn't work in exactly this manner, but strategic airlift was now an integral part of national security policy. In 1965, MATS became the Military Airlift Command, consolidating all long-haul airlift assets. It would not become a specified command for several years, even though this had been supported by many for several years.

MAC's role in Vietnam was significant. The command established a continuous airflow to Southeast Asia. For many years MAC was virtually a military airline hauling cargo across the Pacific. The five percent of supplies that were carried on MAC aircraft were high-priority, time-sensitive ones. While the bulk of supplies moved, as they had in the past, by ship, MAC proved itself a vital channel of resupply. The primary lessons learned came in the area of intratheater airlift. These lessons were so serious that this mission was added to MAC in 1975. The Vietnam conflict never tested MAC's capability to rapidly deploy mass troops and equipment. Thus, little came from these years regarding strategic deployment or emergency airlift.

Modern Airlift

Two significant events occurred after Vietnam that have significantly colored airlift thinking in the United States.

⁴⁰ Miller, p 234.

These are Operation NICKEL GRASS and Exercise NIFTY NUGGET. NICKEL GRASS, the emergency resupply of Israel during and following the 1973 Yom Kippur War provided an actual test of capability. Even though NIFTY NUGGET was only a command post exercise, it proved, very dramatically, how restricted our deployment system was.

Several lessons were immediately obvious from the Israeli airlift, but four are of particular importance. The first was that airlifters needed to be capable of air refueling (AR). Earlier arguments that an all-jet force decreased dependence on island bases were generally true, but the extra flexibility from AR would have paid high dividends....

With aerial refueling, both aircraft [C-141 and C-5] could have carried more cargo, thus delivering more, faster, with fewer missions flown.

The second lesson was that the C-5, under attack for numerous design and cost problems, proved the value of having an airlifter that could carry heavy cargo loads and heavy military equipment and deliver them across long distances quickly. Third, the airlift fleet was put at risk. The U.S. Navy's Sixth Fleet provided air cover and radar coverage to keep the peace in the Mediterranean. But there was concern about terrorist attacks at Lajes, where the field was not secure, and about attacks from missiles stationed in Egypt. Fourth, the years of developing a highly mobile command, control, maintenance, and aerial port system for support of an airlift mission paid off.⁴¹

A fleet of large, jet-powered, aerial-refuelable aircraft coupled with a well-thought-out infrastructure was seen to have a great deal of capability. Was it enough? NIFTY NUGGET clearly said, "No!" There weren't enough airplanes, nor was the national mobility infrastructure sufficient to support a general war scenario.

⁴¹ Miller, pp 342-43.

In a nutshell, NIFTY NUGGET found deployment planning appallingly lacking. Multiple war plans could task the same CONUS-based unit. Army transportation plans didn't mesh with MAC airlift plans, nor with Military Sealift Command's (MSC) intentions for the seaborne portion of deployment. Prepositioned supplies were insufficient. No single exercise can claim NIFTY NUGGET's contribution to mobility planning or to the creation of U.S. Transportation Command (USTRANSCOM). A national, unified approach to mobility planning was seen as critical to solving the problems the exercise highlighted.

The first step to creating this unified approach was the creation of the Joint Deployment Agency (JDA). This organization was tasked with computerizing the nation's deployment plans and creating a system to logically combine them. Ultimately, a unified commander was seen as vital to bringing coherence to the nation's lift resources. Among the many reform efforts of the 1980s was the drive to unify all three of the military's transportation organizations. As a result of the 1986 Goldwater-Nichols Act, MAC, MSC, and the Army's Military Transportation Management Command were joined together to form TRANSCOM, whose commander-in-chief (CINCTRANS) could guarantee an effective coordination of effort.

CHAPTER 3

PLANNING AIRLIFT CAPABILITY

Any assessment of present and future U.S. strategic lift requirements and capabilities -- and the focus here is on airlift -- must start with recognition that the United States has never, in peacetime or in war possessed the necessary lift to meet its lift requirements.

Jeffrey Record¹²

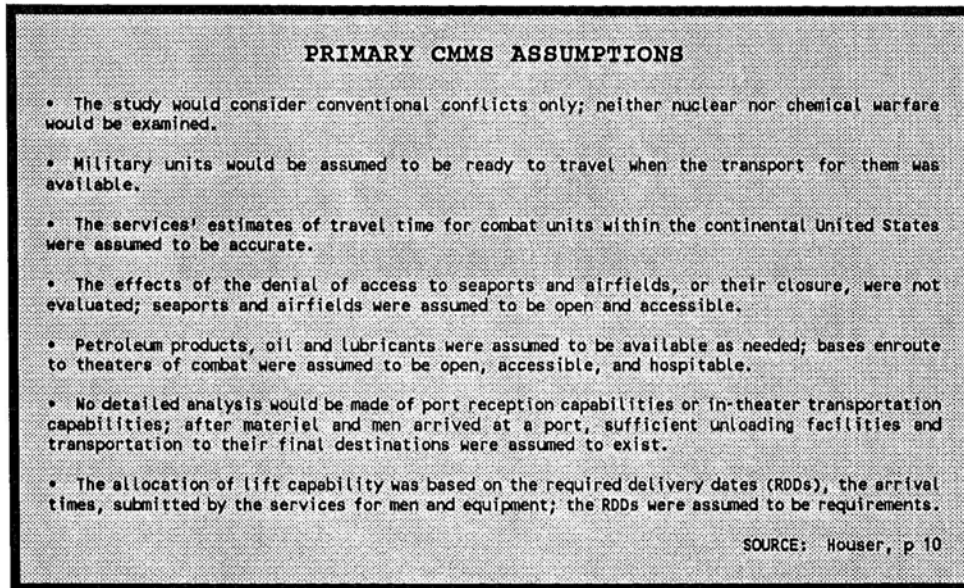
The single frame of reference for airlift, and other mobility, requirements, would be found in the 1981 Congressionally Mandated Mobility Study. This document would, for the next decade, answer the question, "How much is needed?" Coupled with the Reagan campaign pledge to rebuild America's military, CMMS would lead to MAC's Airlift Master Plan, the primary justification to buy more C-5s and new C-17s. Airlift capacity would be increased to 66 MTM/D, the "fiscally constrained" recommendation of CMMS.

The Congressionally Mandated Mobility Study

CMMS was conceived by congressional staffers and DoD analysts to respond to the Air Force's CX program, the development effort that eventually led to the C-17. In 1980, this program was floundering due to an ill-perceived requirement. The Air Force was unable to "sell" its need for the new airlifter to Congress. Indeed, Congress was suspicious of any new

⁴² Jeffrey Record, U.S. Strategic Airlift: Requirements and Capabilities (National Security Paper 2), (Washington: Institute for Foreign Policy Analysis, Inc., January 1986) p 13.

airlift program. Finally, the legislators told DOD that if further' CX funding was desired, a thorough, balanced mobility study was required.



The key aspects of CMMS were its careful analysis of assumptions and its weighting of timing factors in determining requirements. Every attempt was made to keep assumptions to an absolute minimum and to keep them realistic. The general acceptance of the report's findings indicates the analysts' success.

The success of the report was achieved only after heated staff debates over assumptions and, concurrently, over what scenarios to use to conduct the study. Airlift requirements are, almost by definition, scenario-dependent. The capacity needed for a war with Mexico, in terms of ton-miles per day, is far less than for a war in Southwest Asia, even for equal force requirements. The scenarios chosen had to be realistic given

U.S. interests in the world, probable sources and areas of conflict, etc. Different theaters required different aircraft capabilities, as well. Individual and organizational desires played a role.

Given the origins of the [CMMS] study, clearly at least one scenario needed to deal with southwest Asia and the Persian Gulf. Likewise, the possibility of a Soviet invasion of NATO countries formed a central theme of US military planning, and could not be ignored if the study's results were to be meaningful. The working group likewise examined a scenario involving northeast Asia which would require transport to Korea and Japan, and some thought was given to including a Central American scenario....

The members of the working group positioned themselves very carefully on the choice of scenarios. The C-X advocates, for example, wanted to limit the scope of the study's concern to southwest Asia. They knew from experience that mobility requirements generated by a NATO scenario would not establish the need for their airplane; they were equally sure that a Persian Gulf scenario would demonstrate the usefulness of a cargo plane which could land on short, austere equipped field. They lost the argument for narrow focus.⁴³

The four [resulting] scenarios were: a Soviet-backed indigenous force attacking Saudi Arabian oilfields; a Soviet invasion of Iran; a NATO/Warsaw Pact conflict; and a two-front conflict involving the Persian Gulf and a precautionary reinforcement in Europe."⁴⁴

The CMMS analysts worked very hard to find a method to evaluate the timing of force arrival in the scenarios' theaters. Eventually a suitable method was found which counted shortfalls early in a deployment more than shortfalls occurring later. This, of course, "supported the conclusion that, in building up U.S. mobility, priority should go to those modes -- primarily

⁴³ Schuyler Houser, "The Congressionally Mandated Mobility Study," Case Study for John F. Kennedy School of Government, Harvard University, 1987, pp 7-8.

⁴⁴ Youngman, pp 16-17. The first scenario listed is, in fact, a general description of the 1990 Iraqi invasion of Kuwait. Of course, Soviet sponsorship was less of a factor than CMMS analysts assumed.

airlift and prepositioning -- which would deliver troops and equipment early."⁴⁵ The analysts justified this approach:

If classic attack-defense ratios are applied in Scenario I, failure to meet the schedule for the approximate four divisions required in the first 25 days to face 5 enemy divisions could require a .15-division force to drive these enemy forces out at a later time. In Scenario II, the approximate 6-2/3 division force required to face as many as 13 Soviet divisions after 35 days could presumably have to be expanded to about 40 divisions to retake Southern Iran if it were lost. These forces are far beyond what the United States will have available during peacetime. The expense to recruit, train, equip, and maintain such forces would be large. Both the actual expense and the American disposition favor a relatively small, highly trained force which could be moved rapidly to any trouble spot in the world ... Consequently, programs that reduce early shortfalls are more valuable than those that make somewhat larger reductions at a later date.⁴⁶

Using these methods and assumptions, the lift requirements for the four scenarios were generated. Standard methodologies for flowing cargo and passengers into the respective theater and accommodating the required delivery dates established in the scenarios were used. Table I reflects the lift requirements established for the first fifteen days of each scenario. The ton-mile requirements shown are approximations based on average distances to Europe and SWA. They do not reflect any specific peaks in requirements caused by deployment timelines.

While CMMS is the most widely accepted mobility study up until this time, it does have detractors. Lt Col Neil Youngman points out some limitations of the study and its conclusions in an Army War College paper.

⁴⁵Houser, p 13.

⁴⁶CMMS, vol 1, pp 17-19.

CMMS LIFT REQUIREMENTS			
	C+5	C+10	C+15
Scenario I			
Pax ($\times 10^3$)	75.8	114.7	124.4
Tons ($\times 10^3$)	107.2	226.0	269.2
Adjusted Tons	63.2	164.8	199.4
MTM/D	88.5	115.4	93.1
Scenario II			
Pax ($\times 10^3$)	91.0	113.3	137.7
Tons ($\times 10^3$)	118.3	193.2	276.0
Adjusted Tons	74.3	132.0	206.2
MTM/D	104.0	92.4	96.2
Scenario III			
Pax ($\times 10^3$)	323.5	455.4	535.8
Tons ($\times 10^3$)	121.3	877.5	1097.2
Adjusted Tons	88.8	259.0	478.7
MTM/D	53.3	77.7	95.7
Scenario IV			
Pax ($\times 10^3$)	63.2	114.7	124.4
Tons ($\times 10^3$)	107.2	226.0	269.0
Adjusted Tons	63.2	164.8	199.4
NOTES:			
- Adjusted tons allow for prepositioning MPS and POMCUS. - Mixed theaters in Scenario IV precludes any approximation of MTM/D requirements.			
SOURCE: CMMS, vol 2			

Table I

First, the CMMS evaluated only the intertheater airlift requirements, and did not consider the requirements for reshipment by airlift, rail, or truck once equipment and troops arrived in a theater of operations...Secondly, the CMMS assumed unconstrained enroute basing and overflight rights, unlimited petroleum, oil, and lubricants (POL) support, unconstrained port throughput, and finally no loss of aircraft due to accidents or enemy action. Perhaps the ultimate caveat, however, is that the 66 MTM/D is not even the actual requirement that the study concluded was needed. The least demanding scenario actually required an 83 MTM/D airlift effort to meet delivery dates. The 66 MTM/D is in fact a minimum "goal" based, not on the requirements of the CMMS, but

on fiscal realities. In other words, it is an affordable goal.⁴⁷

Even this "affordable goal" represented a major increase in airlift capacity for the nation. To achieve any expansion, the Air Force had to plan its future.

The Airlift Master Plan

To increase its airlift capability, the Air Force took a number of steps in 1983, including buying 50 C-5 and 44 KC-10 aircraft. When these steps are completed around 1989, the Air Force expects to have a long-range airlift capability of about 49 MTM/day.⁴⁸

This 94-airplane buy combined with modifications to the existing C-5 and C-141 fleets represented an increase of 20 MTM/D in programmed capacity.⁴⁹ To increase total capability another 17 MTM/D the Air Force planned to purchase 180 C-17 airlifters. The master plan investigated several options including purchasing C-17s, buying additional C-5s instead, various retirement schedules for aircraft already in the inventory. It also looked beyond the immediate goal of achieving 66 MTM/D capacity and defined a way to maintain it.

⁴⁷ Youngman, p 17.

⁴⁸ GAO, "Military Airlift," p 2.

⁴⁹ The C-5A, produced in the 1960s and 1970s, had suffered a series of maintenance problems. The most serious of these was cracks in the wings. Concurrent with the production of new C-5B aircraft, during the 1980s Lockheed "rewinged" the C-5A fleet. The result of this program was virtually identical lift capacity for C-5As and C-5Bs.

The C-141 stretch program converted C-141A aircraft to the C-141B configuration by lengthening the cargo compartment and adding aerial refueling capability. Experience during the NICKEL GRASS airlift had proved the need for the latter. Operational experience with the Starlifter showed that the aircraft was more often restricted by space ("cubed out") than payload weight ("grossed out"). By lengthening the cargo compartment, therefore, the Air Force gained cubic space and, thus, useful payload.

The increased cargo capacity created by these two programs is included in the 20 MTM/D increase mentioned.

To achieve and maintain the 66 MTM/D goal the 1983 plan retired 54 C-141s by 1998, transferring the remainder between 1991 and 1998 to the Air Reserve Components (ARC). The C-17s to be purchased would be in the inventory by 1998. The 114 C-5s in the airlift inventory (PAA) were retained in a combination of active duty and reserve units. The CRAF was tasked to maintain 18.09 MTM/D cargo capability and 144.9 million passenger-miles per day (MPM/D) capability for the movement of troops.

The long-range portion of the plan called for all C-141s to be retired between 2010 and 2015. To replace their capacity for airlift, the acquisition of an additional 40 C-17s in either active or reserve programs was planned. CRAF and C-5 capacity would remain the same.⁵⁰

Throughout the plan's scope, the C-17 would use its capability to use SAAF to direct deliver cargo to forward areas and also to supply intratheater capacity to the warfighting commanders-in-chief. The airplane was, thus, being acquired with four purposes in mind: supplement the existing strategic airlift fleet to achieve 66 MTM/D capacity; replace the C-141 in the out years; supplement existing intratheater capacity, and; replace some older C-130s in the inventory.

Implementing the Plan

Of course, military procurement is never as easy as simply writing a master plan. The next several years were spent trying

⁵⁰ Headquarters, Military Airlift Command, Airlift Master Plan (Washington: Department of the Air Force, 29 September 1983) pp V-8 to V-11.

to get funding for the proposed fleet of 180 C-17s the Air Force said it needed.

The Airlift Master Plan had weighed the several options and concluded that the life-cycle costs of the C-17 justified purchase. Basically, the Air Force believed the new design to be cheaper, especially when factoring in the new transport's ability to use SAAF. Critics attacked this logic from several angles -- the actual need for direct delivery, the true costs of other alternatives, and the realism of C-17 performance forecasts.

C-17 critics most often cited the SAAF capability of the C-17 as either "goldplating" (an unneeded extra on a weapons system that might not even be used) or redundant. Even supporters of the direct delivery concept recognized the complexity of the issue.

Invariably, however, the question arises: what is the quantitative requirement for direct delivery? The answer to this question is a very complex "it depends." Because of the strong interrelationship with intratheater airlift..., and because (like the intratheater requirement) the direct delivery requirement is very situation dependent, nobody has been able to quantify the direct delivery portion of the airlift requirement. How many forces direct delivery will move depends on such factors as the number (and type) of divisions being moved, the availability of logistical bases in the objective area, alternative transportation modes available, and the amount of time available to put the units in place. Again, taking a systems approach to the requirement (and considering the worldwide inter- and intratheater requirements) will significantly impact every decision.⁵¹

⁵¹ Maj James N. Soligan, USAF, "Direct Delivery," Paper to the Air Command and Staff College, Maxwell AFB, AL, 1985, p 19.

At the time of CMMS, the intratheater airlift issue, upon which much of the direct delivery requirement hinged, was still quite unclear. The Worldwide Intratheater Mobility Study would quantify the issue some in 1986, but situational dependence was still a large factor. Any unquantified requirement is often not a requirement on Capitol Hill. Thus, many critics argued that the C-17's SAAF capability was a waste of money for the Air Force -- a pure example of goldplating. What's more, without SAAF capability, the C-17's usefulness is far more questionable. Many analysts looked to alternatives, including approaches that would include "direct delivery" capability.

The issue is not whether the C-17 is a technically sound strategic airlifter possessing residual tactical capabilities -- it is -- but rather (1) whether such residual capabilities are in fact relevant to future U.S. tactical airlift capabilities, which remain [in 1986] unspecified, and (2) whether alternative airlift force mixes to the present Airlift Master Plan might provide a more timely and cost-effective means of satisfying the CMMS' stated strategic airlift objective of 66 MTM/D, as well as satisfying future U.S. tactical airlift requirements which have yet to be specified....

The controversy was further fueled by the Airlift Master Plan's conclusion that neither the wing-modified C-5A nor the new C-SB could perform the new role intended for the C-17. Skeptics pointed out that the mission need statement finally approved for the C-17 is virtually identical to that which governed the design of the original C-5A; and supporters of the C-S claim that recent tests of the wing-modified C-5A demonstrate that both it and the C-SB are no less capable than the C-17 of performing the mission of direct delivery to austere forward airfields.⁵²

MATS studies in 1962 and 1963 leading up to the C-5 program focused on direct delivery of "heavy" cargo. Aircraft specifi-

⁵² Record, pp 22, 21.

cations included 100,000-pound payloads delivered to 4,000-foot "minimally prepared" airfields. Empty aircraft were to be able to fly out of the same field with fuel for a 4,000-mile trip.⁵³ If the C-5 could do the same job, why buy the C-17?

The Air Force argued that the C-5 couldn't do the job. They cited the difference in ground maneuvering between the two planes. The C-17 could get around the small airports being discussed; the C-5, according to the Air Force, could not.⁵⁴ The two sides never really did reach agreement; as late as September, 1990, the argument still raged.⁵⁵ Jeffrey Record suggested it didn't make any difference. The tactical airlift problem surrounding the direct delivery issue was too complex to slow procurement of strategic airlift aircraft. He saw as an alternative buying more C-5Bs and KC-10s to gain strategic capacity today, "while deferring judgment on a new tactical airlift system design until future U.S. tactical airlift requirements are postulated." Many even saw this as a cheaper alternative.⁵⁶

Service life extension programs (SLEP) of the C-141 were discussed as alternatives. Some experts suggested these could

⁵³ Miller, pp 288-89.

⁵⁴ The arguments came to revolve around capabilities to "reverse taxi" and other technical issues. Trying to balance one against the other is extremely difficult. Lockheed cited various tests that they had run, claiming the Air Force had been guilty of prejudging outcomes, canceling important tests, etc. When all is considered, the pro-C-5 faction always emphasized the ability to land in a given distance. The C-17 advocates focused on ground maneuverability. From my perspective, it is very difficult to see a C-5 actually maneuvered around a small airport. Landing there is not the issue, doing something once the airplane's on the ground is.

⁵⁵ See, for example, Russell Murray 2nd, "\$7 Billion for Nothing," The Washington Post, 2 September 1990, Outlook p 7.

⁵⁶ Record, p vi.

extend service life to 60,000 flying hours, that is, to around 2020. The SLEP proposals were quickly rejected by the Air Force.⁵⁷

The remaining arguments against the C-17 centered on how productive the airplane could really be. The Airlift Master Plan predicted a C-17 contribution to the nation's airlift capacity based upon a utilization ("ute") rate of 15.65 flying hours per day. C-5s and C-141s were only expected to yield 12.5 hours per day. (The C-5's "ute" rate was subsequently lowered to 11.0 hours per day.) "The C-17's higher rate is important because it partially offsets the C-5's greater payload capability...."⁵⁸ Many analysts argued that the 25% difference in expected "ute" rates between the C-17 and its predecessors in MAC was illusory. GAO studies indicated that as a "surge rate" the Air Force's argument wasn't unjustified. They did see the airplane's mission profiles lowering the effective "ute" rate to 14.4 hours per day. This would, in turn, lower capacity in ton-miles.⁵⁹

In the end, Congress accepted the Air Force's claim that the cheapest, most logical way to expand the nation's airlift capacity was to build the C-17. The GAO had accepted the

⁵⁷ Dr. Russell Murray brings this out in William S. Cohen, et al., U.S. Strategic Airlift Choices (National Security Paper 8), (Washington: Institute for Foreign Policy Analysis, Inc., 1986) pp 3-4. A draft paper prepared by the Office of the Secretary of the Air Force advocating the C-17 discounted this argument on the basis of risk. Aircraft life expectancy has been the subject of great technical interest in recent years highlighted by the fatal failure of a high-time Boeing 737's skin over Hawaii. The Lack of experience with high-lifetime aircraft in the Air Force (B-52s are retired at 15,000 flying hours) makes the future of a C-141 SLEP very unlikely. Nor does one seem desirable.

⁵⁸ GAO, "Military Airlift," p 42.

⁵⁹ GAO, "Military Airlift," pp 43-45. The USAF saw the C-17's "effective ute rate" as 15.2 hours per day to account for mission profiles.

potential worth of direct delivery and the Air Force's plan had lower predicted life-cycle costs than any program to procure C-5s.⁶⁰

The C-17 program hit snags, predominantly funding delays. The plane's initial operating capability is now predicted to be achieved in 1993. Timing and quantity seem the issues -- not alternatives to procuring the C-17.

Airlift – 1990

Where did the Reagan years leave MAC and the nation in 1990? By this time all the short-term programs of the 1980s were complete -- the purchase of C-5Bs and KC-10s as well as the stretch of the C-141. The strategic airlift fleet consisted of:

- 109 C-5s with 16.43 MTM/D capacity
- 234 C-141s with 15.49 MTM/D capacity
- 27 KC-10s with 2.54 MTM/D capacity
- A fully mobilized CRAF with 18.09 MTM/D capacity
- Total airlift capacity: 52.55 MTM/D⁶¹

The C-17s, as already stated, were three years away and the C-141 was aging faster than had been expected. Even the Airlift Master Plan's movement of these aircraft to the Air Reserve Component had failed to extend the service life as greatly as

⁶⁰ GAO, "Military Airlift," p 5,

⁶¹ The figures are derived from Headquarters, USAF submissions to the FY 1992 Presidential Budget. (Source: AF/XOOTA) The capacity of the MAC system is listed in numerous documents as either 52.55 or 48.55 MTM/D. The 4 MTM/D difference results from the "JCS withhold." This amount of lift is theoretically always held back by the JCS for higher priority, out-of-theater missions. Therefore, it is frequently "discarded" when looking at the system's response capability to a theater. Because this paper will derive a number of capacity figures using Equation 1-1, 52.55 MTM/D will be used as the "programming capacity" of the airlift fleet throughout.

had been expected. By late 1989, the Air Force had discovered that the expanding role of low level flight for the C-141 and the stresses induced during aerial refueling were causing significant problems with aircraft fatigue. The retirement of some aircraft would have to be accelerated. The effect of this on the 1990 Major Aircraft Review conducted by the Department of Defense will be discussed later.

With this fleet at the ready, TRANSCOM, MAC, and the nation faced its greatest airlift test ever: Operation DESERT SHIELD.

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CHAPTER 4
CASE STUDY: DESERT SHIELD

...[I]f you take the total airlift system, it has meshed itself together really quite well. It is a success story.

Major General Vernon J. Kondra

The MAC Deputy Chief of Staff for Operations and Transportation has reason to be pleased with the command's contribution to DESERT SHIELD. He modestly blends his pleasure with an air of humility, pointing out that the command had problems. He freely admits to "warts." Nonetheless, his pride is obvious -- MAC responded to its toughest challenge ever with tremendous results.⁶²

The numbers are extraordinary. By the end of February, 1991, MAC had delivered over 2,800 loads of passengers and cargo, totalling 463,743 people and 506,858 tons of materiel.⁶³ Even though for General Schwartzkopf and Central Command the joy is to go home, MAC had the job of returning a half-million people and their equipment to Europe and the United States. The pace of the whole operation was impressive.

The operations tempo of our C-5s...has increased to nearly 3-½ times their usual rate...our fleet of C-141s flew over 1,000 missions in August in support of DESERT SHIELD, about twice their normal mission

⁶² Maj Gen Kondra (MAC's "XO" in USAF's arcane system of office symbols) spoke with me during a 17 April 1991 interview at Scott AFB, IL. He was quick out that DESERT SHIELD was not a demonstration of what MAC could do, rather its toughest challenge ever.

⁶³ All the statistics in this chapter were provided by MAC's Command Analysis Group (MAC/XPYS) at Scott AFB, IL, and the Logistics Management Institute of Bethesda, MD. Cargo tonnages are somewhat understated; so-called "MAC mission support" flights are not included. As these contained much of the materials handling equipment (MHE) needed to unload the remaining flights, these flights are as critical as any deployment mission.

rate. By December, they were logging almost 1,400 missions per month -- a pace that continued through January.⁶⁴

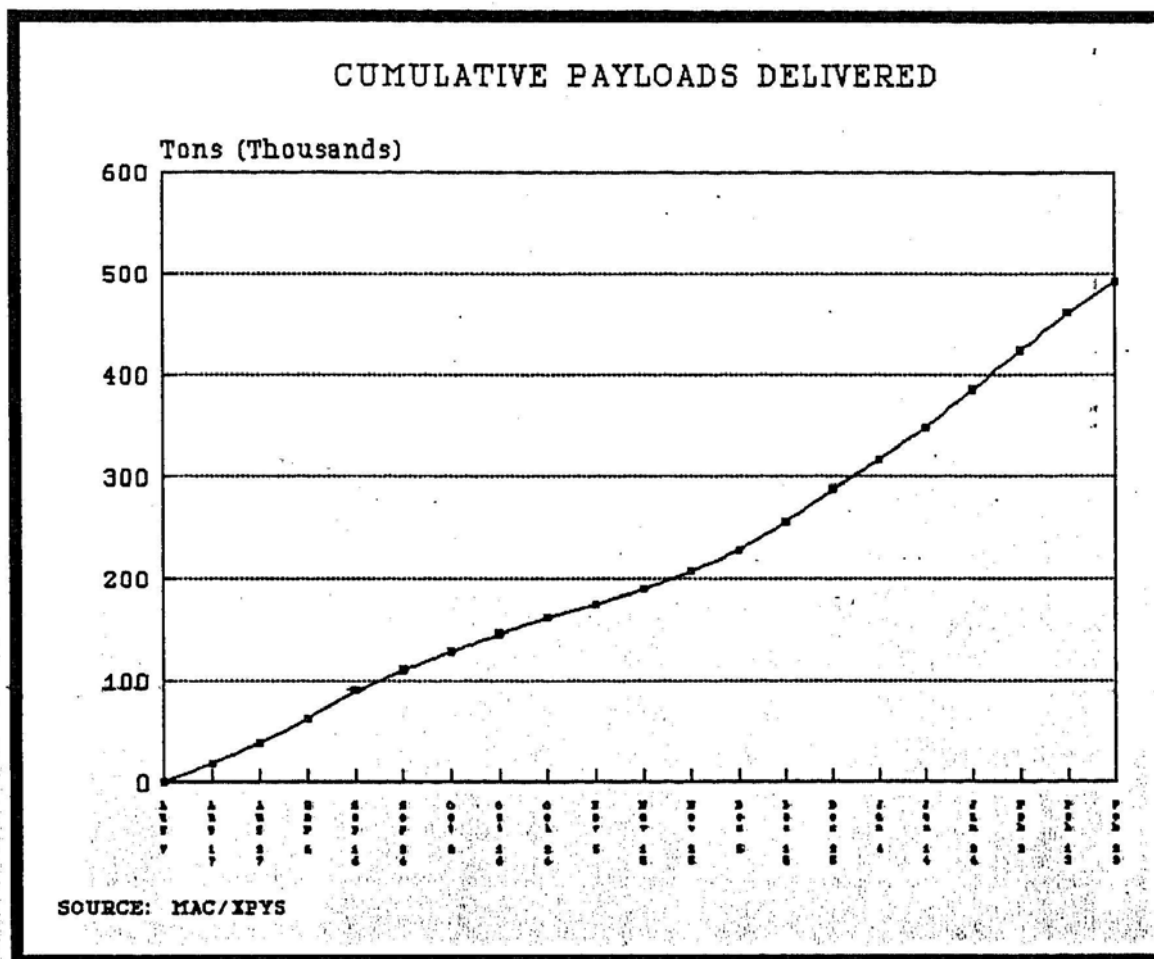
The airlift operation was criticized by some, however, as too slow. At first blush some of the statistics, while impressive, don't seem to support MAC's long-held claims of capability. What seemed like an all-out effort on the surface never approached 52.55 MTM/D. Writing in the Armed Forces Journal International, David Segal claims, "American airlift capacity was overwhelmed even by the initial pre-November deployment... - "⁶⁵ As is nearly always the case, the truth lies between the glowing pride of the command and the hype of the critics. The truth does hold major lessons for future airlift planning.

Performance

Statistics. Figures 1 and 2 show the build up of material and troops in the Persian Gulf region during DESERT SHIELD. The two graphs clearly reflect the two-phased nature of the operation. Initial movements during August and September 1990 built up a defensive capability along the Saudi border with Kuwait. The second phase began in November after President Bush ordered a build up of an offensive capability in the theater. During October, MAC briefly entered a sustainment phase. This brief respite was helpful. MAC used the time to perform maintenance

⁶⁴ General Hansford T. Johnson, USAF, CINC, U.S. TRANSCON, Statement to the House Committee on Appropriations, Subcommittee on Defense, 26 February 1991.

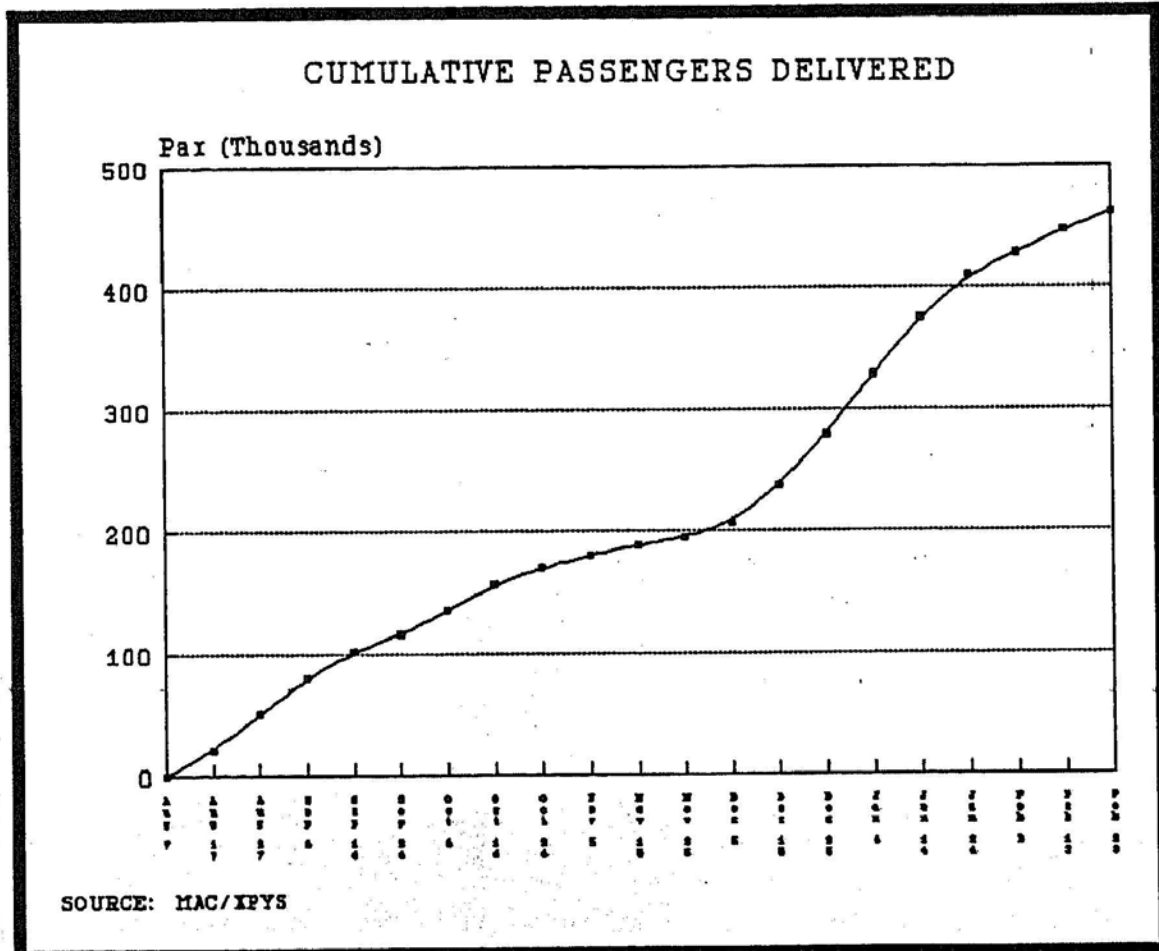
⁶⁵ David Segal, "Whatever Happened to Rapid Deployment," Armed Forces Journal International, March 1991, p 39.

**Figure 1**

upon the tiring fleet of airplanes. Political negotiations during the period also gained access to critically needed offload bases.

The next series of graphs is even more reflective of the October pause and clearly show the results of adding APODs to MAC's list of destinations. Figures 3, 4, and 5 depict the number of offloads, total number of passengers, and total tonnage delivered for each ten-day period of the operation.⁶⁶ Maj Gen Kondra points out that during Phase I of the operation

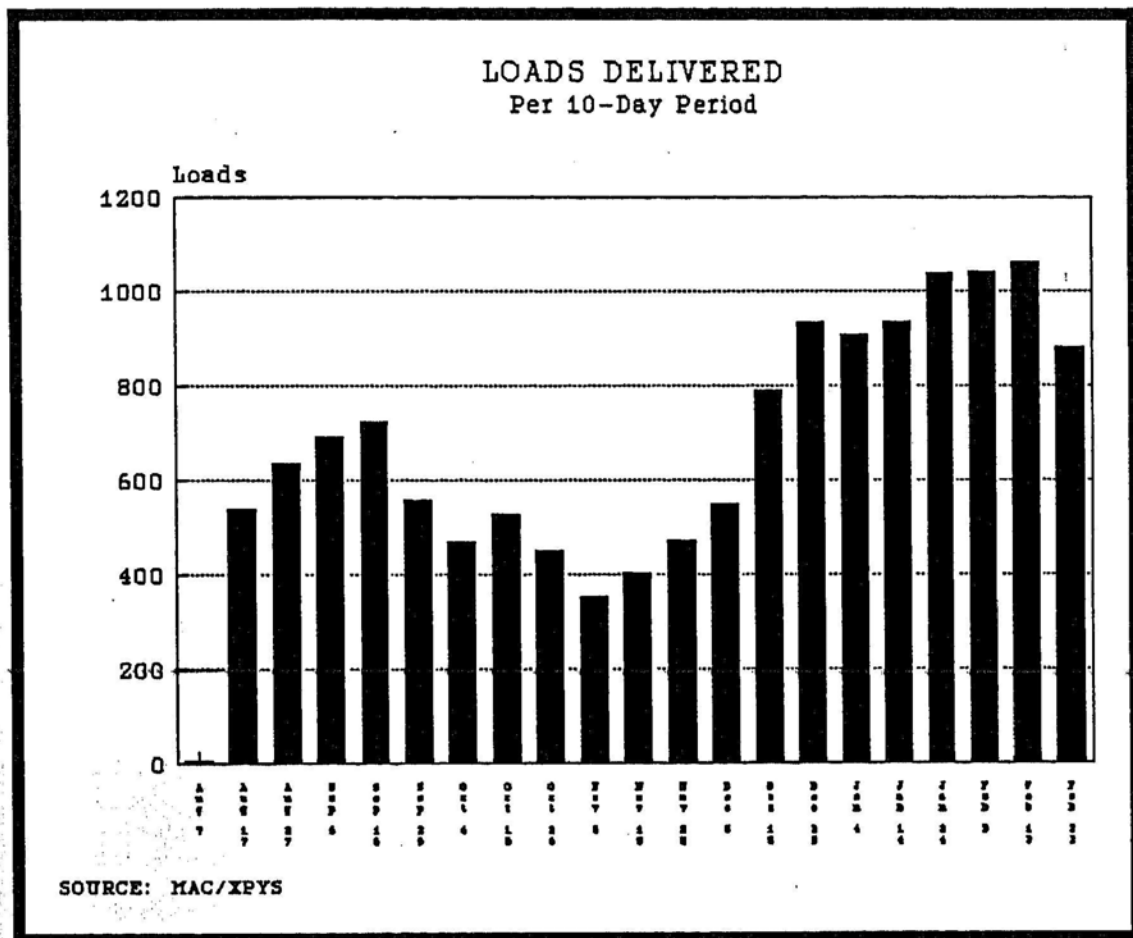
⁶⁶ Each graph shows the end date of the respective periods.

**Figure 2**

the peak number of of floads was 87 in one day, the average slightly over 60 per day. During Phase II, the peak reached 133 offloads and averaged 96 per day.⁶⁷

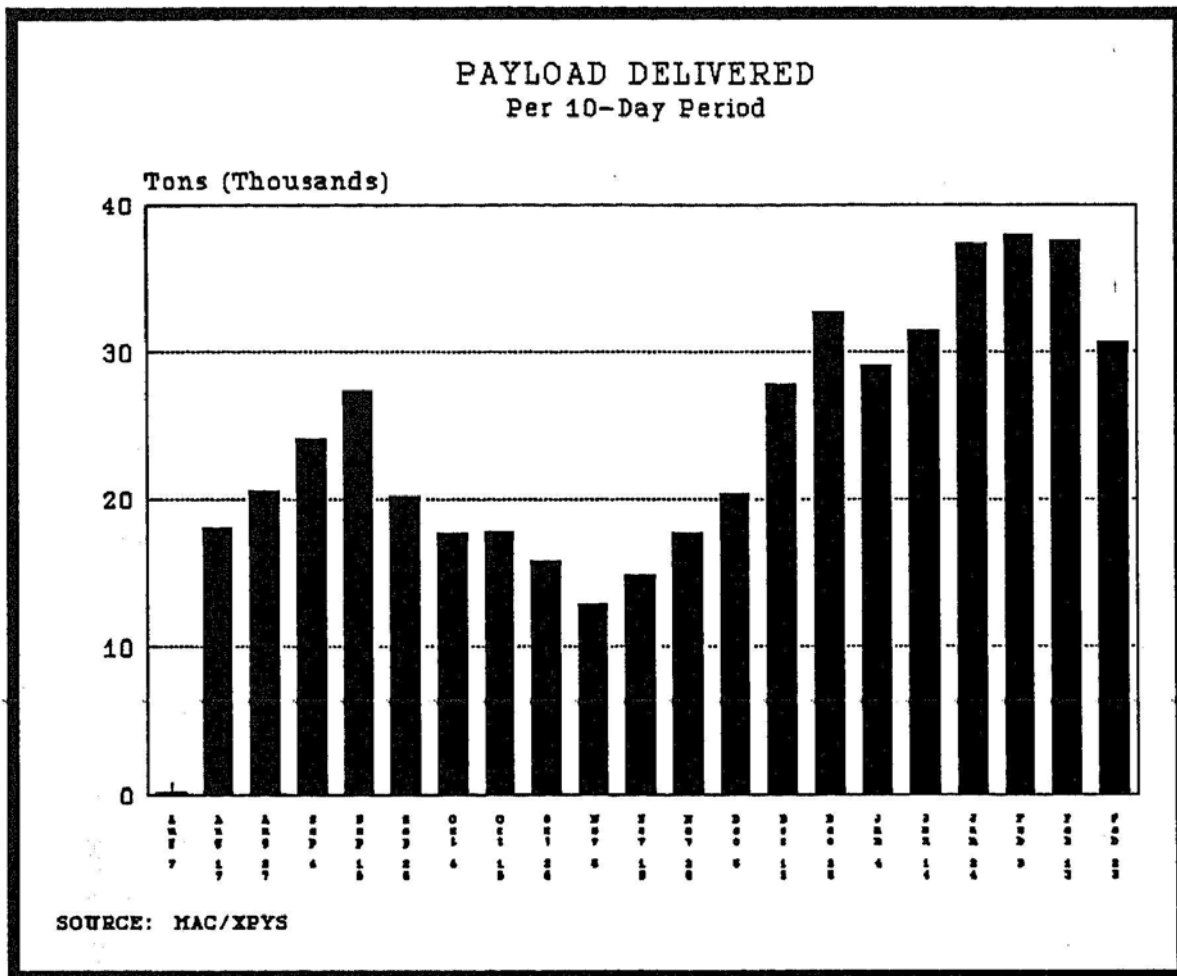
The standard measure of airlift capacity is million ton-miles per day. Figure 6 depicts the average daily ton-mileage achieved during the operation. The MAC statistics show this value to have peaked at 24.25 MTM/D on 4 February 1991. The highest average daily movement over a five-day period occurred at the same time (1-5 February) at 22.60 MTM/D. As this number

⁶⁷ Kondra interview, 17 April 1991, and MAC/XPYS statistics.

**Figure 3**

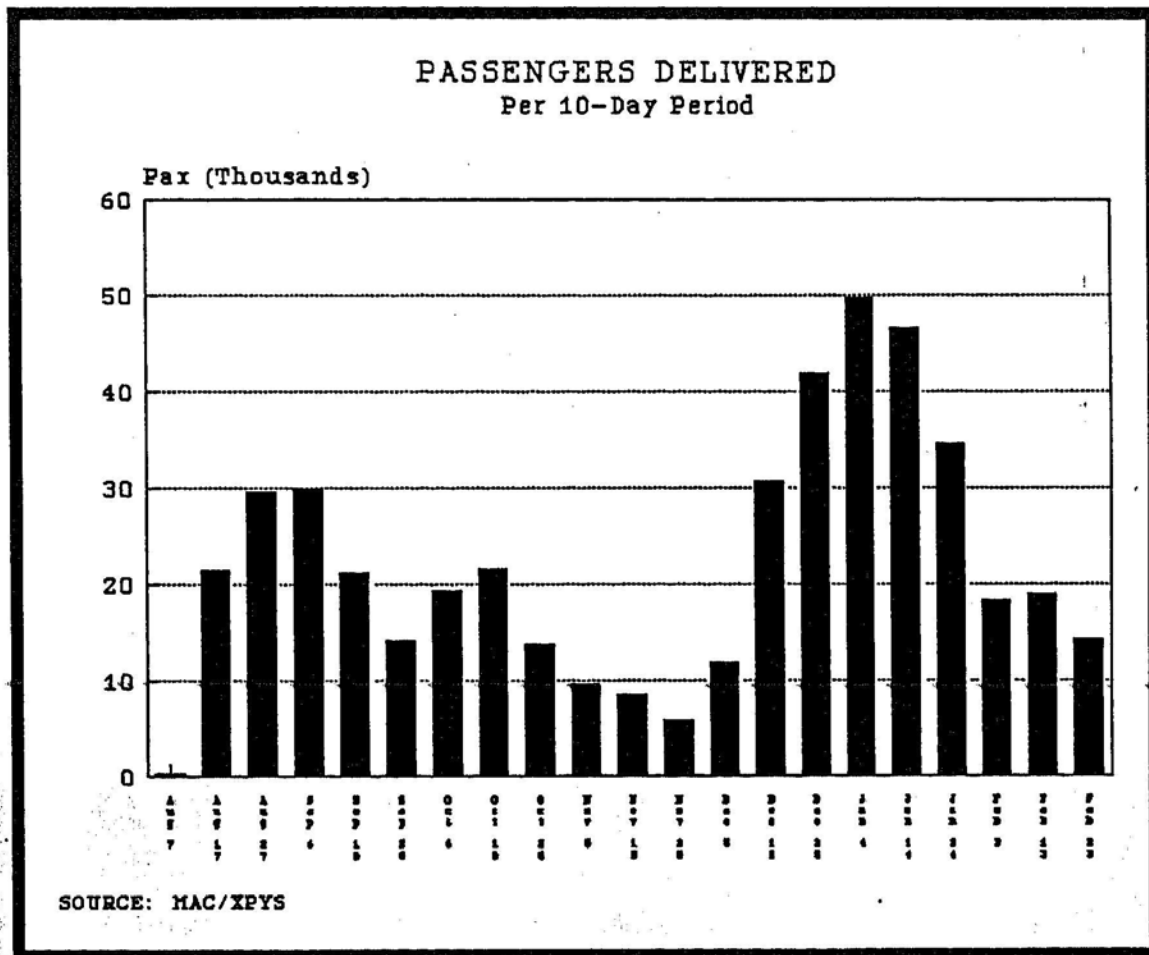
is well below the advertised capability of 52.55 MTM/D, it is worthy of further exploration.

The first thing anyone at MAC would point out about these numbers is that the full capability of 52.55 MTM/D is predicated on total national mobilization, to include full (Stage III) CRAF activation. Stage I of the CRAF was activated by CINCMAC in August, 1990, the Secretary of Defense activated Stage II in November bringing the total number of commercial aircraft available to 40. These airplanes offered a notional 4.73 MTM/D. Had the president activated the third, and final, stage of the CRAF, and additional 71 airliners would have become available.

**Figure 4**

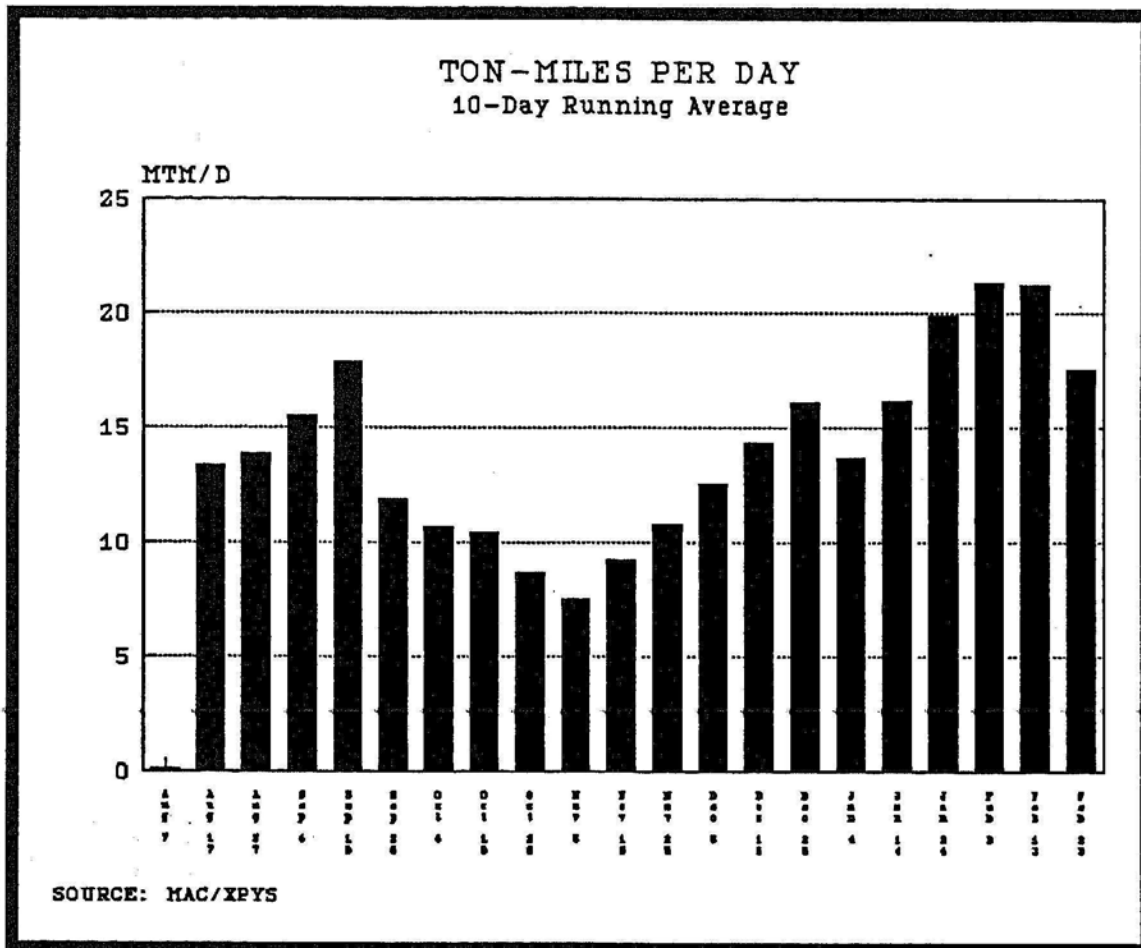
This would have increased the notional CRAF capacity to 18.09 MTM/D. Thus, the organic MAC plus activated CRAP yield a notional capacity of approximately 35 MTM/D.

For a number of reasons, MAC did not call upon the full airlift capacity of the KC-10 either. This subtracted another 1.77 MTM/D from the total airlift system's programmed capacity. The final deduction to make from the total system's capability is the fraction of MAC's organic capacity that remained unused. While the climate surrounding DESERT SHIELD makes it seem preposterous that MAC would intentionally withhold aircraft from the deployment flow, this is exactly what had to happen. The

**Figure 5**

airlift infrastructure, to be discussed further below, simply would not accept every aircraft MAC was capable of throwing at it. Thus, MAC see 27.46 MTM/D capacity unusable or unavailable during this operation.

MAC summarizes the numbers working from the notional planning capacity of 52.55 MTM/D. Table II shows the MAC summary for DESERT SHIELD. The critical numbers to see in this table are the notional airlift capacity employed during DESERT SHIELD and what was actually achieved. With 25.09 MTM/D considered available, MAC achieved a 30-day average as high as

**Figure 6**

19.12 MTM/D and a one-day 24.25 MTM/D.⁶⁸ This one-day high is nearly 90 percent of the theoretical capacity, while the average falls over 20 percent short of programmed capacity.

Implications. Why the averages were not larger is an extremely important question. Recalling the formula for

$$[(\text{BlkSpd}) \times (\text{FlyHrs}) \times (\text{pyld}) \times (\text{PF})] \div 1,000,000 = \text{MTM/D/AC} \quad 1-1$$

$$(\text{PAA}) \times (\text{MC}\%) \times (\text{MTM/D/AC}) = \text{MTM/D}$$

1-2

⁶⁸ MAC references a 30-day average. The 10-day running averages shown in Figure 6 give a better view, and higher peaks, than the Longer-term statistics.

computing capacity (Equations 1-1 and 1-2), the average block speeds, loads, productivity factors, utilization rates, and number of committed aircraft actually achieved are critical. MAC also computed a statistic called "use (or fly) rate" for DESERT SHIELD. In the belief that utilization rates com-

AIRLIFT CAPACITY DESERT SHIELD		
Notional		Ave
20.07	DS C-5/C-141	14.15
0.29	DS KC-10	0.17
4.73	DS CRAF	4.80
25.09	DS TOTAL	19.12
	Difference(%)	-23.79
11.85	Unused MAC	11.85
2.25	Unused KC-10	2.25
13.36	Unused CRAF	13.36
52.55	TOTAL	46.58
	Difference(%)	-11.36
SOURCE: MAC/XPYS		

Table II

puted using actual flying time divided by the total number of aircraft of a given type in the airlift fleet (PAA) would be misleading, MAC statisticians divided the total flying time by the number of aircraft committed to DESERT SHIELD.⁶⁹ The numbers MAC calculated from actual DESERT SHIELD flying are compared with notional programming in Table III. Clearly from these numbers, the planning figures used in previous programming of airlift forces are inaccurate. What factors affected the statistics? Virtually every planning factor proved inaccurate - in the wrong direction.

Utilization, or use, rate was low because the planning figure did not account for unavailable aircraft. Thus, an

⁶⁹ This "use rate" was created by MAC's Command Analysis Group and is essentially logical. It does however, have a limitation. It reflects only the number of aircraft of a given type flown on DESERT SHIELD missions as "committed. In reality, using the mission capable rates found in James C. Hyde, "MAC Flying Nonstop to Support Desert Storm," Armed Forces Journal International, March, 1991, p 12, more aircraft would have to be committed to achieve the missions flown. MAC achieved an 86% mission capable rate for the C-141 and 78% for the C-5, according to Hyde. Thus, MAC's use rate for the C-141 should be divided by 1.163 and the number of committed aircraft multiplied by the same amount. For the C-5s this factor is 1.282. These figures tell us MAC had to commit an average of 86 airplanes to fly 69 C-5s and 170 C-141s to fly 146.

airplane capable of flying 11 hours per day was programmed for that amount. Indeed, MAC got an average of 10 hours per day from its C-5s that actually flew, just 1 hour less than expected. C-141s actually flying did even better. If the

DESERT SHIELD RESULTS						
Aircraft	Number	Hours	Blk Sp	Ave Tone	PF	MTM/D
Notional C-5	109	11.0	423	68.9	0.47	16.42
DS Notional C-5	88	11.0	423	68.9	0.47	13.26
DS C-5 Actual	88	7.8	419	62.9	0.47	8.50
Difference		-21.8%	-0.9%	-8.7%		-35.9%
Notional C-141	234	12.5	410	27.5	0.47	15.50
DS Notional C-141	170	12.5	410	27.5	0.47	11.26
DS C-141 Actual	170	10.3	394	19.5	0.47	6.32
Difference		-17.6%	-3.9%	-36.7%		-43.8%
NOTES:						
• Differences are from DESERT SHIELD notional programmed figures. • Notional fleets have been corrected for non-mission ready, but committed aircraft. MAC uses a notional fleet of 69 C-5s yielding a capacity of 10.40 MTM/D; 146 C-141s yielded 9.67 MTM/D. • Actual MTM/D figures equal MAC statistics.						
SOURCE: MAC/XPYS						

Table III

airplane flew, it did so for 12 hours, just one-half hour less than expected. When this flying time is divided by the number of aircraft committed, the resulting "ute" rate is roughly 20 percent below programmed.

Block speeds were, on the whole, the most accurate planning figure. The C-5's slight difference is not terribly significant and is overcome by faster than planned speeds on the part of the

CRAF and KC-10 (not shown here).⁷⁰ The C-141's 3 to 4 percent discrepancy resulted from the airplane being tasked for shorter than optimal mission lengths. As the smallest aircraft of the strategic airlift fleet, the C-141 is seen as the most flexible transport. It is, therefore, tasked for "feeder" missions from smaller fields, collecting a series of smaller loads, perhaps, for one long final flight to Saudi Arabia. This series of shorter-duration missions cause departure and arrival segments of the flight to become a larger percentage of the entire mission. As these are flown at somewhat slower groundspeeds than cruise portions, the overall average, "block," speed is decreased. (For further explanation, see Appendix I.)

Finally, payloads are programmed near the maximum allowable cabin load (ACL) for a given aircraft. This programming number made more sense when MAC planned to airlift armored divisions. This payload will seldom be completely realized under current plans. The purpose of airlift is to deliver loads optimized to provide combat power, not cargo optimized for airlift. The large discrepancies seen here are likely to be seen again. Users, i.e., those who will fight the war, will never be able to perfectly match operational needs with "efficient" airlift.

One caution on the use of the numbers presented here: These are the products of the most productive 30-day period during DESERT SHIELD. They are not the product of a maximum effort by MAC. There are inaccuracies in the numbers when they

⁷⁰ CRAF figures, while statistically significant, are complicated by the number of aircraft types involved. As a result, only gross numbers and trends are reported here.

are applied to the whole picture. We must remember that the entire fleet did achieve one day of greater than 24 MTM. Applications of the DESERT SHIELD statistics will be taken up later in this paper.

Infrastructure Limitations

Why are we concerned with "notional DESERT SHIELD capacity" anyway? Why not simply compare MAC'S ton-mileage with its advertised capability? The answer, in simple terms, is infrastructure. Due to the structure the airlift system had to operate in, it could never achieve its full capability. Despite the glowing reports of the modern airport facilities with long runways awaiting the airlifters in Saudi Arabia, there were serious limitations in the AOR. Maj Gen Kondra summed it up well:

Only in Saudi Arabia could you have 12,000-foot airfields and nothing else! No refueling, no parking ramps, no offload capability, in some cases you didn't even have lights. You didn't have [instrument] approaches. You had daylight ops [operations]. So, all of that infrastructure had to be put in.

You also needed to have more than one or two bases to go through.⁷¹

In addition to Maj Gen Kondra's concerns about the airports themselves, the immediate environs of the airports also limited the airlift flow. Initially, MAC was tasked to lift 6,000 passengers per day to the AOR, principally through Dhahran. Those 6,000 troops were in transit 18 to 24 hours; they weren't expected to do much more than leave the tarmac on arrival.

⁷¹ Kondra interview, 17 April 1991.

Unfortunately, there was no place on, or off, the tarmac to house them. According to one TRANSCOM staff officer, it took days to provide messing and sanitation facilities along with places to sleep for those newly arrived troops. While their initial defensive positions were just off the airport, it took time to come up with the minimal requirements. The airlift system had to very quickly adjust to this.⁷² At such an early stage of the operation, no matter how much MAC was capable of, the theater of operations simply could accept no more than it did.

As discussed earlier, infrastructure problems were worked out before Phase II began in November. Bases were added, facilities expanded. While the maximum daily number of passengers delivered in Phase I was 4,551 in late August, Phase II topped 6,600 on New Year's Eve. This 45 percent increase is vivid proof conditions had improved.

Locations of APODs were also important. CRAF carriers were expectedly reluctant to fly into King Khalid Military City. The airport, only fifty miles from the Kuwaiti border, made the commercial carriers nervous. They were rightfully nervous given the picture painted of the Iraqi military before DESERT STORM began. One insight derived from the CRAF activation was the low state of the commercial carriers' readiness for a military mission. Training for nuclear, biological, and chemical (NBC) hazards was found to be lacking. This had its impact on how the

⁷² Interview with Hal Bonnie Page, USAF, of TRANSCOM Directorate of Operations and Logistics (J-3/4), 17 April 1991.

CRAF could be used. Restrictions were also found in the CRAF contracting/scheduling procedures that limited flexibility -- the sort of flexibility needed in military operations.

Airlift infrastructure is more than just theater APODs, however. Lieutenant Colonel Greg Sahli of MAC's Operations Programs Division points out what airlift infrastructure means: maintenance personnel and equipment, aerial port capability (especially materials handling equipment), ground refueling capacity, and ramp space. The ramps must provide "lots of parking spaces" at APODs, APOEs, and at enroute refueling stops. This last category is critical. Aerial refueling is limited by the number of tankers and their many missions.⁷³ As Lt Col Sahli points out, "There will never be enough." Only the highest priority items in a deployment flow can justify inflight refueling.

Too often we miss the obvious outcome of this fact, a point Lt Col Sahli emphasized: The enroute bases see twice as much traffic as do the APODs and APOEs. These bases must service the airlifters going to the theater, and again on their return to the U.S. Table IV highlights the differences seen during DESERT SHIELD when the most used airfield was Torrejon AB, Spain, and three of the five most used airfields were in Europe serving as enroute stops.⁷⁴

⁷³ SAC's fleet of KC-135 and KC-10 tankers were tasked during DESERT SHIELD to maintain alert in support of the Single Integrated Operations Plan (SIOP), support deployments of combat aircraft to the theater (both USAF and USMC), and to refuel MAC transports.

⁷⁴ Lt Col Sahli spoke in an interview on 16 April 1991. His interest was not just for DESERT SHIELD. He has spent recent months looking at the importance of an airlift structure in post-CFE Europe.

DESERT SHIELD FLIGHT OPERATIONS					
CONUS BASES		EUROPEAN BASES		SAUDI BASES	
McGuire	4169	Torrejon	7485	Dhahran	5866
Dover	3631	Rhein Main	5080	Riyadh	1319
Charleston	3622	Zaragoza	3983		
Westover	1479	Ramstein	2470		
Travis	1149				
Pope	1116				
Norton	9752				
Average	2305	Average	4755	Average	3593
NOTE: Each operation represents one departure on a DESERT SHIELD mission from the respective airfield.					
SOURCE: MAC/XPYS					

The impact on the airlift flow by the conditions in Europe are significant. The Spanish government capped the amount of fuel made available to MAC to maintain its own national civilian capacity. This despite a ten-fold increase in MAC operations at Torrejon. Operations at the main European airlift terminal, Rhein-Main AB, Germany, increased by a factor of three.⁷⁵ This increase led to a reconfiguration of the Rhein-Main ramp. Where before DESERT SHIELD only three C-5s were allowed on the ground there at any one time, during the massive airlift up to seventeen were parked there.⁷⁶ The impact of any breaks in this infrastructure would have been catastrophic.

Perceptions

⁷⁵ Page interview, 17 April 1991.

⁷⁶ Hyde, p 13.

The way airlift was viewed by the supported units during DESERT SHIELD was as important as anything else in setting the deployment's tone in August, 1990. Inefficiencies resulted "because everybody was leaning forward. Everybody wanted to move things."⁷⁷ Progress was actually slowed because people didn't understand how an airlift system must work, yet they wanted, rightfully, to get the job done. What follows is a paraphrase of MAC'S chief operator's metaphorical look at airlift -- and why it takes time to make it work.

Airlift can be viewed as a garden hose. This one happened to be 7,000 to 7,500 miles long. You can't turn on the spigot in the United States and expect something to come out immediately in Saudi Arabia. You have to fill that hose before anything comes out the other end. Along the way you need pumping stations to keep up header pressure.

Initially, our garden hose had a four-foot-wide opening. On any given day we were onloading at as many as 35 different U.S. locations. We started to fill the hose, running the flow through our European pumping stations. There was some natural leakage there due to maintenance problems, but the real leakage resulted from back pressure. Where we had a four-foot opening in the States, the three off load bases in the AOR represented about a two-inch-wide nozzle. It didn't work very well.

Eventually, we widened the nozzle by adding offload bases. We also metered the flow better. Instead of saying what we wanted for offload, we focused on what we could offload. Realizing that leakage would still occur in Europe, we continued to use a wider opening in the States. The metering process was controlled by a valve in Europe (322d Airlift Division, Ramstein AB, Germany), adjusting the pressure so there would be just the right flow at the nozzle.⁷⁸

⁷⁷ Kondra interview, 17 April 1991.

⁷⁸ Kondra interview, 17 April 1991. The metering process required determining just how many airlifters could be accommodated each day and assigning "slot times" to each mission. Restrictions on the number of missions might be controlled by aircraft operations (each airport was shared by fighters), maintenance, aerial port capacity, or other factors.

The DCS/Operations and Transportation was also quick to point out that the hose's performance should not be measured by how much is put in, but by the flow out of the nozzle.

People were looking at the measure of merit as how much stuff were you getting out of the United States. How many pick ups were you making? That's not the measure of merit! The measure of merit is how much are you delivering at the other end. That's what counts.⁷⁹

Conclusions

As the largest test ever of the United States' airlift capacity and capability, DESERT SHIELD must be examined closely for its lessons. Several follow:

- ▶ The U.S. airlift system was not overwhelmed by the requirements of DESERT SHIELD.
- ▶ The number and capability of aerial ports of debarkation are critical to a smooth and sufficient airlift flow.
 - The number of ports must allow needed throughput as defined by the supported command.
 - Capability includes runway length, navigational aids and lighting, ramp space for aircraft and cargo, servicing (maintenance, refueling, etc.), and cargo processing (personnel, MHE, prioritization system, user interface, etc.).
 - User must define and support requirements for passengers and cargo. (E.g., set the number of troops per day based upon capacity to house and feed them once they arrive.)
 - Limitations in any area will back up airlift flow and decrease throughput of combat power.
- ▶ Enroute infrastructure must be available that can support slightly greater flow than the theater demands.
- ▶ Civil Reserve Air Fleet worked well during its first-ever call up.

⁷⁹ Kondra interview, 17 April 1991.

- Some modification is needed in administrative procedures.
- Risk factors need to be evaluated and scheduling flexibility built into system while guaranteeing carriers live up to training requirements.
- ▶ The capacity of the airlift system is presently overstated.
 - The present utilization rates do not account for non-mission capable aircraft resulting from maintenance problems, or any other cause.
 - Block speeds planned for the C-141 are too high due to its frequent routing along shorter legs.
 - Payloads approaching allowable cabin load are inappropriate as a planning factor. Inefficiencies result from location of onloads, needs to maintain unit integrity, and nature of cargo.
- ▶ Perceptions of the airlift system must be made more accurate through education and exercises. Users and others must understand the "garden hose" metaphor.

These conclusions will be applied to future requirements in Chapter 6 of this paper.

Maj Gen Kondra is proud of his people and their accomplishments. He's right --- MAC is a success. There is much to learn from a DESERT SHIELD case study, but contrary to some critics MAC wasn't overwhelmed. In fact, it could have done much more. It was limited in some areas insufficiently thought out in the past. It can be improved. Nonetheless, it is a hero of DESERT STORM just as much as the I Marine Expeditionary Force or the 24th Infantry Division (Mechanized) are. In all likelihood, the first American to set foot in Saudi Arabia as a result of Iraq's move into Kuwait was a MAC loadmaster. She or he may close the door on the last plane out.

CHAPTER 5

A NEW WORLD ORDER

...[N]o amount of commitment and political will to defend vital interests around the world can substitute for timely deployment of sustainable land forces capable of countering a miscalculation or deliberate aggression by an opponent.

General Carl E. Vuono⁸⁰

Where, in the world of 2015 will that miscalculation or aggression come? Where in the world of 1992 will it come? These are the questions airlift planners must answer to build the nation's airlift force. Can the answer come with total certainty? Absolutely not. Some defense "experts" can't even see the present with total clarity. Take, for example, a Washington Post defense reporter writing on Sunday, 5 August 1990.

Meanwhile the military is planning war scenarios to deal with ballistic missile attacks by Iraq or perhaps an Iraqi invasion of the entire Saudi Arabian peninsula.

Are these new contingencies realistic? Do they compete with the traditional Soviet threat? Many experts say no. Even in Iraq's massive move into Kuwait this week, the United States could find no direct threat to U.S. interests that warranted any military intervention.⁸¹

The United States did find it in the national interest to take on Saddam Hussein and Iraq following the invasion of

⁸⁰ Gen Carl E. Vuono, USA, "A Strategic Force For the 1990s and Beyond," (Washington: U.S. Army, January, 1990) p 13.

⁸¹ Patrick E. Tyler, "Defense Dilemma: Do We Have the Wrong Forces for Today's World?" The Washington Post, 5 August 1990, p D2.

Kuwait. Some argue the Iraqi invasion did not continue into Saudi Arabia because of American intervention. That question may never be fully resolved. Planning for scenarios dealing with Iraqi ballistic missiles did, however, help when the U.S. launched its storm in the desert.

This chapter looks at possible "base cases" for airlift planning. Is Europe replaced? Will the U.S. go back to Southwest Asia? What about other parts of the world? Background for these questions will be presented here. The final chapter will present a way to determine force structure for the future.

The Mobility Requirements Study

Since 1981, the Congressionally Mandated Mobility Study has served to underpin arguments for U.S. airlift forces. As we have already seen, this study is now outdated. As this paper is being written, the Joint Staff is conducting the Mobility Requirements Study (MRS). Airlift experts expect this to become as much a standard for the future as CMMS was in the past.⁸²

Like CMMS, MRS looks at several scenarios and evaluates the lift requirements each generates. Nearly the entire study is classified at this time, but several things can be expected: The methodology will be little different from CMMS, not just in scenario building but also in terms of weighting the "time value of lift." The force structures employed will be logical ones

⁸² Maj Gen Kondra and virtually every other staffer I spoke to at MAC and TRANSCOM believed that the MRS would prove the definitive study for the 1990s. They expect its lift requirements to lead to some number with as much authority as 66 MTM/D has had during the past decade.

for the respective theaters. The time lines will be realistic. We should also expect these to reflect DESERT SHIELD experience, at least to some degree.

The general nature of the MRS scenarios has not been classified. We can see the study is more complex, looking at more options, than CMMS. Two "major regional contingencies" (MRCs) serve as the basic underpinning of the study. MRC-East deals with a second crisis in the Middle East/Persian Gulf region, MRC-West with Korea. Two "lesser regional contingencies" one 2,000 nm from the United States, the other 6,000 nm away, are to be analyzed. Also viewed is an "escalating European crisis" with the "potential for global conflict" and concurrent, sequential major regional contingencies. This last possibility investigates going from one deployed theater to another.⁸³

The MRS will, in all likelihood, repeat CMMS's results. Airlift requirements of the various scenarios will be shown to be vast. (Rumors already fly of capacity requirements greater than 100 MTM/D.) The recommendation put forward will, in the end, be fiscally constrained. The questions will remain: Is that number enough? Are we building up to it fast enough? More than ever a new question will be added: Did we pick the right scenario? Despite the limitations of scenario building, airlift planning always has been and always will be scenario dependent.

⁸³ The nature of the scenarios come from two classified drafts provided to me by Hq USAF/XOOTA and MAC/XPPB. (Only unclassified portions are used here.) The overall thrust of the study was confirmed by the Kondra interview.

Since MRS is considering the most likely problem areas for the near future, let us concentrate on those here.

The Environment

The likelihood that the U.S. military will be called upon at some time and place to defend U.S. interests in a lethal environment is high -- but now, more than ever, the time and place are difficult to predict.⁸⁴

For decades the U.S. has built strategies derived from a policy of containment. This concept no longer makes sense as strategic underpinning. The most significant reason behind U.S. success in DESERT SHIELD was the concurrence of the Soviet Union in the major moves of the United Nations against Iraq. Unlike their actions in recent history, Moscow was not trying to manipulate nations around the world. While the old order was aggravating at most times, it did have a modicum of predictability. That fundamental benefit will be greatly missed over time. As President Bush described it at Aspen, Colorado, on 3 August 1990,

Outside of Europe, America must possess forces able to respond to threats in whatever corner of the globe they may occur. Even in a world where democracy and freedom have made great gains, threats remain. Terrorism. Hostage-taking. Renegade regimes and unpredictable rulers. New sources of instability -- all require a strong and engaged America.

The brutal aggression launched last night against Kuwait illustrates my central thesis: notwithstanding the alteration of the Soviet threat, the world remains a dangerous place with serious threats to important U.S. interests wholly unrelated to the earlier patterns of the U.S.-Soviet relationship. These threats, as we've seen just in the last 24 hours, can arise

⁸⁴ Donald B. Rice, Secretary of the Air Force, during testimony to a House subcommittee, early

suddenly, unpredictably, and from unexpected quarters. U.S. interests can be protected only with capability which is in existence, and which is ready to act.⁸⁵

Numerous authors echo the President's concerns. Many focus on how political stability is lacking, economic strife abounding, and militaries more potent with increasing quantities of deadly, sophisticated weapons.⁸⁶ These are precisely the ingredients existing in the Middle East leading up to Saddam's move into Kuwait. The ingredients weren't eliminated by DESERT STORM; what of the future?

An Air Force White Paper written shortly before DESERT SHIELD began sums up:

While we will continue to have important commitments and interests around the world, those in the following areas will drive the requirement for our forces:

- Europe will continue to be an area of vital interest. We will have a continuing commitment to the European security framework -- though at reduced force levels.
- As the Pacific continues to grow in importance, our security interests in that vast area will become more diverse and less tightly focused on the traditional threat.
- In the Persian Gulf, our objectives will remain to support friendly states and prevent a hostile power -- any hostile power, not necessarily the Soviet Union -- from gaining control over the region's oil supplies and lines of communication.
- Superpower commitments. To maintain influence over the vital determinants of its national well-being in this uncertain world, the United States will remain a

⁸⁵ Bush, Aspen speech.

⁸⁶ Rice, "Global Reach -- Global Power," p 1, and Lt Col William J. Price, USA, "Strategic Mobility: Can We Get There in Time," Paper to Army War College, Carlisle Barracks, PA, 30 March 1990, p 23, are two examples of current thought.

key player -- in this hemisphere and elsewhere on the global scene.⁸⁷

"Superpower commitments" don't tell us very much about how to plan military forces. They can require anything from a two-person training team to hold off a would-be insurgency to ten divisions guarding the Fulda Gap -- and a whole array of other possibilities. U.S. vital interests in the Pacific are still evolving. Certainly the protection of South Korea remains a vital interest of the U.S., and will remain so throughout the next quarter century. Korea may be the only spot in the Pacific Basin where we can clearly see our obligations and interests. The other two regions mentioned in the Air Force White Paper will continue to hold vital American interests throughout the foreseeable future. The remainder of this chapter will focus on Europe and the Middle East.

Europe

Recently, a group of legislators, scholars, and retired military officers began an study of NATO's future. Their initial conclusions point to a U.S. force in Europe totalling some 100,000 troops, about half what is allowed under the CFE Treaty. They arrived at this number after looking at the possible political insecurities in the region.

Taking a long view, defense planners must take account of two ways in which political stability in Europe might be threatened.

⁸⁷ Rice, "Global Reach, Global Power," p 2.

First, despite the current disarray in the U.S.S.R., one cannot rule out the possibility of a reemerging Soviet, or even Russian, military challenge....The cutbacks in the Soviet armed forces and defense budget now taking place could both contribute to this economic revival and open the way to restoration of a smaller, but technologically advanced and even more powerful Soviet military force. Such a resurgent Soviet state could be tempted to seek to reassert its dominance in Eastern Europe and eventually move to challenge the nations of Western Europe for dominance of the Continent for reasons of ideology or national aspiration....

Second, there are the risks associated with worsening nationalistic conflicts, political uncertainties, and economic failures in Central and Eastern Europe and in the Soviet Union itself....

[T]he complete disintegration of the Soviet Union into a state of anarchy could raise significant challenges for the United States and its European allies. Aside from the impetus such a breakdown could give to the emergence of a far more militant and threatening central regime determined to restore order, widespread civil war in the Soviet Union among various national groups, possibly armed with nuclear weapons, could pose serious problems for the fledgling governments of Eastern Europe and, indirectly for the West.⁸⁸

The bipolar world has split. Europe alone can now be viewed in three parts, each with its own unique set of problems. Western Europe moves steadily towards "Europe '92" and its economic unification. The move is irresistible, but the Thatcher government in the United Kingdom fell from tensions over European unification. A reunited Germany has led to pundits' concern globally. Central Europe, the old "Communist Bloc," now must find its own way in the world. Some of the nations are ready to steer their own course -- Hungary has

⁸⁸ Working Group on Changing Roles and Shifting Burden in the Atlantic Alliance, "The United States & NATO in an Undivided Europe" (Washington: The Johns Hopkins Foreign Policy Institute, 1991) pp 5-6. The Working Group includes Sen. Sam Nunn, Rep. Patricia Schroeder, Generals Edward Meyer and Russell Dougherty, Harold Brown, Zbigniew Brzezinski, Barry Blechman, Helmut Sonnenfeldt, and many others.

already made overtures to join the Common Market. Conversely, some of the states are not even sure of their nationhood -- Yugoslavia and Czechoslovakia teeter on the edge of disunity as if they were once again approaching the summer of 1914.⁸⁹ The Soviet Union reforms and, yet, remains seemingly unchanged. Gorbachev is now seen realigning himself with the military and the KGB. While nothing should be glossed over, the military ramifications of Western European unification are beyond the scope of this paper. The threats from Eastern and Central Europe are not.

"No empire has ever fallen peacefully, and this empire has nuclear weapons."⁹⁰ The western reaches of the Soviet Empire have ripped away; now the various republics continue to peck at the bindings of the Soviet state. Disunity seems but a moment away when Boris Yeltsin can speak of Russian independence. This disunity may, in reality, be the greatest threat to the West resulting from the communist domination of Eastern Europe following World War II. In recent Congressional testimony CIA Director William Webster said the Soviet ability to launch an attack on NATO would remain low for several years. He said the more immediate danger to the West could come from civil unrest,

⁸⁹ The subtitle to a recent article on Yugoslavia reads, "Defense Minister Says Country in 'Civil War' and Demands Measures to Quell Violence." Jim Fish, "Yugoslav Army on Alert After Clash at Naval Base," The Washington Post, 7 May 1991, p A27. On the same page: "The...government of...Armenia accused the Kremlin today of 'virtually declaring war' on it..." Michael Dobbs, "Soviet Troops Raid Villages in Armenia."

⁹⁰ This statement is from a pundit speaking with the understanding of non-attribution, but it has stayed in my mind since the fall of 1989.

perhaps even civil war, among the various Soviet factions and official agents.⁹¹

Some would say, "Don't be alarmist, the Russians can no longer support a big military. They have to reform." Secretary of Defense Dick Cheney doesn't necessarily believe so, "...[T]he Soviets' military budget will remain large enough to support their high priority programs."⁹² Even if it does not, the capability already existing within the Soviet forces is awesome and intelligence sources say it is being protected despite CFE provisions.⁹³ Until we know the war machine has been destroyed (which won't happen until we agree to destroy our own) and the risk of civil war has past, the danger for Europe remains great.

The scenarios are new. The "Commies-flooding-through-the-Fulda-Gap" war can be relegated to the dustbin of history. It may be true that a direct Soviet/NATO confrontation is unlikely. Even if this worst-case scenario were to come to pass, nearly all the experts now say warning time would be great.⁹⁴ NATO could formulate plans to meet Soviet (or Russian) aggression in Poland, for example. The more intriguing scenarios deal with rising levels of disruption from unrest in any part of the old

⁹¹ George Lardner, Jr., "Draft-Dodging Rises Dramatically in Soviet Union: U.S. Defense Intelligence Official Says Call-Up Resistance Has Jumped to 20%," The Washington Post, 3 March 1991, p A23. The very thought of draft dodging in the Soviet Union should give us pause. To think it has reached 20% must make military analysts think long and hard about Eastern Europe's future.

⁹² Dick Cheney, Statement of the Secretary of Defense Before the House Armed Services Committee in Connection with the Defense Major Aircraft Review, 26 April 1990.

⁹³ Lardner, p A23.

⁹⁴ The Johns Hopkins group suggests strategic warning lasting years and tactical warning lasting weeks, p 12. The changes in military geography (Poland now stands between the Soviets and Western Europe) rule out the old ten-day-warning scenarios.

Soviet bloc. Just as the assassination of an archduke triggered one world war, a riot in Belgrade, Prague, or Riga could trigger another.

...[W]ith the decline of the Soviet hegemony, we're already seeing a resurfacing of irredentism in Eastern Europe that threatens any stability.., it may be necessary that a strong U.S. presence, acting as what Harry Summers calls "an honest broker," will remain in Europe to allay concerns of Europeans and the Soviets and to act as a stabilizing forces while Eastern Europe seeks to restructure after decades of domination.⁹⁵

The strong presence is changing. CFE restricts U.S. troop levels to 195,000 in Central Europe. This would roughly halve present Army strength there (from four divisions and five armored cavalry regiments to two divisions and two regiments).⁹⁶ The Johns Hopkins group would drop this even farther, to 100,000 troops. This force would be comprised of armored cavalry regiments, tactical air wings, and the cadre of forces needed to receive reinforcements. Prepositioned (POMCUS) stocks would be essential to this plan.⁹⁷

To sum up the European condition today, and for the shorter term future, from an airlift perspective. If Europe is to be the base case for programming, deployments should be seen over longer periods than before. These will more likely come in response to conditions developing from unrest in some corner of Eastern or Central Europe. Inevitably, the full deployment of

⁹⁵ Youngman, p 32.

⁹⁶ Youngman, p31. The drop to two divisions is the present DoD plan, according to Senator William S. Cohen in a 1 May 1991 Letter.

⁹⁷ Johns Hopkins Working Group, pp 12-13.

U.S. and Allied troops will be to positions far to the east of any previously conceived or prepared, perhaps all the way to the Russian/Polish border.

The Middle East and Southwest Asia

When Jimmy Carter put forth his doctrine declaring access to the Persian Gulf in the vital interest of the United States it is unlikely he envisioned Saddam Hussein as an aggressor. The Carter Doctrine was first seen as telling the Soviet Union to keep its hands off Iran. Secondarily, it addressed other threats in the region.

The oil-rich lands of the Middle East remain a vital interest of the United States; DESERT SHIELD proves that. The region that spawned Ghadafi, Assad, and Saddam also remains unstable. While one can hope that the current efforts of Secretary of State James Baker and the Bush administration can settle decades-old disputes, the threats to the world's stability will not end with the settlement of the Palestinian question. In today's world oil brings money, money brings weapons, and weapons bring war. The "new world order" will not change that. High technology weapons in large numbers will continue to infest the region as will leaders seeking greater power. The 1950s saw the rise of the Shah and Nasser; the 1960s and 1970s ushered in the trio of Ghadafi, Assad, and Saddam. The twenty-first century can be expected to see new megalomaniacs come to power.

The lessons of DESERT SHIELD should demonstrate that crises can erupt quickly in this region. While Gen Schwartzkopf had some strategic warning of trouble in the region, the tactical warning was limited to days. Even then, no response could be made before Kuwait fell. Similarly, we should remember how benign some aspects of the crisis were. Gen Hansford Johnson, CINCTRANSCOM, recently pointed out to Congress how difficult the U.S. position would have been had Iraq not stopped at the Saudi/Kuwaiti border. "It would have been a completely different scenario if we would have had to fight our way onto the Arabian peninsula."⁹⁸

A second Southwest Asian war could come fast and engender a much steeper requirement for airlift capability. DESERT SHIELD was tough; next time could be far tougher. Unlike the European possibilities, it is very easy to say another clash will come in the Middle East. The unknown is whether the U.S. will participate and to what extent, if it does.

Developing Strategy

A new strategic concept may take several years to emerge, said [former arms negotiator Paul H.] Nitze, noting that after World War II it took a few years for the realities of an aggressive Soviet Union and exhausted Great Britain to crystallize U.S. postwar imperatives.⁹⁹

There are some "givens" in the development of this new strategic concept. They are "givens" upon which an airlift

⁹⁸ Johnson testimony, 26 Feb 1991.

⁹⁹ Tyler, "Defense Dilemma," p D2.

system meeting the needs of the nation must be built. Secretary Cheney put forth his framework for structuring the "givens."

In assessing the impact of the changing world environment on defense needs, let us for the moment set aside any doubts about the prospects for reforms in the Soviet Union and make optimistic assumptions about the future course of events. We can then envision a world marked by a more democratic, less threatening Soviet Union; successful arms control negotiations on conventional and strategic forces; and a democratic Eastern Europe, free of Soviet troops. Indeed, I have directed the military departments to plan their forces for the mid-90s on exactly these assumptions....But even in this assumed optimistic world, we would still need quality forces, forces with three characteristics, which must be kept in mind as we evaluate tomorrow's... needs.

- First, the need for flexibility....
- Second, the ability to reconstitute our forces... should our hopes and expectations be disappointed.
- Finally, the need to exploit our strengths: sea power, air power, and our ability to deploy forces rapidly at long distances.¹⁰⁰

Army Chief of Staff Gen Carl Vuono expanded upon these points, with particular emphasis on the need to rapidly deploy.

The nature of the United States' interests around the world, and its coalition-based strategy, will require that U.S. forces be globally deployable, with little or no warning, from the United States or from forward bases. While operational circumstances will determine which deployment mode is best in each case, the Army must have forces prepared to execute either option....

The United States cannot afford to risk the effectiveness and credibility of its overall defense strategy by failing to develop and field adequate worldwide lift assets. Airlift and sealift assets currently available or approved for acquisition are inadequate. This deficiency will have to be addressed in the years ahead....

¹⁰⁰ Cheney testimony, 26 April 1990.

In the 1990s and beyond, the United States will have to rely more heavily on the rapid deployment of Army forces from the United States to guarantee its security. Thus, despite reductions in the defense budget, it is vital that sufficient resources be allocated to correcting the serious shortfalls in U.S. sealift and airlift.¹⁰¹

Gen Vuono seems to go against a great deal of speculation when he speaks of "little or no warning," but DESERT SHIELD reminds us that while European warning time grows, crises in other regions may develop faster than ever. Lt Gen George Butler put it this way:

(A)fter months of reflection, I have concluded that there are only two legitimate answers to the question of how much warning time will be available in a given crisis. The short answer is, "I don't know;" the second and slightly longer is, "That depends on how the crisis arises and unfolds."

I have also formulated the following dictums about warning time. First, to guess wrong when dealing with a powerful adversary is to lose. Second, warning time isn't warning time unless you exploit it; otherwise it is wasted time. And, third, the propensity to avail oneself of warning is inversely proportional to the amount of time perceived to be available...This led us to conclude, therefore, that warning time is far more likely to be exploited by key decision makers if they have a large menu of discriminate response options from which to choose.¹⁰²

As we build a strategic airlift force to meet this guidance, it is worthwhile to remember the guidance of one text on strategy. Col Dennis Drew and Dr Donald Snow conclude, "In the absence of definitive knowledge...the natural and quite prudent policy is to play it safe, to hedge bets." They recommend this approach while cautioning that building a "worst case scenario"

¹⁰¹ Vuono, pp 12-14.

¹⁰² Lt Gen George L. Butler, "New Direction in American Military Strategy," Speech to the Center for Defense Journalism, The National Press Club, 27 September 1990.

risks exaggerating the threat, provoking an enemy, spending too much money, and ignoring capabilities needed for lesser cases.-

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In selecting a base case for airlift we must hedge bets, failure to do so leaves the U.S. military stuck in garrison. The criticality is increased by the rollbacks from forward deployment. With a smaller U.S. force based to a greater degree in the CONUS, strategic deployments will be required for any significant crisis. The forces to meet these crises will be sized based on Drew and Snow's guidance. Indeed, American tradition indicates that rather than exaggerating the threat, we may underplay it. This should avoid provoking enemies. Nonetheless, the DoD had better be ready to explain the need for and costs of lift, because the price tag is not likely to go down. This is evident even though the military is shrinking. The one caveat of Drew and Snow not terribly troublesome to airlift planners is equipping for the wrong war. While there are some special cases, the aerial deployment system will work across the spectrum of conflict.

¹⁰³ Col Dennis H. Drew & Dr Donald H. Snow, Making Strategy: An Introduction to National Security Processes and Problems (Maxwell AFB, AL: Air University Press, 1988) pp 51-52.

CHAPTER 6

A NEW BASE CASE

To adopt a new base case for airlift requires some scenario-building. By its nature, airlift is scenario-dependent. This has been borne out by every major study of the subject, including the Congressionally Mandated Mobility Study and the current Mobility Requirements Study. This chapter will set out such a scenario and develop from the assumed base case a premise for airlift needs of the nation. Once this premise is developed the lessons of DESERT SHIELD will be applied to it in order to obtain the transport fleet required to meet these needs. The infrastructure and other support needed by this airlift system will then be discussed. The reader must remember: What is important here is methodology, not the specific scenario or numbers.

Which Theater?

Three theaters present themselves as possible locations for base case planning: Europe, Korea, and Southwest Asia. Unlike structuring other forces, as long as the "most difficult" case is chosen, the airlift force will be properly designed. That is, where armor may be critical in one theater for the Army and not in another, lift capacity and aircraft design for airlift is as applicable to one theater as to another. (There are some exceptions to this rule, primarily dealing with intratheater

needs.) Similarly, airlift planners are lucky in that unforeseen locations for crises are unlikely to require vastly greater amounts of lift, if the proper base case is chosen.

While CMMS did not evaluate a Korean theater for lift requirements, the airlift experts seem to discount this as MAC's most demanding case in the past or the future. I concur with this judgment. A replay of June, 1950, should not require greater lift than a European or SWA crisis.¹⁰⁴

However, the question of SWA versus Europe is an onerous one. Every staffer I spoke to at MAC and TRANSCOM believes SWA will serve as a basis for airlift planning.¹⁰⁵ Their belief is that SWA is such a demanding scenario when coupled with increased warning times in Europe that it must drive airlift needs. Their belief also seems based on the conscious or unconscious conclusion that European scenarios are no longer acceptable politically. Given the present concerns over the Middle East, they believe they can obtain the resources (new transports) they need by pushing a second SWA scenario.

The given risk of another crisis in the Middle East should not cloud judgment concerning Europe. As previously discussed, the likelihood of an imbroglio affecting NATO is great.¹⁰⁶

¹⁰⁴ The MRS should verify this by the end of 1991.

¹⁰⁵ Interviews conducted 16-17 April 1991 at MAC and TRANSCOM headquarters, Scott AFB, IL. This conclusion was completely across the board, including MAC/XO Hal Gen Kondra.

¹⁰⁶ I would question the probabilities depicted in Don Oberdorfer, "Strategy for Solo Superpower," The Washington Post, 19 May 1991, p A1, A14-A15. Mased on a reading of the Joint Military Net Assessment, Oberdorfer presents a risk of MRC-East as approximately three times th

Europe, we must remember, is far more important to United States interests than Southwest Asia. Our commitment to our NATO allies is far stronger than to the coalition of DESERT SHIELD. When U.S. forward presence in Central Europe is decreased towards 100,000, the total lift requirements to reinforce NATO will be staggering. Given an Army posture that appears headed for two divisions in Europe, one in Korea, and the nine remaining divisions in CONUS, lift requirements for active-duty forces would likely be eight divisions plus a corps headquarters in the event of a major crisis.

The nature of this major European crisis has evolved significantly. With tactical warning times clearly up to 45 days¹⁰⁷ and far longer strategic warning, lift requirements can be spread out over a much longer period of time. The old rule of thumb, "ten divisions in ten days," simply does not apply. To actually spread out deployment will require NATO to use the warning time given. NATO will not want to insert itself into Eastern Europe's politics and civil strife, but it may want to deter expansion of that strife by reinforcing with US forces from CONUS. Done a division at a time, the MTM/D requirement could be kept quite low.

This prolonged deployment period is not exactly what DoD is presently studying. According to Senator William Cohen (R-Maine), plans are being developed to deploy 4 divisions, 30 tactical fighter squadrons, and 1 Marine Expeditionary Brigade

¹⁰⁷ See, for example, Senator Sam Hunn, "The Changed Threat Environment of the 1990s," Remarks before the U.S. Senate, 29 March 1990.

in 10 days. Additional forces would arrive in 8-12 weeks.¹⁰⁸ If 80 percent of the weight requirements of the 4 army divisions (armored and mechanized) are prepositioned, this move could be done with some 30-35 MTM/D capacity. For each 10 percent of the requirement not placed in POMCUS, an additional 10-15 MTM/D will be required.¹⁰⁹

Non-European crises could be met with up to five divisions, plus air and naval units, in 'about six weeks.'¹¹⁰ To accomplish this could be a daunting task for airlift if these divisions had to be moved 7,250 nm to Southwest Asia. That region's vital nature to the United States and its continuing propensity for crisis make it the area to focus on. Thus, the following base case.

AIRLIFT'S BASE CASE: The nation's airlift requirements must be based on a likely scenario for a second Southwest Asian War.

We must first develop a scenario adequately defining the movement to the region in time of crisis. This will require several careful judgments. Upon these a premise will be built for the new airlift force.

¹⁰⁸ Cohen ltr, 1 May 1990.

¹⁰⁹ Price, p 8, shows the lift requirement for a mechanized division as 93,370 tons; an armored division's is 90,220 tons. An average lift distance of 3,500 nm is used here.

¹¹⁰ Cohen ltr, 1 May 1991.

Theater Requirements

The lift requirement to SWA could be developed in several ways. Based on DESERT SHIELD, four to six weeks will be required before any sealift resources can reach the theater from CONUS. Thus, the five division DoD plan will be based totally on airlift and land- or sea-based prepositioning. As the bulk of the lift requirement is composed of ground forces, the analysis here will focus on that component.

DESERT SHIELD sent components of at least eight Army divisions and three corps to Saudi Arabia along with two Marine divisions.¹¹¹ The DoD plan and the anticipated force structure of the mid-1990s make it improbable that a future SWA force can be as large. In that future scenario, it is highly unlikely that the two European-based divisions (or equivalents) will be touched. Just as in DESERT SHIELD, the Korean-based division will similarly be left in place. This leaves nine divisions possibly available in CONUS. For many reasons (e.g., training levels, need for a strategic reserve, other possible crises on the horizon, etc.) it is unlikely that more than six army divisions (or equivalents) could be deployed to the theater.

The likelihood that the opponent in a second SWA war will be heavily armed with modern weapons is high. The ample supplies of oil money in that part of the world and the pro

¹¹¹ According to briefing slides compiled by the Logistics Management Institute, these included, XVIII Airborne Corps, III and VII Corps, 82nd and 101st Airborne Div, 1st and 24th Infantry Div, 1st Cavalry Div, and 1st, 2nd and 3rd Armored Div of the U.S. Army plus 1st and 2nd Marine Divisions. This is not to slight the numerous other units that were involved in the operation. It only serves as a basis for sizing requirements.

liferation in the world arms market make it very possible for Iraq, Iran, Syria, and others to become major powers over the next quarter century. To face this, the Army will once again choose to have heavy firepower available -- corps artillery units will be part of the deployment package.¹¹² Thus, despite the number of units available to provide support to the commander, a "heavy" five-to-six-division force can be expected from the Army. This accounts for firepower, aviation, support, and troops.

Experience tells us the contribution of Marine forces in the theater, both as fighting infantry and as amphibious threat. Thus, Marine Corps deployments to a second DESERT SHIELD can be expected to be roughly the same as during the first.

Despite the five-division plan, the SWA force could easily range up to eight divisions and support. This is only slightly less than DESERT SHIELD's ten divisions and support. A safe estimate for such a force's airlift requirement, in terms of tonnage, would be roughly 80 percent of cargo moved during DESERT SHIELD.¹¹³ Thus, by the end of the deployment phase the commander would have directed the delivery of some 285,000 tons of cargo, all

REQUIRED CAPACITY	
10 Weeks	30 MTM/D
8 Weeks	37 MTM/D
6 Weeks	49 MTM/D

Table II

¹¹² During DESERT SHIELD the "extra" corps artillery came from III Corps. While the origin of these "extra" assets is hard to predict, it is very doubtful the commander of a SWA force would go any Lighter in firepower than forced by the size of the military.

¹¹³ There are any number of ways this tonnage could be estimated or derived. For this paper, choosing the 80% figure should be adequate.

shipped from the U.S. This equates to 2,065 MTM.¹¹⁴ The luxury of DESERT SHIELD was the length of time allowed for deployment, five months. A more aggressive foe would not allow this luxury of time. Table V shows three possible requirements.

These numbers are too low, however. Sealift did not reach Saudi Arabia from CONUS for roughly four weeks during DESERT SHIELD. While 7th Marine Expeditionary Brigade was joined up with its maritime prepositioned supplies within sixteen days of the commitment to Saudi Arabia, non-prepositioned materiel travelling by ship will take time to get to the theater. Thus, airlift requirements can be seen to increase as the duration of the deployment decreases.¹¹⁵ Some of this has been accounted for within the simplistic calculations employed here. Since the required tonnage was computed based upon actual deliveries to Saudi Arabia in DESERT SHIELD, the figures reflect some amounts of sustainment cargo. The shorter the duration of the deployment phase, the less sustainment cargo will be needed during the deployment phase. Thus, I have somewhat overstated the cargo requirements from DESERT SHIELD, but this should offset the increases due to earlier required delivery dates.

None of my estimates completely describe the requirement. The extrapolation from DESERT SHIELD is a simple approximation that should serve as a guide to airlift requirements to satisfy

¹¹⁴ As of 16 January 1991 when DESERT STORM began, MAC had delivered 355,821 tons of cargo(MAC/XPYS statistics). This number is conservative, not all ground forces were in place on D-Day. The ton-mileage is computed based upon a 7,250 nm average distance from the U.S. to the theater.

¹¹⁵ Current rumors in MAC headquarters indicate the MRS scenario will yield required capacities significantly greater than even 49 MTM/D. Since CMMS produced capacities of 83 MTM/D and greater, these rumors do have credence.

a SWA scenario. Which of the three timelines to pick? Given the swiftness of Iraq's conquest of Kuwait in August, 1990, six weeks could be a very long time to build up forces. A great deal of credit would have to be given to the deterrent effect of the early units deployed if eight or ten week scenarios were used. Seemingly, that was the case during DESERT SHIELD, but we must recall Snow and Drew's conclusion: strategists must plan for the worst case, without being unrealistic.¹¹⁶

The case made here is kept realistic less by the timeline suggested, but by the possibly low estimates of lift requirements. Therefore, we can set out the airlift premise for future requirements.

AIRLIFT'S PREMISE: The airlift fleet must be capable of meeting the needs of a Southern Asian war. This requires an average airlift capacity of 49 MTM/D.

To obtain an average capacity of 49 MTM/D requires a peak capacity in excess of this figure. During MAC'S peak operations supporting DESERT SHIELD, daily ton-mileage fluctuated approximately ten percent about the mean for the period. For the purposes of this paper, this ten percent fluctuation will be taken as an average. Thus, 4.9 MTM/D must be added to meet peak-day requirements. This will be rounded off to yield a capacity required of 54 MTM/D.

¹¹⁶ The divisions added over the five-division DoD planning figure don't necessarily skew these numbers improperly. A force of four mechanized/armored divisions (40% prepositioned) and one airborne division moved from CONUS to SWA without corps headquarters support can be shown to require 42 MTM/D airlift to deploy in six weeks.

Most defense program analysts would object to this 5 MTM/D "pad." Strategists and practitioners of the operational art must argue vehemently for this sort of additional capacity in the airlift system. Throughout the next portion of this paper a series of "pads" will be added, each one is militarily vital to the deployment needs of the nation. If this methodology is not used, a commander in SWA, and possibly in Europe, will face a potential of not having enough forces in time to do the job. As we saw in DESERT SHIELD, having enough force means having a lot of force -- lift is not wasted, even in "pads."

Sizing the Airlift Fleet¹¹⁷

The next number to be added to the 54 MTM/D requirement is the JCS withhold of 4 MTM/D previously described in Chapter 3. The final desired capacity of the airlift fleet is, therefore, 58 MTM/D.

Current Air Force planning for the future constrains how this larger capacity transport fleet can be constructed. Contracts have been let on the C-17; numerous commitments have been made. The existing fleet cannot simply be made to go away. Therefore, the underlying constant fleet consists of 109 C-5s, 57 KC-10s, and a CRAF capacity of 18.09 MTM/D. The variables to

¹¹⁷ The derivation of the capacities used in this chapter can be found in Appendix I. Like the other numbers used in this section they are approximations. The method employed is far more important than the actual numbers. No matter what numbers are used, the methodology points to buying more aircraft than the DoD currently plans.

be considered are the size of the C-141 fleet and procurement of the C-17.¹¹⁸

The Air Force's current program consists of the underlying fleet above providing 37.05 MTM/D capacity plus the inventory

AIRLIFT FLEET PROGRAM					
Year	C-141 Fleet	MTM/D	Year	C-17 Fleet	MTM/D
1991	234	15.50	1991	0	0
1992	234	15.50	1992	2	0
1993	230	15.24	1993	7	0
1994	214	14.18	1994	15	2.28
1995	214	14.18	1995	20	3.04
1996	203	13.45	1996	32	4.86
1997	182	12.06	1997	48	7.29
1998	170	11.26	1998	64	9.72
1999	152	10.07	1999	80	12.15
2000	136	9.01	2000	86	13.06
2001	128	8.48	2001	102	15.49

SOURCE: AF/XOQTA, 1991

Table III

and capacities shown in Table VI from the C-141 and C-17. Thus, in 2001, the Air Force expects to have a total airlift capacity of approximately 61 MTM/D. There are two things wrong with this number: 1) It is transitory; the C-141 will not last much past 2001. 2) These capacities do not reflect the realities learned from DESERT SHIELD. Table VII shows a possible retirement pattern for the C-141 and reduces the capacity of the system based upon DESERT SHIELD experience. Because MAC's Persian Gulf

¹¹⁸ An older argument favoring the purchase of the C-5 in favor of the C-17 seemed to have died out. The added flexibility of the C-17 plus financial factors seemed to have put it to rest. A recent article says it has been resurrected again. (See Benjamin F. Schemner, "McDonnell Douglas' Finances Cloud C-17's Future as C-5s Option Surfaces Yet Again," *Armed Forces Journal International*, May, 1991, pp 13-15, 30.) The article does indicate Little Air Force support for the option. In the end, life cycle costs should favor the C-17 since its maintenance requirements are far less than the C-5. The methodology used in this paper still applies, however, if the C-5 is procured. The number of Galaxies needed is less because of its higher capacity.

AIRLIFT CAPACITY AS C-141 RETIRES								
YEAR	C-141			C-17			AIRLIFT CAPACITY	
	#	HTM/D		#	HTM/D		HTM/D	
		Prog	Red		Prog	Red	Prog	Red
1991	234	15.50	8.98	0	0.00	0.00	52.56	39.58
1992	234	15.5	8.98	2	0.00	0.00	52.56	39.58
1993	230	15.24	8.82	7	0.00	0.00	52.29	39.42
1994	214	14.18	8.21	15	2.28	1.29	53.51	40.10
1995	214	14.18	8.21	20	3.04	1.72	54.27	40.53
1996	203	13.45	7.79	32	4.86	2.75	55.36	41.14
1997	182	12.06	6.98	48	7.29	4.13	56.40	41.71
1998	170	11.26	6.52	64	9.72	5.50	58.40	42.62
1999	152	10.07	5.83	80	12.15	6.88	59.27	43.31
2000	136	9.01	5.22	86	13.06	7.39	59.12	43.21
2001	128	8.48	4.91	102	15.49	8.77	61.02	44.28
2002	112	7.42	4.30	102	15.49	8.77	59.96	43.67
2003	96	6.36	3.68	102	15.49	8.77	58.90	43.06
2004	80	5.30	3.07	102	15.49	8.77	57.84	42.44
2005	64	4.24	2.45	102	15.49	8.77	56.78	41.82
2006	48	3.18	1.84	102	15.49	8.77	55.72	41.21
2007	32	2.12	1.23	102	15.49	8.77	54.66	40.60
2008	16	1.06	0.61	102	15.49	8.77	53.60	39.98
2009	0	0.00	0.00	102	15.49	8.77	52.54	39.37

NOTES:

- USAF programming figures are used for C-17 fleet size. C-141 fleet is sized on programming numbers until 2001, then an estimate of retirement rate is made.
- Standard USAF figures are used for programmed capacity, reduced estimates are based on DESERT SHIELD experience. (See Appendix I.)

SOURCE: AF/XOOTA and MAC/XPYS

Table IV

experience reduces the expected capacity so dramatically, roughly 25 percent, alternatives to the current program are critical.

The present program does not address what happens to the airlift fleet after 2001, but the scenario painted here is very likely. The C-141 reduction shown is predicated on straight-line projection to a complete retirement in 2008. As previously discussed a service life extension program (SLEP) of the C-141 is not cost effective due to an inherently high risk factor. Staff officers at both MAC and the Air Staff indicated the C-141

will retire from the active duty forces early in the next century. Recent experience indicates the ARC will not keep an airplane not in the active force. The precise rate of retirement may vary slightly from Table VII, but this is a good approximation. This leaves the nation right where it is today, with a programmed 52.55 MTM/D airlift capacity. More realistically, MAC can deploy forces at the rate of 39.58 MTM/D.

It is rather plain to see how the Major Aircraft Review reached a recommendation of 120 C-17s to be purchased. The resulting 102 PAA yields exactly the same capacity as the C-141 fleet. A program to increase capacity has become a replacement program to maintain capacity. This fact and the motivation are seen in Secretary Cheney's remarks to Congress.

The original plan was to buy 210 aircraft for a total cost of \$41.8 billion, thereby expanding U.S. military airlift capability by approximately one third. I have now concluded that this number of C-17s exceed the requirements of the newly emerging strategic environment and can be reduced to 120. This would save about \$11.9 billion over the current program and would maintain our existing lift capability.¹¹⁹

How many C-17s should be purchased? Certainly more than 120 are needed, but this is a very expensive aircraft being developed at a time of budget limitations. Programmers at MAC believe the airlift system needs roughly the same number of airframes in the future as today to operate smoothly. That is, to maintain a peacetime training pace and service the nation's needs around the world, 211 C-17s and C-5s (PAA) are simply not enough. Consequently, they have tentatively concluded the C-17

¹¹⁹ Cheney statement, 26 April 1990.

buy should be expanded to 228 (PAA) to maintain today's fleet size. This would yield a programmed airlift capacity of 71.48 MTM/D, more than the old goal of 66 MTM/D well into the future.¹²⁰ Applying the lessons of DESERT SHIELD, this capacity is reduced to 50.20 MTM/D, still less than our desired 58 MTM/D goal.

Another factor in sizing the C-17 force after the retirement of the C-141 is the division ready brigade (DRB). This strategic force projection element of the 82nd Airborne Division is expected to remain part of the nation's plans. It is seen by many as a useful element of policy to maintain a small, but able, rapid response force capable of strategic insertion. This is particularly easy to see in a Southwest Asian scenario where critical ports might need to be defended or seized prior to commencing the mass airlift flow discussed above. To accomplish this mission, 91 airdrop C-17 sorties are required. This, in turn, requires a fleet of 147 C-17s.¹²¹ To this requirement MAC adds "incremental force packages" and an "airfield seizure package." These provide additional capability to the Army forces involved (additional airborne and Rangers). While unlikely, all "packages" could be called upon at once. This would require 170 C-17 sorties from a fleet of 274 aircraft.

¹²⁰ Maj Mark Fry, MAC/XPPB, interview, 16 April 1991.

¹²¹ This entire discussion of the DRB is based on an interview with Maj Ron Bean of MAC's Operations Programs Division (XPPP). The fleet size is obtained by dividing the sortie requirement by the mission capable rate (82.5%). This quotient is then divided by the portion of the fleet that can be positioned in time to support the requirement (75%). MAC premises time-sensitive planning on its ability to gather its airplanes from stations around the world without significantly risking accidents, provoking intelligence speculation, etc. Maj Bean's analysis is supported by Maj Gen Kondra and others on the MAC staff.

Thus, justification is provided for C-17 fleet sizes of 147, 274, and 228 by various MAC agencies. Even 274 C-17s do not yield a total fleet capacity of 58 MTM/D. To achieve this with a fleet of 109 C-5s, 57 KC-10s, and a CRAF capacity of 18.09MTM/D, the Air Force must buy 319 C-17s (PAA) if they are to be utilized as the Air Force has traditionally budgeted their operational flying time. If only the originally forecast 220 PAA are employed to supplement theater airlift, the number could be slightly reduced. MAC's planning on the C-17 has included a portion of its daily flying hours applied to intratheater missions, approximately 0.45 hours per day per aircraft. If this flying time is added back in for the portion of the fleet over 220, the C-17 requirement drops slightly to 317 aircraft. If the further decision is made to drop the C-17's intratheater role completely during the surge of deployment, 314 C-17s are sufficient.

A fleet of 109 C-5s and 319 C-17s would constitute a huge airlift force -- one probably beyond the capability of the U.S. to fund in the foreseeable future. The cost of just the airplanes would be big enough, but to add the other life-cycle costs would be tremendous. Such mobility expenditures would likely erode the capabilities of the force they are designed to lift. The lessons to be drawn from this are significant. The U.S. will not have sufficient airlift to meet its stated goals during the next twenty-five years, unless significant changes occur in defense spending practices. As a result every effort

must be made to garner the greatest benefit from the lift we do procure.

Implications

To gain these greater returns, users of airlift will have to plan very carefully in procurement, organization, and loading. This is particularly true of the Army as the primary user of airlift. Training with the airlift system must be made realistic and demanding of both MAC and user. System infrastructures must be preserved and enhanced. All of these areas must be addressed to insure the nation has global reach for its military power.

The Army. The U.S. Army will face new constraints as its structures for the future. Lift previously thought to exist simply is not available. Certainly, Army planners haven't been planning on 66 MTM/D since the 1990 Major Aircraft Review. It is now obvious they cannot plan on even 45 MTM/D until past the turn of the century.

First and foremost for the Army, this new evidence should indicate the days of "lift growth" must stop. Table VIII shows the growth in airlift requirements during the 1980s. Looking at this table might encourage some to recommend the extensive use of light infantry. Again, the lessons

AIRLIFT REQUIREMENTS Tons		
Div Type	1980	1989
Airborne	17720	22780
Inf/Lt Inf	29200	13530
Mechanized	66750	93370
Armored	67880	90220
SOURCE: Price, p 8		

Table V

of DESERT SHIELD would draw that premise into question. The existing light infantry divisions were not utilized. This lends credence to a 1987 critique of the light units.

Thus in 1983 the light infantry division was born, its principal design feature being it could be squeezed into 500 C-141 sorties. Why 500 was the key number, or what capability the division would have upon arrival in an operational theater, were issues that were dealt with only after the division was squeezed into the preordained box...Thus it has come to pass that the strategic mobility tail is wagging the landpower dog -- a very unhealthy situation.¹²²

Brig Gen Bahnsen suggests the Army not size to lift constraints, but it will have to try or become a hollow force. The open-ended growth of the past has slowed, now it must stop. Alternatives must be seriously considered with airlift in mind. The deployability of the LAV-25 light armored vehicle used by the U.S. Marine Corps and others has been contrasted with the Bradley fighting vehicle. While one cannot replace the other, the balance must be investigated.¹²³ This is just one aspect of the oft-heard admonition, "Let's get smaller, smarter."

Army procurement and organization are well beyond the scope of this paper, but careful planning and designing of both can configure the Army to make better use of the lift available. A reexamination of the division ready brigade (DRB) could reduce the requirement levied upon MAC to support it or, more likely, provide MAC with a needed justification for additional aircraft.

¹²² Brig Gen John C. Bahnsen, USA (ret), "Mr. President, We Can't Go!" Armed Forces Journal International, October 1987, p 114.

¹²³ Segal, p 40.

The airlift shortfalls in DESERT SHIELD have been shown to result from loading aircraft with far less weight than previously expected. These shortfalls were dramatic in the C-141, reaching 30-35 percent. As previously indicated this lower than expected performance had to do with a number of factors. The "age of computers" could help increase the density of airlift loads in the future. Proper use of electronic aids could increase efficiency without a loss of combat effectiveness. In the rush to condense, however, the Army must not lose sight of the mission -- the build up of combat power.

Exercises. MAC's DCS for Operations and Transportation was quite clear on one point: The airlift system must be exercised. Asked if MAC, the unified commands, etc., would be able to apply the lessons of DESERT SHIELD to future war plans, Maj Gen Kondra replied, "They're in the war plans. The problem is you have to exercise."¹²⁴ The nature of these exercises was left unstated. His concern about the perceptions of the airlift system by those outside MAC indicates his belief education is critical and presently less than adequate.

In the past, command post exercises such as NIFTY NUGGET have highlighted shortfalls. With DESERT SHIELD to build upon, these exercises have to expand and search for theater restrictions, missing hardware such as materials handling equipment, and ill-defined requirements or needless limitations. Students of war remember the elder von Moltke's adage that no war plan

¹²⁴ Kondra interview, 17 April 1991.

survives the first contact with the enemy. It may be true that no deployment plan can survive first arrival in theater, but our expectations and, therefore, our planning can get better than they were in August, 1990. This requirement crosses all service boundaries and must be met by the warfighting commanders-in-chief, supported by CINCTRANSCOM.

Infrastructure. The need for an airlift infrastructure in Europe was clearly demonstrated by DESERT SHIELD. As the United States withdraws from that theater, it must try to maintain the ability to use Europe as a transition region to the Middle East. Both the U.S. and NATO are trying to cut budgets at the present time. On the surface, bringing American troops home looks good to everybody. The recent Johns Hopkins study stresses that one thing to leave behind in Europe is the cadre needed to receive reinforcements to Europe.¹²⁵ The Alliance must look beyond just this structure to its out-of-theater needs. Bases like Torrejon AB, Spain, played a key role in DESERT SHIELD and will be needed in the event of a second Southwest Asian war.

If the nation commits to an expanded airlift fleet, infrastructure will be needed in the U.S. as well. A fleet of 319 C-17s could not be housed in the existing MAC bases. Restructuring beyond that recommended by the two base closure commissions could be required. Airfields currently under Army control, as in Savannah and El Paso, come to mind as possible

¹²⁵ Johns Hopkins Working Group, pp 12-13.

MAC bases. This requirement for increased basing, however, further illustrates the unlikely chance of a force of 319 C-17s.

Again, then, we must turn to the most effective ways to move forces given the restrictions. Possible APODs must be identified and equipped, if at all possible. For example, while the Saudis do not want a permanent U.S. presence, greater prepositioning and airfield preparation could be carried out to speed the next airlift. The alliance structure so often addressed by policy makers can be elaborated in key areas of the world to insure in-theater structures supporting MAC's operations.

Both prepositioning and building infrastructure have risks. Politically, putting too much into Saudi Arabia, for example, may harm Saudi or American relations with other nations in the region. Leaders may fall souring relations, such as when the Ayatollah Khomeini toppled the Shah in the 1970s. Indeed, prepositioned equipment can be lost and infrastructure improvements wasted in events like these. They may seem wasted if they are never used. They are, however, a vital hedge against limited lift, however.

Trim, but powerful forces will be needed as lift limitations continue to face a military shrinking in size and returning to CONUS. For the U.S. to have a credible force projection capability, it is critical for these forces to be properly trained, equipped, and organized in light of available lift. Projection also requires the U.S. maintain an airlift infrastructure around the world, one with the capacity to

service the deployments planned by the unified commands. Land- and sea-based prepositioning will be crucial for force employment, given the limitations of airlift. This will be important in other regions, not just SWA.

Other Issues and Regions

The key "other" to be considered is Europe. Chapter 5 described the threats remaining on that continent. The importance of that theater cannot be diminished, nor ignored. Similarly, it would be wrong for this paper to fail to address an issue outside the scope of other discussions of the Army -- their response to the C-17s direct delivery capability. Related issues, materials handling equipment (MHE) and the CRAF, must also be looked at.

Europe. There is something wrong with the logic, "Retaining a smaller force of American troops in Europe will mean that we will need considerably more lift capacity to get a greater number of American forces back to Europe if war breaks out."¹²⁶ Greater capacity is needed if enough time is not available. Time is now available -- perhaps a year of strategic warning. Tactical warning may, in fact, be measured in months. Warning time is not, however, reaction time. Warning time available, but not used, is useless.

Foreseeable lift limitations dictate that the U.S. use strategic warning to thwart threats in Europe. This may mean

¹²⁶ David S. Sorenson, "Getting Back to Europe: Strategic Lift Needed Now More than Ever," Parameters, June 1990, p 66.

far earlier reinforcement decisions than in the past. Just as reserves were called up and troops deployed to Germany during the Berlin crisis in the 1960s, Army units may have to move to Europe at an early sign of trouble in the twenty-first century. Basing airlift on a Southwest Asian scenario demands this. There is no chance the old goal of "ten divisions in ten days" will be achieved, not given the lessons of DESERT SHIELD. Ten divisions may still be a very real requirement, to get them there will take time.

Prepositioning will be important in all theaters. The four-division DoD plan for reinforcing Europe makes POMCUS critical. Sets presently in place will have to be added to, not diminished. The lift requirement earlier in this chapter is predicated on 80 percent prepositioning. As time goes on, POMCUS locations may also have to change as well. The entire NATO structure was based on a defense conducted along the intra-German border, a line now erased from the map.

Additionally, because of the changes in European geography, intratheater lift becomes far more important than ever. It was beyond the scope of this study to analyze the intratheater needs of a European war. The various combinations of APOD/SPODs, rail lines, and airlift must now be carefully analyzed from Amsterdam to Warsaw, and beyond. The C-17 fleet and programmed C-130s may not be enough.¹²⁷ The greater distances, the possible need to

¹²⁷ Intratheater airlift did not take on as big a role in this paper as I had expected. The primary study on the subject, the Worldwide Intratheater Mobility Study, remains classified and quantifying intratheater airlift requirements is an extremely scenario-dependent task. DESERT SHIELD will shed new light on certain aspects of the intratheater/tactical airlift debates. For example, Maj Gen Kondra indicated previous efforts to move the C-130 exclusively to the ARC will have to be reconsidered.

use more spartan airfields built by the Warsaw Pact, and the greater reinforcement efforts will all change the intratheater requirements.

Southwest Asian scenarios, other than a replay of DESERT SHIELD, could also shape intratheater airlift requirements. The distances from APODs to the "front" were short enough in Saudi Arabia to allow trucks to move deploying forces. In an Iranian scenario this would not necessarily be the case. The Mobility Requirements Study will address some aspects of the intratheater issue. Its link to the strategic bears more study. MAC may find it necessary, and politically expedient, to "sell" strategic airlift based on a Middle East scenario and tactical airlift on a European one.

Doctrine. Airlift doctrine is changing. The advent of the C-17 has been heralded for years by the promise of "direct delivery." In fact, the C-17 may have been slowed by the promise of direct delivery. The idea of flying from a CONUS APOE directly to a small austere airfield (SAAF) is far from new. The concept shows up in writings from the 1930s. The complexity and cost of the C-5 stems, in part, from a requirement to be SAAF-capable. The long-anticipated, never-delivered capability was the center of numerous arguments over whether to buy the C-17 or more C-5s. For numerous reasons, it is now

Interestingly, there is no major effort to replace the venerable C-130, nor to visualize drastically new forms of tactical airlift. Numerous studies exist pointing to "scaled-down C-17s," "widebodied C-7s," "stealth air lifters," and others. The most common feeling at MAC Headquarters is that the C-130 will be replaced by the C-130, perhaps the C-130J now being touted by Lockheed. This aircraft takes the four-decade-old design and updates it -- reducing runway requirements and crew size, for example.

logical to believe direct delivery capability is on the horizon, to be available in FY94. What is it all about?

The Air Force believes that, if properly implemented, direct delivery could

- reduce congestion at the main operating bases where airlift forces must share available space with several other types of forces;
- improve unit integrity, which means a cohesive fighting force of personnel and their full array of equipment; and
- facilitate a faster force closure rate, which is the speed with which a fully equipped fighting force becomes available for deployment against the enemy-¹²⁸

The Congressionally Mandated Mobility Study quantified these beliefs somewhat.

Our analysis of the benefits of being able to use austere airfields in Scenarios I and II showed a 7-15% productivity advantage for direct delivery. Since flexibility and timeliness are dominant characteristics of airlift, these advantages are directly transferable to the amount of airlift which must be purchased to accomplish a given objective. Ability to operate in austere runway environments, particularly with aircraft that can transport cargoes up to out-size, improves the effectiveness of other mobility alternatives which can deploy cargo to major air and sea ports of debarkation and thus require transshipment to forward locations.¹²⁹

The C-17 was hailed as bringing this additional direct delivery capability to the fleet. The new aircraft has become more of a replacement for the airlift force, supplanting the aging C-141. The direct delivery capability is now more an "added luxury" for the fleet. The impetus to move from the

¹²⁸ GAO, "Military Airlift," p 23.

¹²⁹ CMMS, v 1, p 27.

"traditional airlift doctrine" (main operating base to main operating base) to a doctrine of direct delivery (main operating base to SAAF) may be lessened. DESERT SHIELD does nothing to force the change. As mentioned, the short distances from the large, if sometimes austere, airfields precluded major trans-shipment problems or a desire to fly to short fields during deployment. The primary addition to the lift, as seen by MAC experts, of the C-17 would have been the ability to get more (25 to 30 percent) throughput in an airplane-constrained environment.

The C-17's capability for direct delivery will not be forgotten; MAC will plan to utilize such operations in future conflicts. To garner the greatest possible benefit, however, will require more than just new airplanes.

...[T]he Army has designed its logistic doctrine, procedures, and requirements "around" the traditional airlift concept. However, the Army may have to modify its resupply requirements and change the organization of its logistic system because direct delivery delivers forces to their wartime location "sooner" and further forward than the traditional concept would have delivered them.¹³⁰

The indications from DESERT SHIELD are that the Army is not ready for direct delivery. MAC's constrained APOEs were seemingly due to Army requirements as much as they were due to political restrictions placed upon U.S. action by Saudi Arabia. Interviews with MAC staff personnel indicated an Army reluctance to do the restructuring Maj Soligan suggests. For direct delivery to work the Army units will have to be somewhat self-

¹³⁰ Soligan, p 46.

supporting, MAC aerial port personnel will not be available for all the smaller fields. The Airlift Concepts and Requirements Agency (ACRA), a joint Army-Air Force group, has published a document to try to force thinking in this area, but much remains to be done.¹³¹ The SAAF capability of the C-17 is too much to waste. A high priority as the airplane begins to come on line in the 1990s must be to develop direct delivery procedures through exercises and evaluations.

The intratheater capacity of the C-17 will also generate doctrinal questions, primarily within the Air Force. Presently, operational control (OPCON) of theater airlift assets (C-130s primarily) is vested in the theater commander. OPCON of strategic airlift assets remains with MAC. This has its basis in historical problems when strategic airlift assets were assigned to theater commanders. The advent of the C-17 will re-muddy the waters. The clear dividing line presently used will lose its meaning. When is a C-17 a theater asset? There is simply no easy answer, but procedures must be established.

Materials Handling Equipment. One element that will be critical to direct delivery, and to maximizing throughput elsewhere is MHE. Presently, no available MHE ideally suits widebody aircraft. A new unit is in development (the so-called "60K loader"). This unit will provide one piece of MHE that can quickly unload C-5s, C-17s, and C-141s from their low cargo

¹³¹ ACRA, "Multi-Service C-17 Employment Concept" (Scott AFB, IL: MAC/Army Training and Doctrine Command/Marine Corps Combat Development Command, 8 Jun 1990) and interviews with various MAC staffers.

floors as well as KC-10s and Boeing 747s from their high ones. This development is very important to the MAC infrastructure.

Even more important will be the rapid availability of sufficient MHE for all the fields to be used in an airflow. This number could be significant in a "SAAF-rich" environment (e.g. Iran or Poland). This links directly with the development of Army procedures and doctrine mentioned above. During DESERT SHIELD the Army had a difficult time maintaining MHE to support its fleet of CH-47 helicopters in the theater. Adding the deployment airlift flow to Army requirements would have been too much.¹³²

One TRANSCOM staffer suggests the solution lies in buying airlifters with internal MHE, such as the Soviets have.¹³³ This is an avenue worth exploring, but to redesign present aircraft would only add weight to them and decrease their cargo-carrying capacity, something already too constrained. This may be something to pursue for a follow-on airlifter whose design must begin around 2010.

Civil Reserve Air Fleet. The CRAF is the last of the "other" issues to be addressed here. DESERT SHIELD marked the first activation of the CRAF in its 38-year history, the results were good. To maintain an estimated 18.09 MTM/D capability will be difficult, but far from impossible. Some questions were raised about the CRAF and procedures for activating the CRAF

¹³² Interview with Lt Col Blame Hyten, ACRA, 16 April 1991.

¹³³ Lt Col Tom Cohoon, TRANSCON J-5, interview 17 April 1991.

during DESERT SHIELD.¹³⁴ The overall success of the program makes the CRAF's future secure.

TRANSCOM and MAC will probably reshape the civil carriers' participation. The present system of staging may disappear. Current incentives for airlines to sign on to the CRAF will likely change. Requirements levied on participants may become greater. In the end, however, all indications are the CRAF capability will remain constant. This will have to happen -- the CRAF has long been and will continue to be crucial to the nation's airlift capacity.

Conclusions

This paper presents a way to view airlift. While it suggests capacities required of the airlift system by the nation, it is more important for the reader to adopt the viewpoint and not the numbers. Airlift can only be seen as a systematic whole, Maj Gen Kondra's garden hose analogy is apt. The plumbing to the CONUS spigot seems sound. The size of the hose is too small, pumping stations enroute are jeopardized, we may need a bigger nozzle, and, in some theaters, we may even need more watering cans to get to the hard to reach places. If we buy just a bigger hose, the pumping stations may not be able to handle the back pressure and the hard to reach spots will

¹³⁴ Page interview, 17 April 1991. Specific interest focused on the CRAF's ability to get into a higher-threat environment, such as King Khalid Military City. Significantly, no concerns were apparent about Dharhan, even after the SCUD attacks there. The other significant procedural question revolved around a small, but interesting point. Why is CINCMAC still empowered to activate the CRAF, and not CINCTRANS?

with. Similarly, just a bigger nozzle or just more watering cans doesn't fit the bill.

We must not fail to see our hose as part of a larger irrigation system, either. Prepositioning is a reservoir along the way and sealift serves as the canals bringing huge amounts of water to the theater. This paper focuses on airlift, but airlift is just a part of a much larger whole. Balance has never been achieved throughout the U.S. military. Attaining it is no easier now than ever.

Hopefully, the reader can take from this paper a methodology to determine what airlift capability is available to the nation and can see the alternatives for sizing the fleet in the future. We must factor in mission capable rates when programming. We must lower our estimation of individual performance characteristics (speed, flying time, and payload). This more realistic evaluation of capability then can be used to provide airlift balanced to our requirements and capabilities.

What follows is a summary of specific conclusions.

- ▶ Airlift forces should now be planned using a Southwest Asian scenario as the base case.
 - This region's resources and instability combine to make it the area with the most massive threat to U.S. interests.
 - Low response times and long distances make SWA the U.S.'s most demanding airlift case.
 - A simplistic approximation reveals an airlift requirement averaging 49 MTM/D.
- ▶ The base case requirement means the airlift fleet must be capable of 58 MTM/D, as a minimum.

- The 49 MTM/D average requirement must be increased by at least 10 percent to allow fluctuation in the airlift flow. To this total must be added the JCS withhold of 4 MTM/D.
- There is a fixed fleet underlying airlift for the next 20 to 25 years: 109 C-5s, 57 KC-10s, and a CRAF yielding 18.09 MTM/D. This fixed capacity is 30.60 MTM/D.
- The fixed fleet and C-141s presently in inventory yield a capacity of 39.58 MTM/D, based upon the lessons of DESERT SHIELD.
- The C-141s will be retired by FY2008.
- ▶ To maintain or increase fleet capacity will require the purchase of C-17s. Several options exist for fleet sizing.
 - The presently approved buy of 102 PAA provides 8.77 MTM/D in 2009. Total fleet capacity: 39.37 MTM/D.
 - Fixing capacity at 44.28 MTM/D existing in FY 2001 requires continuing buy to 159 PAA.
 - To possess the capability to perform the airdrop mission for the deployable ready brigade (DRB) requires 147 C-17s PAA. To carry out the DRB mission plus associated force packages would take 274 C-17s PAA. These would yield fleet capacities of 43.24 or 54.16 MTM/D, respectively.
 - Maintaining MAC's present fleet size in numbers of airframes would mean replacing the C-141 one-for-one with the C-17, a total buy of 228 PAA. This would yield a fleet capacity of 50.20 MTM/D.
 - To achieve a total fleet capacity of 58 MTM/D requires 319 C-17s PAA.
 - The originally planned buy of 220 C-17s PAA emerges as an effective balance of airlift capacity and cost.
- ▶ To get the most possible from a constrained fleet, the entire deployment system must be routinely and thoroughly exercised. Emphasis must be made on avoiding unrealistic requirements on MAC and determining theater restrictions to airlift.
- ▶ CRAF contracts must preserve a capacity of 18.09 MTM/D that can be effectively utilized in expected scenarios.

CRAF carriers must be ready, willing, and able to perform their wartime roles -- facing wartime risks.

- ▶ Europe remains a high priority theater even though not serving as the base case.
 - Planners must develop deployment concepts to best use the longer warning times. Deployment to a European crisis will take a long time.
 - The effect of the expanded European theater (now extending a possible "front line" out to the Polish-Russian border) on intratheater lift requirements must be analyzed.
- ▶ The airlift infrastructure must be made ready for deployments to likely theaters of operation.
 - European and Pacific bases must be preserved with a capability to deal with the airflow to Southwest Asia and other theaters. All servicing requirements must be met at these bases.
 - Aerial ports of debarkation should be prepared to provide capabilities matching war plans wherever politically and economically feasible.
 - Materials handling equipment must be obtained to speed throughput and to support direct delivery operations using the C-17.
- ▶ The Air Force must develop the doctrine for the intra-theater use of the C-17. Issues of priority, timing, and command and control must be decided.
- ▶ As the primary user of MAC airlift, the Army must meet several requirements.
 - "Lift growth" must be stopped. New procurement and organizational structures must consider available lift means and speeds.
 - Load planning must be made as effective as absolutely possible.
 - Develop doctrine and acquire MHE for direct delivery operations by the C-17.
 - Use land-based and sea-based prepositioning in every theater possible -- balance loads, time, and capability.

These conclusions point to tough decisions ahead. A fleet of over 200 C-17s will be very tough to sell politically. Admitting previous lift programming is erroneous will not be easy. Balancing the emerging lift requirements with readiness and sustainment of other forces has never succeeded.

This paper points to numerous lift requirements without even looking at what is needed for sealift or in prepositioned stocks. I make no apology for that. To project out a quarter century is not easy. To look out cautiously, with a depth of understanding is crucial. Others will, and should, look at the other legs of the mobility triad. Our nation's total reach depends upon it. The crises that may develop are impossible to predict, as we have seen. We can only guess at how our global power will be called upon. Without a global reach, it will not prevail.

APPENDIX I

STATISTICAL ANALYSIS

All the capacity statistics in this paper are based on Equation 1-1 presented in the first chapter. A single aircraft's capacity is the product of block speed, average load, the productivity factor, and utilization rate. Air Force programming has, historically, multiplied that number times the number of authorized aircraft, the PAA, to get a fleet capacity. That is, the Air Force has applied Equation 1-2 with a mission capable rate of 100 percent. The sum of the various fleets of aircraft (C-5, C-141, KC-10, etc.) is the total system capacity.

This paper has shown two fallacies in this approach: the lower performance actually derived from DESERT SHIELD and the lack of maintenance reliability in the equation. In light of DESERT SHIELD, I have applied smaller performance numbers based upon the averages actually attained. Inserting these into Equations 1-1 and 1-2 produces reduced fleet capacities. I have also factored in historical maintenance reliability, that achieved during the build up to the Iraqi war, into Equation 1-2. This further reduces fleet capacity. Table A-1 shows the original Air Force programming numbers¹ and the revisions derived from DESERT SHIELD.

These reduced numbers were derived as follows:

Utilization Rate: MAC obtained a "use rate" for its

¹ These are found in the Airlift Master Plan, p A-1a, and were updated by MAC/XPYS.

PLANNING FACTORS					
Aircraft	Ute Rate	Blk Spd	Ave Pyld	PF	MTM/D/AC
Programmed					
C-5	11.0	423	68.9	.47	0.1507
C-141	12.5	410	27.5	.47	0.0662
C-17	15.65	440	48.3	.47	0.1518
KC-10	10.0	445	52.9	.47	0.1106
Reduced					
C-5	10.0	419	62.9	.47	0.1239
C-141	12.0	395	20.0	.47	0.0446
C-17	13.9	427	38.6	.47	0.1042
KC-10	10.7	450	42.3	.47	0.0957
NOTES:					
• C-17 utilization rate is effectively reduced in USAF programming to 15.2 hours per day to account for intratheater legs flown by this dual-capable transport. A reduction of 0.45 hours is applied to C-17 ute rates throughout this paper, except as noted in Chapter 6. • KC-10 average payload in DESERT SHIELD was 29.3 tons. As this was derived from a very small statistical sample, a 20% reduction to USAF programming has been applied here.					

Table A-1.

various aircraft employed in DESERT SHIELD. This use rate was the average flying time an aircraft of a given type actually flew during a given day employed on a DESERT SHIELD mission. This average is used here. C-17 utilization is a revised estimate.²

Block Speed: During the course of DESERT SHIELD the C-5 averaged 418 knots, nearly its programmed speed. The C-141's block speed suffered (averaging 394 knots, rounded up slightly here) due to shorter flight legs. The C-141 is the smaller work horse of the MAC strategic fleet, it is assigned some of the "feeder" routes, etc. Figure A-1 shows a hypothetical pair of profiles demonstrating the reduction in block speed over shorter legs, despite constant cruise speeds. The C-17 will replace the C-141 as the short-leg workhorse; its programming block speed has been reduced 3.0 percent, roughly what the C-141 lost.

² The GAO used 14.4 hours per day as a more reasonable estimate in a pre-DESERT SHIELD report. This 13.9 estimate was given to me by a MAC staffer. Interestingly, it is the same reduction (and nearly the same percentage loss) from 14.4 as the C-141 experienced from 12.5 hours programmed. In my judgment, if it is in error, it is too high.

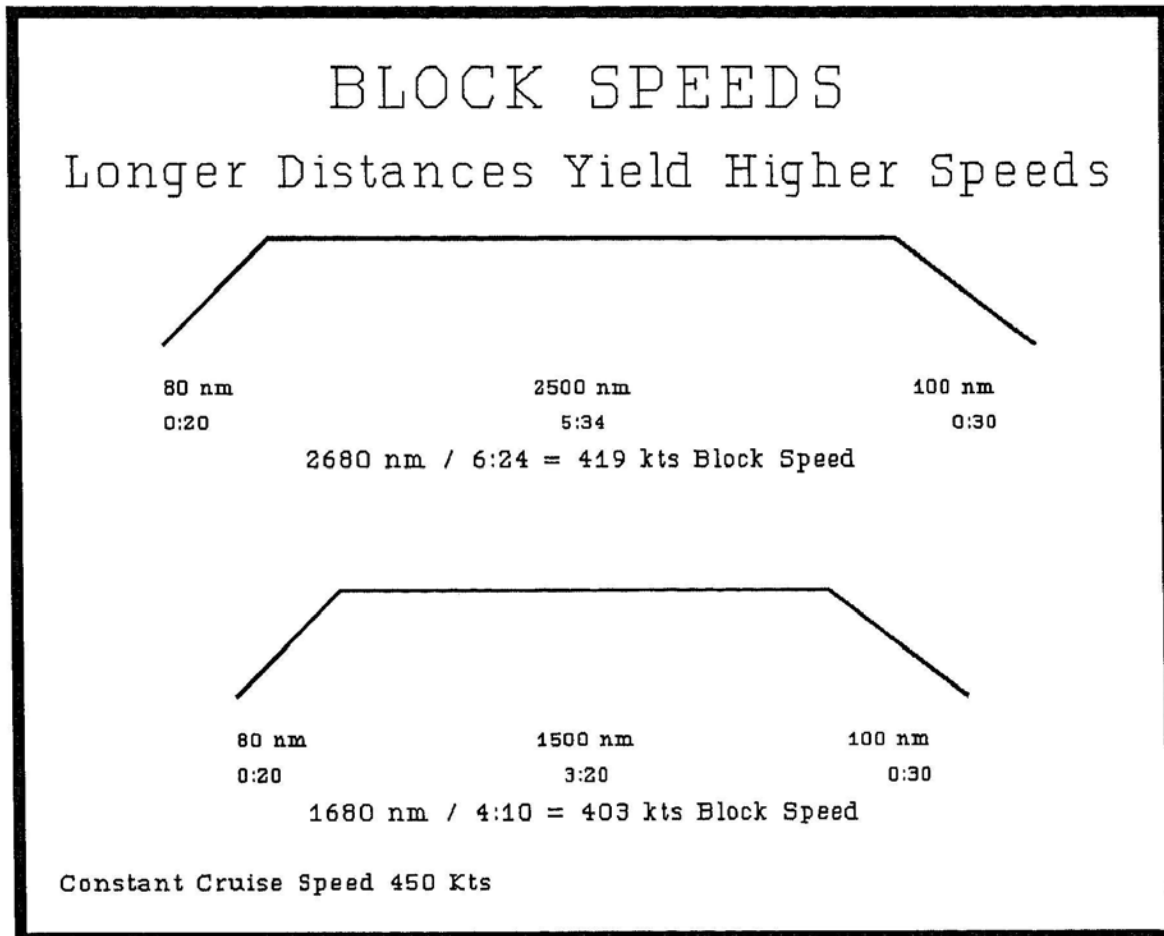


Figure A-1.

Average Payload: Payloads during DESERT SHIELD fell short of programming numbers significantly. The C-S was roughly 10 percent short, the C-141 30 percent of expectations. This is due to a number of factors. Most significantly, MAC no longer moves as much of the Army's armor as originally planned. This significantly lowers the density of the average load. Secondly, the programming numbers are based more on airlift efficiency than combat effectiveness. Real loads are planned to put effective loads at the destination. C-17 programmed payloads were reduced 20 percent -- intentionally between the results of MAC's current airlifters during DESERT SHIELD.

Performance Factor: This value represents the reality of airlift -- an aircraft is only productive from APOE to APOD and not on the return leg. Thus, about half of its flying time is non-productive. This value was borne out by DESERT SHIELD experience for all aircraft.

When the data in Table A-1 is applied to Equation 1-2, present fleet capacities are reduced as shown in Table A-2. This table also reflects the application of mission capable rates to the programming numbers.

When dealing with averages and projecting those averages into the future, one should perform a sensitivity

analysis on the re-

sult. To do this here, I will apply standard deviations for individual factors, as derived from a DESERT SHIELD sample. Table A-3 shows the standard deviation for each factor derived from a 60-day sample ending on D-Day, 16 January 1991. From these standard deviations are derived a range of MTM/D/AC for the C-141 and C-5. A normal distribution of data leads one to the conclusion that there is a 68 percent probability the actual value lies in the range shown.³

Applying this same sort of analysis to the C-17 projections indicates a variation of approximately 5.5 percent about the average derived from a given payload figure. That is to say for a 20 percent reduction in payload, capacity varies from 0.0982 MTM/D/AC to 0.1103 MTM/D/AC. If a 10 percent reduction is used

FLEET CAPACITIES				
Acft	#AC	%MC	MTM/D Per AC	MTM/D Fleet
C-5	109	78	0.1239	10.5
C-141	234	86	0.0446	9.0
C-17	102	82.5	0.1042	8.8
NOTES:				
• %MC is mission capable rate in percent.				
• C-17 %MC is obtained from procurement contract obligations.				
• Currently programmed capacities are C-5 - 16.4, C-141 - 15.5, and C-17 - 15.5 MTM/D.				

Table A-2.

³ Any standard statistics text shows a normal distribution as a bell curve with a 68.2% probability of actual values lying within ± 1 standard deviation, and 95.4% within ± 2 standard deviations of the mean. See for example, Seymour Lipshutz, Probability (New York: McGraw-Hill Book Co., 1965) pp 106-08.

SENSITIVITY ANALYSIS					
Acft	Standard Deviations			MTM/D Min	MTM/D Max
	Fly Hr	Blk Sp	Pylt		
C-5	10.15	0.51	5.07	0.1019	0.1479
C-141	9.68	0.30	2.45	0.0382	0.0514
NOTES:					
• Deviations are shown as percentages of programming values.					
• Capacities shown are maxima and minima for ± 1 standard deviation variation of performance factors.					

Table A-3.

to determine capacity, the range is 0.1149 to 0.1284 MTM/D/AC. While this is a significant range, the largest number is still 15 percent less than programmed by the Air Force at the present time. Given DESERT STORM's example, it seems programming based on the 20 percent reduction would be more logical as this is still far better than the C-141 averaged.

If the best possible C-17 performance is assumed the fleet required to achieve the 58 MTM/D described in Chapter 6 is reduced to 259 aircraft. Conversely, if the worst case develops, 338 C-17s would be needed to meet the requirement.

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