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AIR FORCE JOURNAL of LOGISTICS

Air Mobility Issues 2002

in this edition:

- Civilian Contract Air Refueling: Innovative or Insane
- 18 Hours on Green Ramp
- Looking Ahead: Future Airlift
- Air Mobility: Simultaneous Enhancement of Airpower Legitimacy and Security Dilemma Ameliroration

Volume XXVI,
Number 1
Spring 2002

AIR FORCE JOURNAL of LOGISTICS

Volume XXVI, Number 1 | Spring 2002 | AFRP 25-1

FEATURES

DEPARTMENTS

The *Air Force Journal of Logistics* (*AFJL*), published quarterly, is the professional logistics publication of the United States Air Force. It provides an open forum for presenting research, innovative thinking, and ideas and issues of concern to the entire Air Force logistics community. It is a nondirective publication published under AFI 37-360, Volume 1. The views and opinions expressed in the *Journal* are those of the author and do not necessarily represent the established policy of the Department of Defense, Department of the Air Force, Air Force Logistics Management Agency, or organization where the author works.

The *Journal* is a refereed publication. Manuscripts are subject to expert and peer review, internally and externally, to ensure technical competence, accuracy, reflection of existing policy, and proper regard for security.

The publication of the *Journal*, as determined by the Secretary of the Air Force, is necessary in the transaction of the public business as required by the law of the department. The Secretary of the Air Force approved the use of funds to print the Journal, 17 July 1986, in accordance with applicable directives.

US Government organizations should contact the *AFJL* editorial staff for ordering information: DSN 596-4087/4088 or Commercial (334) 416-4087/4088. Journal subscriptions are available through the Superintendent of Documents, US Government Printing Office, Washington DC 20402. Annual rates are $15.00 domestic and $18.75 outside the United States. Electronic versions of the *Journal* are available via the World Wide Web at: http://www.aflma.hq.af.mil/lgj/Afjlhome.html. The *Journal* editorial staff maintains a limited supply of back issues.

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Innovative or Insane?

Civilian Contract Air Refueling

The ability to project and sustain military power over vast distances is a basic requirement of deterrence.

Major Mark D. Camerer, USAF

Introduction

Simply put, America's National Security Strategy, built on the imperative of world-wide engagement, demands nothing less than the best global transportation system the world has ever known, one capable of projecting U. S. strength and resolve—anywhere, anytime.

—General Charles T. Robertson, Jr[1]

The ability to project and sustain military power over vast distances is a basic requirement of deterrence—the first line of our national security.[2] General Charles T. Robertson, Jr, commander of US Transportation Command (USTRANSCOM), stressed this point when he noted the importance of rapid global mobility to the nation's ability to project and sustain military power.[3] Air refueling is a force multiplier inherently critical to achieving the rapid global mobility described by General Robertson. As a force multiplier, it bridges the gap between the continental United States (CONUS) and various theaters of operation, accelerating the deployment cycle and reducing dependency on forward staging bases and host-nation support.

While deterrence is the first line of national security, the ability to fight and win, regardless of the level of conflict, is the bedrock of our national security.[4] Air refueling's second role, force enhancement, is critical to military activities in this regard. As a force enhancer, it extends the range, payload, and loiter time of combat and combat support forces, allowing a variety of combat aircraft to attack strategic and tactical targets, deep in an adversary's territory, with greater payloads. These unique capabilities, force multiplication and force enhancement, make air refueling an indispensable military resource.

Despite their importance to national security, air-refueling assets have dwindled. A June 2000 General Accounting Office (GAO) report on military readiness concluded the Department of Defense (DoD) is 19 percent short of the air-refueling capability required to execute wartime plans.[5] Additionally, the Air Mobility Command's (AMC) *Air Mobility Strategic Plan 2000* identifies two deficiencies directly related to air-refueling capabilities.[6] The first is increased depot-maintenance cycle time for the aging KC-135 tanker fleet, and the second is the unknown service life of the KC-135 airframe.[7] AMC planners predict a need to begin retiring KC-135s in fiscal year (FY) 2013. Currently, there is no replacement tanker on the drawing board or in the budget.

These shortfalls have spawned the question: is it feasible and/or desirable for

(Continued on page 39)

Air Mobility's Command Support of the 82d Airborne Division Ready Brigade

18 Hours on Green Ramp

Major Scott A. Haines, USAF

Deploy worldwide within 18 hours of notification, execute parachute assault, conduct combat operations, and win.

From 1998 to 2000, I had the privilege of supporting a major piece of our national power projection capability, the 82d Airborne Division Ready Brigade (DRB) from Fort Bragg, North Carolina. Outload of the division occurs on the *Green Ramp*, located on Pope AFB, North Carolina (collocated with Fort Bragg). During this time, I developed an intense respect for the troops of the 82d as they shuffled day after day; night after night; through rain, bitter cold, and stifling heat, awaiting aircraft on Green Ramp.

Introduction

Force does not exist for mobility, but mobility for force.

—Alfred Thayer Mahan

Tucked quietly away in a corner of the Pope AFB flight line is the Green Ramp, described as a *precious national asset* by one recent wing commander.[1] Since the Vietnam War, members of the 82d have departed from Pope in support of many

Air Mobility

issue and challenges 2002

significant military operations. Unfortunately, the US military now is not the same force that fought so effectively in the deserts of Southwest Asia 10 years ago. For example, recent figures on current military airlift capacity project a shortfall ranging from 17 to 30 percent,[2] causing significant concern regarding the Air Force's ability to support national security objectives. A vital concern, directly related, is the ability of Air Mobility Command (AMC) units at Pope AFB to effectively support DRB's 18-hour contingency deployment requirement.

The Mission

An understanding of the 82d Airborne Division's mission will aid appreciation of the readiness challenge that AMC faces in providing support for the DRB. This mission, simply stated, is: "Deploy worldwide within 18 hours of notification, execute parachute assault, conduct combat operations, and win."[3] Upon receiving a call from XVIII Airborne Corps Headquarters, the 82d issues an alert order to the on-call DRB. Within 18 hours, elements of the DRB must be in the air in support of vital US national interests anywhere in the world. Twenty-four hours a day, 7 days a week, 52-weeks a year, a contingent of the 82d, identified as DRB-1, remains on alert (Figure 1). The division is built around three airborne brigades. Each brigade, in turn, is based on a reinforced parachute regiment. A former commander, Major General James H. Johnson, aptly described the 82d as "the only US combined arms force with a capability to conduct forced entry and secure an area, while building enough combat power to fight, sustain itself, and win the initial battle."[4]

The Air Force provides airlift support in the form of strategic airdrop. Outload of the DRB occurs on Green Ramp. Pope AFB has been an AMC asset since its transfer from Air Combat Command (ACC) on 1 April 1997. Before the transfer, the 624th Air Mobility Support Group (AMSG) provided primary support to the brigade. The 624 AMSG consisted of three primary elements—command and control, the 3d Aerial Port Squadron (APS), and the 624th Maintenance Squadron (MXS)—operating under the umbrella of the AMC en route system. Currently, the 43d Operations Group (OG) En Route Support Section, 3 APS, and 743 MXS provide support for the brigade. Despite similarities in organizational structure, the transition from ACC to AMC had an adverse effect on determining readiness to support the brigade.

Recent Operations

Joint Vision 2020 continues to stress the importance of overseas basing in meeting national security objectives but also places greater emphasis on continental United States (CONUS)-based power projection capabilities.[6] The effectiveness of the DRB during recent operations reinforces current operational concepts espoused by the Chairman of the Joint Chiefs of Staff (JCS). Two of the more notable conflicts supported by the brigade were Operations Just Cause and Desert Shield/Desert Storm.

Operation Just Cause. On 17 December 1989, an alert order was transmitted to the 82d, using an emergency readiness deployment exercise as deception cover. The rapidly deteriorating situation in Panama had convinced the President and Secretary of Defense that it was time to act. The final Air Force package supporting the DRB portion of outload operations on Green Ramp consisted of 51 C-141 aircraft (20 for people, 28 for heavy equipment, and 3 container delivery system [CDS] aircraft). There were minor problems during the initial phases of the deployment, compounded by the fact the deploying DRB had just changed from the 3d to the 1st Brigade. However, it was loaded within 24 hours, with the first aircraft fully loaded in 10 hours.[7] In the early morning hours of 20 December 1989, the air assault on Panama began. An effective combination of airborne, helicopter, and ground assaults on multiple objectives quickly ended the hostilities. The early morning assault originated primarily from CONUS bases and was the largest personnel airdrop since the Korean War and the largest nighttime parachute assault in history.[8]

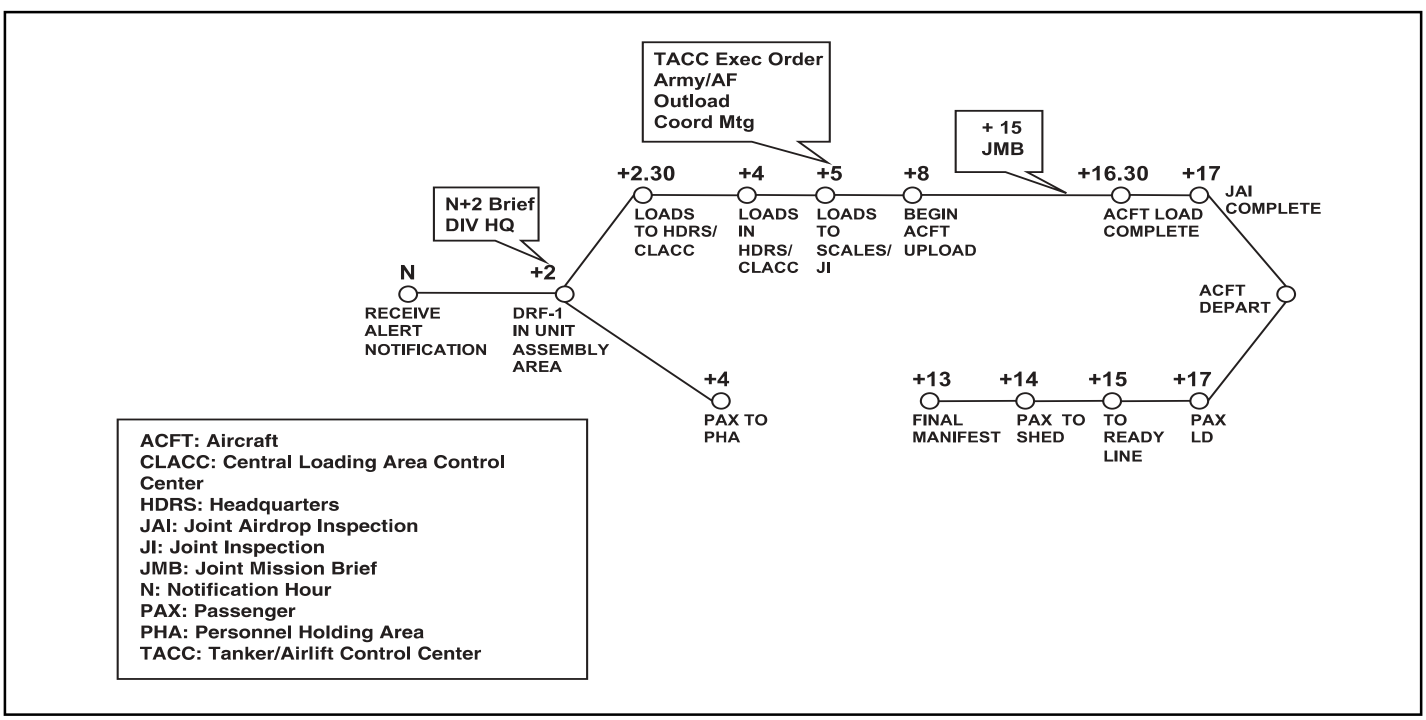

Figure 1. DRB Deployment Time Line[5]

Operation Desert Shield/Storm. Elements of the 82d began returning home from Panama in January 1990. However, their respite from operational deployment was short-lived. In early August 1990, Iraq invaded and quickly overran Kuwait. As Iraqi armored divisions stood poised on the border of Saudi Arabia, America's response was debated. On 6 August, King Fahd requested assistance, and President Bush quickly responded. The logical choice for an initial response was a rapidly deployable, light ground force. The 2d Brigade of the 82d, on call as the DRB, was ordered to Kuwait. The first C-141 aircraft transporting the brigade was airborne less than 14 hours after official notification.[9]

Elements of the 82d were the first ground troops in Saudi Arabia as part of Operation Desert Shield. Consequently, they were assigned the task of protecting the airfield and ports needed to receive US and coalition forces. General Norman Schwarzkopf described the role of the DRB: "The 82d was nothing more than a tripwire force. It was a show of resolve, a way to say to the Iraqis, If you run down the highway, by the way, you are at war with the United States."[10] The brigade accomplished its mission and remained deployed in support of Operation Desert Storm, the eventual ground war that resulted in the liberation of Kuwait.

There are many organizations within the Department of Defense responsible for the success of the 82d. This article reviews only three organizations supporting Green Ramp operations today: 3 APS, 743 MXS, and 43 OG En Route Support Section with primary focus on current readiness to meet support requirements as delineated by the XVIII Airborne Corps and the 82d.

The success of the DRB concept during Operations Just Cause and Desert Shield/Storm is well-documented and hard to dispute. However, the simple reality that the US military does not currently maintain the same robust capabilities it did a decade ago is also hard to dispute. Not surprisingly, force reductions and other developments during the last 10 years have resulted in significant changes to the organizations on Green Ramp. Can these units still provide the required support for the DRB? In fact, do we even have a system in place to measure their readiness?

Current Support Requirements

Leaped to their feet a thousand men, their voices echoing far and near: "We go, we care not where or when; our country calls us; we are here!"

—Author Unknown, 27 April 1861 (to the New York 7th Regiment)

Understanding the DRB process and requisite support for Green Ramp operations represents a crucial first step toward determining readiness. For example, airlift support requirements for the DRB vary depending on the nature of the operation. While performing as DRB-1, the assigned battalions are on 6-week rotation schedules (Figure 2). One battalion is designated Division Ready Force-1 (DRF-1). Battalion personnel prerig all DRF-1 unit equipment for airdrop and transport it to a prestaging area, where it awaits loading onto aircraft. Equipment preparation conforms to requirements of a standard loading process, awaiting customization during the 18-hour sequence, based on mission requirements.[11]

By default, Air Force support requirements depend primarily on the nature of the contingency being supported by the DRB. One of the most critical requirement areas—the different types of aircraft loads or missions—drives personnel training, equipment procurement, and other support requirements at Pope AFB for organizations that support Green Ramp operations. Clear identification of these requirements helps ensure development of effective methods to determine the unit's readiness to support the DRB.

Aircraft Mission Type

Mission planners base requirements on four primary load types: personnel, container delivery system (CDS), heavy equipment, and airland. This load type affects readiness issues such as aircraft availability, support equipment, and training. Additional considerations include aircrew availability, command and control, and aircraft parking. Strategic airlift and tanker aircraft combine to provide capability to respond on a moment's notice anywhere around the globe. C-141, C-5, and C-17 aircraft provide strategic airlift support, and C-130 aircraft provide tactical airlift support.

Passenger Aircraft. The C-130E Hercules can transport 64 fully equipped paratroopers in side-facing seats, and the newer C-130J-30 model can accommodate 92 fully equipped paratroopers.[13] The C-141 Starlifter can carry 155 paratroopers but is rapidly approaching the end of its service life. When it retires, the C-17 Globemaster III will provide the primary support to the DRB. The new Dual Row Airdrop System—which uses a two-row, side-by-side rail system— supports 102 fully equipped paratroopers (Figures 3 and 4). In contrast to the C-130, the C-17 can make direct delivery to forward operating bases from aerial ports in the CONUS.

Container Delivery System. Advantages of the container delivery system include increased accuracy, fewer rigging requirements, and minimal materiel-handling equipment (MHE) requirements for loading. A-22 containers are normally used to package items rigged for container delivery systems, with loads ranging from 250 to 2,200 pounds. The C-130E/H is capable of airdropping up to 16 A-22 containers at a time, and the C-130J-30 is capable of airdropping up to 24. The C-141 and C-17 are both capable of airdropping up to 40 A-22 containers.[15]

Heavy Equipment. The heavy equipment delivery system is capable of delivering larger and heavier loads than the container delivery system. With heavy equipment airdrops, the user is responsible for rigging the loads, a labor-intensive process requiring specialized materials. In contrast to the CDS method, however, heavy equipment requires significant MHE capability. Both the C-130 and C-141 are capable of delivering loads up to 42,500 pounds with the heavy equipment method, and the C-17 can deliver up to 60,000 pounds.

Airland. Aircraft, using the airland method, land at the forward operating location and unload cargo and personnel. It is the safest and most efficient delivery method in terms of cargo delivered and availability for return cargo. Using the airland method takes approximately 29 hours to deploy the DRB.[16] The C-130, C-17, C-141, and C-5 are all capable of using the airland method.

Current DRB Airdrop Requirements

The DRB requirement in fiscal year 1997 consisted of a formation of 64 C-141 aircraft: 24 for people, 38 for heavy equipment, and 2 for container delivery systems, with a 27-minute pass time.[17] However, upon retirement of the C-141, the C-17 is

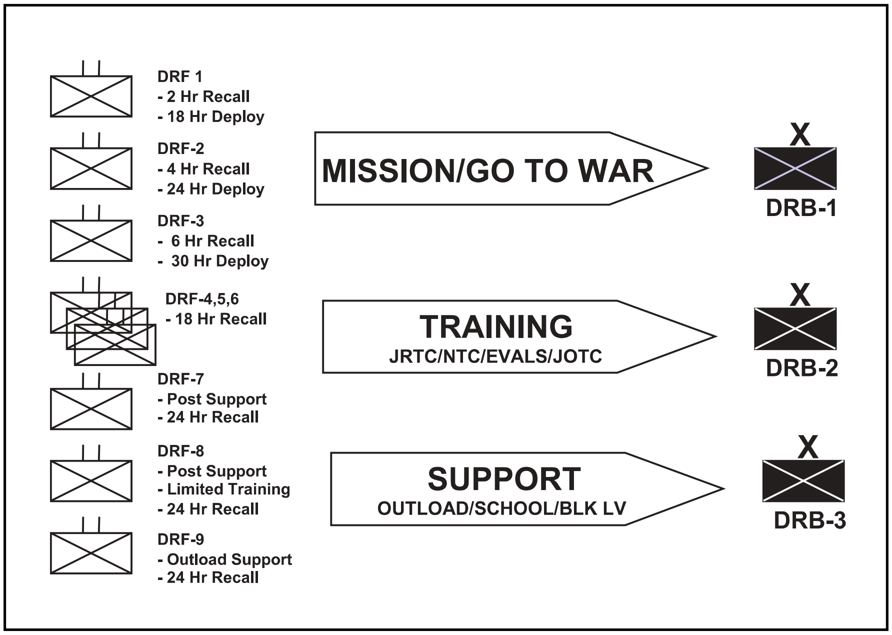

Figure 2. The DRB Cycle[12]

Figure 3. C-17 Dual-Row Airdrop

primed to assume the DRB support role. One recent projection for DRB support in fiscal year 2004 consisted of 71 C-17 aircraft, with 24 for people, 45 for heavy equipment, and 2 for container delivery systems.[18] Finally, the C-130 can adequately support DRB requirements for nearby operations that do not require aerial refueling.

AMC recently completed three initiatives designed to ensure the ability of the C-17 to meet the Army's 30-minute, pass-time requirement. In addition to installing the Dual Row Airdrop System and new equipment to facilitate tighter formations during inclement weather, personnel at Pope AFB conducted airdrop testing of reduced spacing between aircraft during personnel airdrops.[20] These initiatives enable the C-17 to conform to the Army's minimum, tactical insertion-time requirement and reduce the total number of heavy equipment aircraft required from 45 to 25.

Pope AFB Support Requirements

Command and Control. A number of people perform command and control functions on Green Ramp. Controllers are assigned to the outload support section of the 43 OG. The deputy operations group commander for joint operations provides oversight. Two Army officers provide ongoing interface with the 82[d]: the assistant chief of staff, operations and plans (G3) for air and the G3 airlift coordination officer (ALCO), formerly known as the ground liaison officer.

Station Capability. Maximum on ground (MOG) and *hot spot* aircraft parking capability are two key areas that affect the ability to support the DRB. MOG is the number of aircraft (of a given weapon system) personnel can work simultaneously. It is based on several factors, including parking ramp space, maintenance servicing, and cargo-loading capability. It can be improved through personnel augmentation and by freeing up parking ramp space. For example, using the entire airfield at Pope increases the MOG to 63 C-141s, 25 C-5s , or 61 C-17s.[21]

Hot-spot parking is another issue that affects a base's ability to support the DRB. Safety concerns preclude aircraft transporting explosives (hot cargo) from parking near facilities or major thoroughfares. Pope has four primary hot-cargo parking spots, all located across the runway from Green Ramp, for items such as 105-millimeter ammunition, blasting caps, C-4, and small arms ammunition.[22] Additional parking spots on Green Ramp are sited for 1.3- and 1.4-net-explosive weight items, such as flares and some small arms ammunition.

Aerial Port and Aircraft Maintenance. The 3 APS and 743 MXS are the two biggest force providers on Green Ramp. From initial touchdown at Pope AFB to departure, the personnel ensure aircraft are fully mission capable and safely loaded for transport of the DRB.

Miscellaneous Support. Many organizations on Pope operate behind the scenes, providing support to the DRB. For example, the 43[d] Support Group provides billeting, food services, security forces, fire department, and communications. The 43 OG provides intelligence support, air-traffic control, and weather. Transportation, supply, contracting, and additional maintenance support is provided by the 43[d] Logistics Group, and the 43[d] Medical Group coordinates all medical support.

En Route Support Structure

Through mobility we conquer.

—Motto, The Cavalry School, Fort Riley, Kansas, c. 1930

AMC defines the en route system as "an interdependent global network of manpower, material, and facilities that provide command and control, maintenance, and aerial port services to air mobility forces performing AMC worldwide missions."[23] With the dissolution of the 624 AMSG in 1997, Pope AFB ceased to function as an en route location. However, despite changes in manpower and organizational structure, Green Ramp's mission continued relatively unchanged. Interestingly, the functions of the organizations supporting this mission continue to mirror those that still define the AMC en route system.

Command and Control

The 624 AMSG used 44 manpower authorizations to accomplish the command and control function on Green Ramp. The current organizational structure reduced this number to 23, dispersed between the 43 OG, wing command post, 3 APS, 43d Operations Support Squadron, and wing plans and programs offices.[24] The 43 OG Deputy for Joint Operations is the focal point for en route activities. However, this position lacks the necessary authority to ensure unity of effort for the organizations supporting the DRB and clear guidance for determining readiness.

Several different offices on Pope perform command and control functions for operations on Green Ramp. These responsibilities mirror AMC en route guidance: "timely and accurate flow of information, and direction of operations relating to mission movement, aircrew status, aircraft status, load configurations, loading of passengers and cargo, and coordination with host base services."[25] Primary command and control functions are coordinated by the 43d Airlift Wing (AW) Command Post, including indirect support such as contracting, billeting, and transportation. This facility contains the operations management controllers, Maintenance Activities Coordination Center (MACC), ALCO, 3 APS Information Controller, and Emergency Action Cell. Personnel from the operations support squadron develop the aircraft parking plan, ensuring MOG is not exceeded on Green Ramp. The MACC coordinates and documents all logistics activities.

The G3 ALCO is a critical link in the support process, with responsibility for "liaison and coordination between Army and Air Force operational and support elements for all inbound and outbound aircraft using Pope AFB."[26] The ALCO mans two positions in the command post, collocated with the command post controllers, and provides a vital link between all elements involved in airlift operations, including supported units assigned to the XVIII Airborne Corps, 82d Airborne Division, Army Special Operations Command, and all supporting active duty and reserve Air Force units.[27] An in-depth understanding of the capabilities of both Army and Air Force assets is required to ensure the success of joint operations.

3d Aerial Port Squadron

All aircraft upload and download activities conducted on Pope AFB are controlled by 3 APS. The primary mission of the unit is "to operate a fixed tactical air terminal facility supporting airland and aerial delivery of personnel and equipment."[28] The air terminal operates 24 hours a day providing support to the XVIII Airborne Corps, 82d Airborne Division, Joint Special Operations Command, host wing, Headquarters AMC, Tanker/Airlift Control Center, Joint Chiefs of Staff-directed exercises, Air Reserve component, and humanitarian and contingency missions. Ongoing joint airborne/air transportability training (JA/ATT) events are also supported by 3 APS.

Its mission is unique, earning it the nickname "The All-American Port." Unit capability includes providing:

> . . . passenger and cargo onload and offload support to all AMC and commercial aircraft, command and control, load planning, fixed heavy equipment scales, joint inspections, joint airdrop inspections, staircase requirements, rigging and recovery for wing training loads, all required fleet service requirements and space available travel service.[29]

Requirements are normally coordinated through the air terminal operations center. Augmentation is required when the MOG exceeds 5 aircraft in 5 hours for airdrop missions and 9-12 aircraft for airland.[30]

Providing support to such a wide variety of missions and aircraft poses many challenges to the unit. Consequently, training must focus on different types of loads, utilizing different types of materiel-handling equipment, on several different airframes, while ensuring compatibility with Army equipment and materials. An example of the challenges faced by leadership is the large number of inspectors required to conduct joint airdrop inspections (JAI) due to the mission of the XVIII Airborne Corps, and the 82d. After an aircraft is loaded, joint airdrop inspections must be conducted in the presence of the user and a qualified Air Force representative. MHE capability increased dramatically in recent years with procurement of the 60K Tunner aircraft loader. AMC also plans to procure 264 Next-Generation Small Loaders, as the remaining 25K loaders reach the end of their service.[31]

AMC en route units are traditionally considered forward deployed for their wartime tasking, ensuring rapid transport of personnel, equipment, combat forces, and supplies around the globe. When the 624 AMSG ceased to exist, most of the rules normally applied to the en route system were no longer applicable to Green Ramp operations. The 3 APS currently supports a designated operational capability (DOC) statement, which requires the capability to conduct aerial rapid-deployment operations during contingency or humanitarian relief operations. When AMC tasks the 3d for deployment overseas, much of its capability, honed through daily training with the 82d, goes with it. When this happens, the 53 APS, a reserve unit located at Pope AFB, fills the gap. This unit also has the advantage of having trained with the Army for the last several decades. As an operation continues, additional active duty and reserve units provide augmentation in terms of personnel, JAI-qualified loadmasters, and materiel-handling equipment.

Figure 4. C-17 Personnel Airdrop[21]

743[d] Maintenance Squadron

The 743 MXS, has the following motto prominently displayed in its squadron: "The Center of Gravity for Strategic Contingency Operations." The squadron's primary mission is to:

> . . . directly support the XVIII Airborne Corps, 43 AW, Joint Special Operations Command, and other special operations units in the Pope/Fort Bragg community as well as units/aircrews transiting Pope AFB. To provide timely and responsive maintenance in order to meet customer requirements in peacetime and during contingencies.[33]

In 1997, the 624 MXS was deactivated and redesignated as the 743[d]. The unit was subsequently realigned under the 43[d] Logistics Group, while the other primary organizations supporting the DRB remained in the operations group.

The 743[d] is also a unique squadron. No other unit in the Air Force has a similar mission. On the surface, it functions much like an AMC overseas en route location. Responsibilities include launch, recovery, and equipment maintenance for en route aircraft, including the C-141, C-17, C-5, C-130, KC-10, and KC-135. The primary difference between the 743[d] and AMC en route units is the support provided for airborne operations. The 743[d] hosted C-17 and C-5 aircraft airdrop testing, including the Dual Row Airdrop System from both aircraft and C-17 personnel airdrop. The 743[d] proudly maintains its reputation as the authority on launching mass formation combat airdrop missions.

The unique mission on Green Ramp, combined with the changing face of air mobility, poses many challenges to the 743[d]. The C-141's role as the workhorse of the airborne mission led to development of a strong corps of C-141 maintainers. Normally, first-term airmen do not man a unit of this nature—experienced personnel are needed to maintain qualifications on several different airframes. Unfortunately, it is difficult to find training opportunities to maintain proficiency in most units. As the C-17 replaces the C-141 and assumes support of the DRB, the importance of growing a corps of experienced C-17 maintainers becomes more pronounced.

Unlike 3 APS, the 743 MXS does not have a DOC statement. Unit maintainers are not on mobility status, as they focus on supporting Green Ramp operations. However, the size of the unit does not allow for an increased, sustained operations tempo during contingencies. As with the 3[d], when its workload exceeds the working MOG, augmentation is provided from other active duty and reserve units, in the form of personnel and commonly used supply parts. Additionally, crew chiefs normally accompany their aircraft, providing both experience and familiarity with the aircraft's status. Unlike the logistics flights at overseas en route units—which maintain a forward supply location stocked with C-17, C-141, and C-5 parts and in some cases spare aircraft engines—the 743 MXS does not have an forward support location or spare engines.

Outload Operations

Command and control, the 3 APS, and the 743 MXS represent the three primary support units for Green Ramp operations. The deputy operations group commander for joint operations conducts a weekly meeting to address issues affecting the outload mission. Indirect support organizations such as services, safety, transportation, and security forces, as well as tenant units such as the 23[d] Fighter Group also attend. However, the issue of readiness continues to represent an illusive topic during these meetings.

Determining Readiness

The man who is prepared has his battle half fought.

—Cervantes: Don Quixote, 1605

The US military's demonstrated capability was a crucial factor in ending the Cold War. Unfortunately, victory in the Cold War and the subsequent absence of a clearly defined threat actually witnessed an increase in operations tempo. Aging weapon

Figure 5. 82[d] Personnel Boarding AMC Aircraft[32]

Figure 6. C-17 Crew Chief [34]

systems, declining force structure, and increased focus on a CONUS-based force has brought readiness issues to the forefront in recent years. Ultimately, these issues necessitated changes in the way readiness is measured.

The Air Force continues to focus on people, training, equipment, logistics, and infrastructure to define and measure readiness.[35] These factors are evident in inspection methods used by AMC, the Twenty-First Air Force, and base-level units. However, for a variety of reasons, these inspection methods are not effectively used to measure readiness of the primary AMC units that support DRB outload operations on Green Ramp.

Air Mobility Command

The AMC inspection program is the basis for determining an AMC unit's readiness to respond anywhere around the globe, on short notice, as part of the expeditionary aerospace force concept. The program emphasizes Information Superiority, Global Attack, Rapid Global Mobility, Agile Combat Support, and command and control.[36] Inspection methods include stand-alone exercises, expeditionary operational readiness inspections (EORI), and en route readiness inspections (ERI). Philosophically, AMC uses a combination of these methods to determine mission readiness on Green Ramp.

Stand-Alone Exercises. Stand-alone exercises are valuable tools. However, they focus more on measuring deployment capability and less on home-station missions, such as supporting outload operations on Green Ramp. Since 743 MXS personnel are not required to maintain currency for mobility, they do not have the mobility equipment or receive other than initial mobility training and, consequently, are not subject to stand-alone exercises.

Expeditionary Operational Readiness Inspection. Expeditionary operational readiness inspections evaluate units' ability meet to meet their wartime taskings. This inspection emphasizes unit type codes (UTC) and measures readiness against standards published in the AMC task list. A unit type code "identifies a deployable package of resources (personnel, equipment, or both) configured to provide a specific wartime capability."[37] All AMC units with DOC statements are included in the Air Force-wide UTC Availability and Tasking Summary and are subject to EORI taskings.[38] An expeditionary operational readiness inspection normally includes personnel from different locations and does not generate an overall wing or group grade. Demonstrated operational capability and IG exercises are the two types of EORI inspections.

The most effective measure of readiness is unit performance during real-world operations. Demonstrated operational capability inspections consist of direct observation of events such as aerospace expeditionary force deployments, JCS exercises, contingency operations, and significant JA/ATTs (a significant JA/ATT uses seven or more aircraft, not including KC-10s, to complete a mission). These inspections assess home-station deployment activity, unit operations at deployed locations, and strategic airlift operations.[39] Obviously, the most opportune time to discover operational deficiencies is not during a real-world contingency. However, all phases of an operation—mobilization, deployment, employment, sustainment, and redeployment—provide valuable opportunities to evaluate readiness. The inspector general (IG) periodically observes real-world missions to evaluate unit performance but does not inject exercise scenarios into the operation.

An IG exercise is a complex event involving unit type codes from approximately 15 units that are combined into an expeditionary air wing. The exercise is normally conducted at a combat readiness-training center but may be held elsewhere. It emphasizes team building and fosters an expeditionary culture, "thus mirroring real-world operations."[40] Its focus is on anticipated response to a crisis, with an obvious emphasis on what the Air Force brings to the fight. The expeditionary air wing receives all inbound aircraft and then uploads outbound aircraft under simulated wartime conditions (not unlike a significant JA/ATT). The exercise typically lasts from 6 to 14 days.

Although the IG exercise format is appropriate, AMC has not directly used this program to measure unit readiness on Green Ramp. The 3 APS is subject to IG exercises and participates based on assigned unit type codes. However, unit readiness measurements from an IG exercise primarily reflect a wartime deployment role, not the routine Green Ramp mission. As previously stated, the 743[d] does not have a mobility commitment, does not support any unit type codes, and is, therefore, not subject to IG inspections. Applicability of IG inspections to the command and control aspect of Green Ramp operations is also minimal.

En Route Readiness Inspections. En route readiness inspections "evaluate a unit's ability to move passengers and cargo effectively and expeditiously through the Defense Transportation System."[41] Major graded areas include readiness, aerial port, logistics, and command and control—all applicable to the three primary Green Ramp support units. However, as mentioned earlier, in 1997, Pope AFB ceased to function as an en route location for AMC. Consequently, the 43 AW is not subject to en route readiness inspections.

Readiness is an evaluation of the movement of cargo and personnel to meet deployment requirements and "effectively transition from peacetime to contingency/wartime operations."[42] The aerial-port grading criteria evaluate the air terminal support of aircraft, cargo, and passengers. Aircraft maintenance and supply support for all AMC en route aircraft are the primary focus of logistics grading criteria. Finally, the command and control function stresses "effective decision making, direction, coordination, execution, and reporting of deployment and readiness activities."[43] Consequently, the ERI concept is ideally suited for determining the readiness of the 3 APS, 743 MXS, and outload operations' command and control elements.

Twenty-First Air Force

The 43 AW is a subordinate of the Twenty-First Air Force, located at McGuire AFB, New Jersey. Numbered air forces are tactical echelons, providing operational leadership and supervision. They are responsible for ensuring the readiness of assigned units. The mission of the Twenty-First is "to command and ensure the combat readiness of assigned air mobility forces in support of Global Reach."[44] Senior leadership continuously monitors personnel, equipment, infrastructure, and training associated with readiness and provides guidance and assistance when required. Methods for providing feedback on Green Ramp readiness issues include staff assistance visits and significant JA/ATT situational reports and post-video teleconferences. However, a recent Air Force Audit Agency Report concluded numbered air force personnel failed to conduct readiness assessment visits at 11 en route locations.[45] These required assessments are a critical tool for assisting senior personnel in determining the readiness of assigned units.

Staff Assistance Visits. Personnel from various Twenty-First Air Force functional areas periodically conduct staff assistance visits at assigned units to gain knowledge of readiness issues. Green Ramp's unique mission increases the value of such visits. Critical issues—infrastructure improvement and logistics support—are often difficult to grasp without actually seeing the landscape. For example, the Army is currently in the midst of a $105M outload enhancement project on Green Ramp, with completion expected in 2004. This project will eventually expand Green Ramp to include approximately 240 acres on what is currently Fort Bragg.[46] Pope AFB requires assistance from the Twenty-First and AMC to ensure organizations supporting operations on Green Ramp receive commensurate improvements.

Situational Reports and Video Teleconferences. During a significant JA/ATT, the AMC mission commander drafts a situational report at the end of each day's flying activity. This report is a concise recapitulation of events throughout the entire day. Included are statistical data on actual versus planned airdrops and issues associated with the aircraft loading, launch, and recovery process. The mission commander transmits the situational report to the commander of the Twenty-First Air Force, providing an opportunity for immediate, as well as post-event, feedback. Additionally, the commander of the Twenty-First normally chairs a video-teleconference with all major players as soon as practical after the event to ensure constructive feedback is provided before the next significant JA/ATT. These initiatives are invaluable tools for helping determine readiness to support the DRB.

Base-Level Units

The operations group deputy commander for joint operations provides critical oversight of Green Ramp operations. Though lacking formal authority, this individual develops comprehensive guidance for all issues affecting support for outload operations, including the DRB. Primary support organizations attend the weekly outload working group meetings, where they share information and discuss current and potential problems. This meeting is the primary forum for determining readiness at the base level. The commanders of the 743 MXS and 3 APS are key figures in this process, even though they report to the 43[d] Logistics Group and 43[d] Operations Group commanders, respectively.

Unfortunately, the unique nature of the DRB-support mission makes it difficult to identify objective factors for measuring readiness from an Air Force perspective. No other base in AMC has a similar mission. Consequently, senior leadership of the three primary support organizations must continuously look for indicators to assess the readiness of their units to meet the DRB's18-hour deployment requirement. Assessments typically focus on factors such as personnel availability, training, and support equipment. The challenge is to identify objective factors in these areas pertinent to DRB support. However, in the end, the best indicator is performance. Short of an actual contingency, the most practical way to determine readiness is through training events such as the Army's emergency readiness deployment exercise.

The Army

The emergency readiness deployment exercise is one of the primary tools the Army uses to determine readiness to execute the mission. It allows the division to test the 18-hour deployment concept by executing the tasking with no notice. In fact, the DRB normally does not know if the alert call is an emergency readiness deployment exercise or a real-world contingency. The exercise is beneficial for determining Air Force readiness as well, although key personnel assigned as *trusted agents* are in-briefed early in the process. Organizations supporting Green Ramp operations receive early notification to ensure availability of adequate support.

Current Readiness

Theoretically, the tools discussed here should provide senior leadership with a clear picture of the current state of readiness to support the DRB on Green Ramp. However, upon closer review, it becomes apparent there really is no process to determine readiness to support DRB-outload operations at Pope AFB.

Recommendations

Every unit that is not supported is a defeated unit.

—Maurice de Saxe, 1732

The DRB-outload support mission is unique to Pope AFB. Many rules, regulations, and procedures normally associated with AMC (and AMC-gained) units are not applicable to Green Ramp operations. Maintaining the capability to project timely combat power around the globe necessitates a nonstandard approach to ensuring readiness. Possible areas of improvement include regulatory guidance; organizational structure; inspection criteria; conduct of exercises; and training, equipment, and personnel.

Regulatory Guidance

When Pope AFB was assigned to ACC, the 624 AMSG functioned as an AMC en route tenant unit. The commands developed memoranda of agreement and understanding, delineating responsibilities of the units providing support to Green Ramp. Currently, guidance exists only in the form of AMC Operation Order 17-76, *Joint Airborne/Air Transportability Training*, and Pope AFB Instruction 11-105, *Air Mobility Task Force Combat Air Delivery Operations*. These publications do not provide adequate guidance.

Lack of concise, official guidance makes it difficult to clearly define the DRB-support mission and, thus, how to effectively measure readiness. Official recognition of DRB support as a primary mission by AMC could alleviate this problem. A DOC statement with a clearly defined mission, requiring some method of reporting and, consequently, accountability may solve it. A clearly stated requirement would also support adequate funding

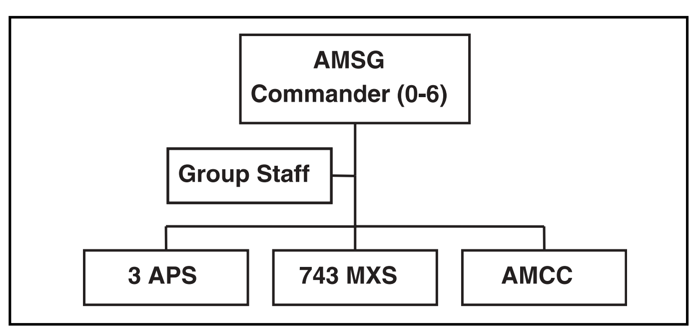

Figure 7. Proposed AMSG Organizational Structure for Pope AFB[49]

for infrastructure improvements and procurement of support equipment.

Organizational Structure

The primary organizations providing support to the DRB are aligned in different groups within the 43 AW. The deputy commander for joint operations has overall coordination and oversight responsibilities but no formal authority. Interestingly, the nature of the mission, combined with the capabilities of supporting units, is ideally suited for the AMC en route organizational structure. The en route system is designed to support aircraft transiting the European and Pacific theaters; there are no CONUS en route organizations. However, this organizational structure worked well at Pope, until it fell by the wayside when the base was realigned under AMC.

Reestablishing an air mobility support group at Pope would have little or no impact on normal operations. Manpower authorizations for the 3 APS and 743 MXS would remain the same. AMC ownership of the base negates the need for additional authorizations for command and control and leadership functions. The 43 AW could continue to provide support in areas such as weather and intelligence. The 3[d] would continue to support all aircraft upload and download operations, and the 743[d] would provide support to organic aircraft as the workload permitted. Minor realignments of additional support personnel, such as ramp controllers and ALCO personnel would also be necessary. Support requirements for the XVIII Airborne Corps, 82[d] Airborne Division (most notably the DRB), and the Joint Special Operations Command warrant consideration of this proposal. The deputy commander for joint operations would retain the status of group commander, with commensurate authority. AMC should otherwise consider eliminating this position.

Inspections

The current organizational structure for outload support on Green Ramp does not lend itself to evaluation under the AMC inspection system. In fact, the 743 MXS is not currently in the database of the AMC Inspector General as an inspected unit. The EORI concept can measure the ability of 3 APS to forward deploy but is not geared toward measuring home-station, outload-support readiness. In contrast, the AMC en route readiness inspections are an ideal tool for measuring readiness to support the DRB mission. However, Pope is not currently subject to them. Obviously, establishment of an air mobility support group at Pope would solve this problem. Even if this does not happen, AMC should consider developing guidance to inspect the outload-support mission based on the ERI concept.

Exercises

In one sense, capabilities on Green Ramp are tested at least monthly. This comes in the form of significant JA/ATT training events such as Large Package Week, Capstone (an orientation course for newly appointed general officers and senior ranking civilians), and Combat Aerial Delivery School/Weapons Instructor Course graduation exercises. However, significant planning normally accompanies events of this nature, an advantage not available during a DRB recall. From an Air Force perspective, an emergency readiness deployment exercise has similar disadvantages. The emergency readiness deployment exercise represents the Army's primary tool for determining the readiness of the DRB. AMC should consider including Air Force support units at Pope in the no-notice portion of an emergency readiness deployment exercise to test readiness.

In 1999, Pope conducted Gryphon Warrior 99-01—consisting of 94 C-130, C-17, and C-141 airdrop and airland missions during a 5-day exercise, to include engine-running—offload sorties at night.[48] Exercises of this nature, conducted in a realistic environment on a semiannual basis, could also assist in determining readiness to support the DRB mission.

Training, Equipment, and Personnel

Operational requirements must be clearly defined to ensure effective training. With the imminent retirement of the C-141, the C-17 will assume primary responsibility for DRB support. Consequently, Green Ramp personnel must shift their training focus to the C-17, sending people to Charleston AFB for training, in addition to ensuring maximum use of transient aircraft for ground training. Special experience identifiers must be a priority when assigning new personnel to help overcome the challenge of training on multiple airframes. AMC should continue to focus on a new generation of materiel-handling equipment, in addition to prepositioning support equipment at Pope AFB, such as aircraft tow bars, engine change equipment, and applicable test equipment.

Personnel assignments also represent a crucial piece of the readiness puzzle. The current policy to assign only second-term, or longer, aircraft maintainers to the 743 MXS is a success story in this area. AMC should also consider placing limits on the tour length in primary outload-support organizations, as do overseas en route units. Personnel also need the training advantage offered by the home-station environment.

Conclusion

Tis time to leave the books in dust, and oil the unused armor's rust.

—Andrew Marvell

In September 1994, it seemed a peaceful solution for restoring democracy in Haiti was not in the offing. The 82[d] was alerted, and a task force was airborne in minimum time. However, the aircraft never reached Haiti. "The 82[d]'s eminent arrival influenced Haitian government leaders to agree to a peaceful solution."[49] The ability of the DRB to respond rapidly anywhere in the world with significant combat power represents a valuable deterrence tool for national leadership. The importance of air mobility as a force multiplier remains central to ensuring the capability to protect our national interests. This also includes humanitarian interests, as witnessed by the use of the DRB in the aftermath of Hurricane Andrew in southern Florida in 1992.

Pope AFB performs a central role in determining the effectiveness of the DRB. Over the years, regardless of base ownership or organizational structure, AMC (and reserve component) personnel have remained firmly committed to ensuring the success of this vital mission. However, several years have passed since the DRB was called upon in support of a major national crisis. During this time, the US military witnessed a major reduction in personnel, forward bases, and airlift resources. Consequently, a periodic evaluation of current readiness is required to ensure timely correction of deficiencies.

(Continued on page 45)

The next-generation aircraft must be cost-effective enough to be acquired and maintained in sufficient quantities to meet future security and military strategy requirements.

Looking Ahead: Future Airlift

Lieutenant Colonel Chad T. Manske, USAF

Introduction

Rapid global mobility provides the virtual spine of our global engagement philosophy. Without it, the United States would eventually degrade into a regional power. We must maintain a complete or full degree of ability to position and sustain mobility forces and capabilities through air and space, across the range of military operations as required.

—Air Force Task 5, Rapid Global Mobility Air Force Doctrine Document 1-1

The changing and uncertain nature of the strategic climate for the next 30 to 50 years merits serious thinking regarding the design and acquisition of a next-generation strategic airlifter versatile enough to perform a variety of missions while having the defenses to resist the myriad of threats it may encounter. Three to 5 decades from now, when the life cycles of both the C-5 and C-17 are projected to end, there will be a gaping hole in strategic airlift capability, necessitating the development of an aircraft that can fulfill the missions they now accomplish.[1] This aircraft must be cost-effective for acquisition and maintenance in sufficient quantities to meet future security and military strategy requirements. In the near term, this implies a large buy of C-17s to handle requirements the United States cannot meet. However, there must be an aircraft with the requisite technology to meet the requirements. This article looks at the kinds of capabilities required for the development of the next-generation strategic airlifter.[2]

When considering the capabilities of the next-generation airlifter, it is important to understand current airlift aircraft capabilities enabling the evolution of new capabilities, characteristics, and features. The aircraft ultimately developed and fielded will likely have similar, yet vastly updated, features and capabilities. This article steps the reader through some of today's significant airlift aircraft capabilities and features, while

Designing the Next Generation Airlifter, A Capabilities-Based Approach

discussing some of their implications for potential future use. Assumptions and limitations are given regarding the status and progress of some of Air Mobility Command's (AMC) airlift modernization efforts, as well as other improvements and enhancements affecting future development. From there, an analysis of considerations and characteristics of future technologies is presented, laying the foundation for future recommendations. Considering Department of Defense (DoD) acquisition and budgeting cycles, it is now appropriate to begin delving into these issues to position US forces for sustained progress.

Current Airlift Capabilities

The United States depends on a flexible and responsive global transportation system that can get American and allied forces to a theater in a timely and decisive manner.

—Air and Space Power in the New Millennium

Current airlift aircraft capability has evolved as a function of requirements and available technology. Requirements and technology are conceived and constrained by fiscal necessities and defense priorities as determined by the DoD's defense planning systems process. This process accounts for threats to US security at home and abroad as enunciated in the President's annual National Security Strategy, which outlines how US national instruments of power—such as diplomacy, information, military forces, and economic power—are used to protect American interests worldwide. Approximately every 3 to 5 years, the Chairman of the Joint Chiefs of Staff translates the National Security Strategy into a national military strategy, which then provides broad guidance on how the Armed Forces will "prepare now for an uncertain future by including a broad strategy for defending against threats to US interests."[3] Therefore, aircraft capabilities are developed in relation to requirements to counter threats to American interests.

This article provides brief descriptions of aircraft capabilities available in the Air Force airlift fleet today that have evolved over time in response to the threat environment and fiscal constraints. Capabilities are categorized as physical features, avionics and defensive systems, and specific mission functions. An understanding of these capabilities is the foundation for understanding future decisions

THE FUTURE

- Needs of potential users, as well as the forecasted strategic environment, should be taken into consideration.
- Aircraft must be built around emerging threats and requirements of the Services and CINCs at the time of its development.
- The design must be flexible enough to be upgraded (plug-and-play avionics boxes that can be swapped out easily for upgraded ones).
- The design effort should be conducted closely with industry manufacturers and CRAF partners from the beginning and should emphasize DoD needs over industry partners to ensure defense requirements and survivable systems are installed.
- Partnering with industry and CRAF participants allows access to the benefits of commercial-off-the-shelf technologies.

being made regarding the characteristics of the next-generation airlifter.

Physical Features

Unique physical features provide airlifters the ability to perform their mission efficiently and will remain considerations for the next-generation airlifter unless superseded by better, more cost-effective technologies.[4]

Outsized Capacity. Among airlifters' most utilitarian features is the ability to carry outsized cargo,[5] which only the C-5 and C-17 currently have. Outsized capacity allows items—such as main battle tanks, Patriot missile batteries, large helicopters, a submarine rescue vehicle, and an Army mobile-bridge layer—to be transported very close to their ultimate destination. However, the latter three items can be carried only on the C-5, showing a lack of versatility in the airlift fleet.[6] For example, if a major C-5 structural problem were discovered, necessitating the grounding of the fleet, how would the United States transport those specific outsized items in an emergency? It could be contracted out to foreign operators, or it could be shipped by sea. What if those foreign operators put restrictions on the use of their aircraft or in some way compromise the security of the mission? What if getting it there by sea were not fast enough? Clearly, a versatile airlifter with outsized capacity is needed in the future.

Armor-Resistant Aircraft Skin. Armor-resistant aircraft skin is another feature currently available. "The C-17 is designed to survive a 2,000-foot hit from a 12.7 millimeter, armor-piercing incendiary projectile, anywhere on the airframe."[7] This kind of feature has evolved in response to the threat environment for airlift assets. Since it is expected airlifters will be employed ever closer to a hostile environment and sometimes within it, their exteriors must be resistant to small-arms fire and blast fragments. Currently, aircraft have armor installed in the seats and cockpit floors to protect the operators from these hazards.

Fly-by-Wire Flight Controls. The C-17 has the unique distinction of being built with fly-by-wire flight controls and an electronic flight-control system, allowing it to fly at extremely low speeds during the landing phase. Shorter touchdown distances are possible, permitting the aircraft to land and operate at locations with short runways or semiprepared strips of approximately 3,500 feet or less, depending on aircraft weight and runway surface conditions. Further, the C-17 electronic flight-control system features auto trim, lessening pilot workloads during critical maneuvers. This capability allows the aircraft to operate at literally hundreds more locations than previously possible with aircraft of similar capacity.

Powered-Lift Technology. Hand-in-hand with fly-by-wire flight controls is powered-lift technology. When the C-17 flaps are lowered into the range for approach and landing, engine exhaust interacts with them allowing both slower approach and touchdown speeds, as well as steeper approach angles. This lets the aircraft land and stop easily on a runway of limited length—a crucial capability for airlifters as the trend toward expeditionary operations and the actual use of shorter, austere airfields remains.

Large Cargo Doors. Though often taken for granted because of their simplicity, large cargo doors are a crucial design feature of airlifters. They provide for relatively easy onloading and offloading of unwieldy loads like helicopters and tanks. Additionally, loading and unloading time is shortened as a result of large, unencumbered cargo compartment entrances. This becomes critical for operations at austere airfields with a low maximum, aircraft on-ground capability.[8] Large cargo doors allow for quicker cargo throughput in these types of situations.

High-Wing/Low-Ramp Design. Wings on the top of the fuselage give the added benefit of faster loading and unloading because of the relative absence of wing encumbrance in the loading area. High-wing design contributes to ramps that are low to the ground, making it convenient for aircraft loading personnel and materiel-handling equipment to load and unload the aircraft quickly. High-wing designs normally equate to slower en route cruising speeds compared to most commercial turbojet aircraft operating at similar high altitudes (above 30,000 feet) in the same airspace. It will be crucial to improve the performance of these types of designs in future airlifters to avoid exclusion from the airspace for inability to fly at required minimum speeds.

Roll-On/Roll-Off Capability. Closely related to large doors and high-wing/low-ramp design is roll-on/roll-off capability. This capability offers speed and ease of loading and unloading of aircraft cargo. Roll-on/roll-off capability implies the ability not only to drive rolling stock cargo—such as high-mobility multipurpose wheeled vehicles and tanks—on and off the aircraft but also to literally roll cargo on and off via the built-in, roller-floor system. Roller-floor systems can be configured quickly from the roller configuration to a smooth surface in a matter of minutes by a single person, adding enormous flexibility and mission capability to an aircraft. A roller-laden floor also allows pallets to be pushed into place quickly.

Avionics and Defensive Systems

Although physical features are static design attributes of all airlifters, the avionics and defensive systems built into them offer easy upgrade to newer, more capable, and cost-effective versions. Avionics and defensive systems permit airlifters to operate close to hostile environments with reasonable self-protection. Yet, the current capability is purely defensive. Technology, requirements, and new employment tactics must be developed and improved before a safe, standoff capability (directed energy, self-defense weapons) is installed on airlifters.

Traffic Collision Avoidance System. The Traffic Collision Avoidance System (TCAS) is designed to improve the situational awareness of the cockpit crew by providing them with information about the location of other aircraft in the vicinity of the TCAS-equipped aircraft. As airspace becomes more saturated with air traffic (especially the North Atlantic region) and airlifters increasingly operate in areas where air-traffic control services, TCAS will help avert catastrophes like the 1997 US C-141 and German TU-154M collision off the west coast of Africa that killed 33. This technology or its updated successor will become standard equipment on future airlifters.

Redundant Global Positioning System (GPS). Since the early 1990s when the GPS made its debut on aircraft, many have come to rely on its ability to tell them where they are, where they want to go, and how to get there. Inherent with prolific GPS is pinpoint navigation of multiple aircraft continually flying over the same geographical navigation fixes and routes. The *big sky* theory is reduced to *small sky* as a result of enhanced precision, increasing the chance for accidents.

Despite this, the benefits of GPS-equipped aircraft are great. They no longer have to rely on internal navigation systems, which, without periodic updates are susceptible to error. However, when most single GPS-equipped aircraft malfunction or satellite coverage goes down, their ability to navigate can be severely reduced. Also, how can one be sure the data the GPS is feeding to the navigation system are accurate?

Redundant GPS units with the receiver autonomous-integrity monitoring (RAIM) system provide the solution.[9] RAIM is a relatively new capability available with GPS; not surprisingly, it has not made its way into many military aircraft. RAIM notifies pilots of several types of malfunction, including loss of satellite coverage and out-of-range navigation data, as it constantly evaluates the quality of the data it delivers to the flight crew. Another benefit of redundant GPS is increased performance accuracy during precision airdrop maneuvers. This technology or an enhanced version thereof should be incorporated in any future airlifter.

Head-Up Display. Head-up displays (HUD) provide pilots the convenience of flying tactical maneuvers without reference to internal control and performance instruments. They allow aircraft like the C-130J and C-17 to fly steep, austere airfield approaches to a precise touchdown point. This feature, combined with fly-by-wire and powered-lift technologies, are the heart of contemporary airlifters' austere airfield capability.[10] Head-up displays also aid in formation flight, permitting pilots to focus their eyes on other formation aircraft while simultaneously monitoring the aircraft's performance.

Night Vision Goggle Capability (NV)G. NVG capability permits the C-130, C-141, and soon, the C-17 to fly special operations missions in a *dark cockpit* environment. Even if the capability is not used on the next airlifter, it is advisable to incorporate the technology since it is both relatively inexpensive to install and can be used for special operations missions. NVG capability requires both cockpit-lighting enhancements that use night vision goggles, as well as connections, within the aircraft to power the goggles.

Joint Tactical Information Distribution System (JTIDS).[11] JTIDS is briefly mentioned here as a technology to consider installing on the next airlifter. Installation and use will be dependent on the role JTIDS will play in conjunction with the core role of the aircraft. Currently, few aircraft types in the Air Force inventory (none of them airlifters) are equipped with JTIDS technology. Air Force technology and airlift doctrine must evolve in a manner directing its widespread use, after which it should be installed and employed to its maximum capability.

Missile Warning System and Countermeasures Dispense Sets. Considering the potential and actual threat environment airlift aircraft currently operate in, it is critical for them to be protected with defensive systems capable of warning the aircrew of incoming shoulder-fired or ground-launched missiles. Missile warning systems and countermeasure dispense sets (CMDS) offer that protection and can be programmed by the user to operate at various altitudes and flight regimes. The CMDS system can also be programmed to dispense stores either manually or automatically, providing flexibility of use. The importance of these systems cannot be overstated and should improve into more capable, reactive systems.

Chaff and Flares. Closely related to missile warning systems and countermeasure defense sets are chaff and flares. Chaff and flares are designed to confuse and divert radar-guided missiles aimed at aircraft. Chaff, made from metallic strips, is ejected from the aircraft when a missile is detected by the aircraft's onboard missile warning systems. Flares serve the same function as chaff except they are designed to defend against heat-seeking missiles by ejecting extremely high-temperature devices out the rear of the aircraft, attracting incoming heat-seeking missiles.

Radar Warning Receiver (RWR).[12] Radar warning receivers notify the aircrew of an incoming missile via radar lock-on detection. This system is usually integrated with other, onboard defensive systems to provide a full, defensive system suite, capable of thwarting most asymmetric threats.

Forward-Looking Infrared (FLIR) and Enhanced Visual System.[13] Forward-looking infrared and enhanced visual systems use heat to *paint* and detect images. Consideration should be given to incorporating the evolved version of this technology as a hedge against future threats. FLIR technology, coupled with the enhanced visual system on HUD-equipped aircraft, will permit airlifters to operate more efficiently by allowing them to land and take off at fields previously restricted by weather. The enhanced visual system superimposes the heat signature of any airfield lighting and other heat-producing devices or structures onto the head-up display regardless of outside weather conditions. FLIR and enhanced visual systems will reduce the possibility of having to divert aircraft full of mission-critical cargo.

Specific Mission Functions

The history of airlift has provided us with examples of constantly evolving missions requiring stellar attributes. The unique characteristics of today's airlifters will support the bridge for tomorrow's attributes.

Direct-Delivery Concept. The concept of moving cargo directly from origin to destination by the C-17 has revolutionized airlift doctrine and employment. Direct delivery decreases delivery time because of fewer en route stops. It also reduces the chance for maintenance failures attributed to increased aircraft cycles. Additionally, direct delivery is not reliant on organic intratheater aircraft to augment the mission, thus conserving tactical assets. For example, a C-17 can transport an M-1A Abrams main battle tank and crew directly from its point of embarkation in the United States to an austere airfield very close to hostilities, eliminating the need to offload the tank and crew at an intermediate stop where ground transportation would have to deliver them to the battle. This capability could be employed extensively in the future if, for example, the entire C-130 fleet were grounded.

Expeditionary Airfield Operations. Direct delivery of forces and equipment has required airlifters such as the C-17 and C-130 to operate at minimally capable, austere airfields where other large, fixed-wing aircraft cannot operate. Some of airlift's physical features previously discussed enable operations to, from, and at expeditionary airfields. This capability is linked to the absence of overseas bases and operating locations for airlifters to operate from, necessitating the need for an aircraft conducting its mission autonomously from locations with crude facilities and infrastructure.

Reverse-Thrust Taxi. Reverse-thrust taxi not only improves throughput of cargo per day but also, in the case of the C-17, is designed to deflect reverse thrust, both forward and upward to avoid damaging an austere airfield's surface. By deflecting the thrust upward, foreign object damage is minimized. C-130s also perform reverse-thrust taxi operations, making them and the C-17 nonreliant on-ground, towing equipment required by the C-5.

Air-Refueling Capability. Much has been written about the advantages of aerial refueling, which extends the range of operations for airlift forces and allows missions to continue from origin to destination without landing and the possibility of ground delays. Despite tying up valuable tanker assets that may be in high demand during contingency operations, its use far outweighs the disadvantages. This capability should remain a part of any next-generation airlifter, especially in light of its versatility.

Airdrop. Airdrop capability allows the precise delivery of troops, equipment, and relief supplies over a specific geographic location. Its employment may be required when basing options do not exist, when the element of surprise is to be preserved, when contingency operations are taking place, or a host of other reasons. The Army currently requires the Air Force to deliver a brigade of troops and support equipment over a single drop zone within 30 minutes.[14] Future airlifters will likely retain this requirement since it is an essential element of the Army's forcible entry mission.[15]

Combat Offload. When airdrop of supplies is not feasible because the cargo is not rigged for it or the crew transporting it is not airdrop qualified, combat-offload capability offers enhanced delivery options. Combat offload is performed on the ground by releasing the aircraft brakes from a stationary position and a high power rating set. It is usually employed due to limited maximum aircraft on ground at the airfield where other aircraft must also land and deliver cargo or when hostile conditions exist at an airfield. Combat-offload capability provides the prompt but orderly disgorgement of a full load of cargo in a matter of seconds. Like other mission capabilities, it provides aerospace planners an additional, flexible employment option.

Low-Level Operations. Low-level operations allow aircraft to fly below an adversary's radar coverage and remain undetected from the ground visually and, thus, small-arms fire and shoulder-launched missiles. This capability is especially useful on airlifters who are performing special operations and provides inherent flexibility for aircraft employment options.

Summary

Current airlift aircraft capabilities have provided contingency planners with several versatile options for employing airlift assets. Though there are dozens of characteristics not listed here, these should stimulate thinking on practical measures for improving the existing technologies and capabilities.

Physical features allow the aircraft to carry outsized equipment with faster and easier onloading and offloading of difficult loads, while avionics and defensive systems protect the aircraft, cargo, and crew from threats in current and future ambiguous threat environments. Current, specific mission functions illustrate the kinds of missions airlifters are accomplishing and highlight the requirements of our forces. These capabilities are starting points for development of the next-generation airlifter that will meet the requirements of the next-generation armed forces. To consider capabilities the aircraft should exhibit, assumptions and limitations follow regarding the timeframe in which it will be fielded.

Assumptions and Limitations

The post-Cold War need for mobile, flexible forces to deal with threats and flashpoints that can flare up at a moment's notice has placed a new emphasis on airlift.

—Jane's Defence Weekly[16]

When considering logical assumptions for the years 2030 to 2050, better mobility processes and technologies are sure to top the list, but there are others. AMC's *Air Mobility Strategic Plan 2000*—the 2000 version of the command's roadmap outlining capabilities, aircraft modernization efforts, and acquisition priorities—provides some of the answers. What *other* assumptions can be made? Operating improvements, computer-aided design, and enhancements to operating procedures provide the impetus for development of a better aircraft. The advantages they provide must be considered.

Inherent Operating Improvements

Five operating-improvement assumptions are stated here as a result of rapidly changing technologies likely to be present between 2030 and 2050. First, lighter weight, stronger materials are available. Harking back to when the first airplanes were built with canvas, wood, and metal to the present-day development of lighter, yet stronger, composite-framed aircraft, future aircraft will likely be even lighter, more durable, and more structurally sound than aircraft built today. Stronger composite materials will withstand the extreme temperature variations encountered as a result of more capable aircraft engines transporting aircraft between the fringes of space and earth.

Second, the evolution of technology suggests advanced, high-bypass engines or even advanced, non-air-breathing engines that operate near space could be manufactured for aircraft of the future.[17] Several factors drive this evolutionary technology. Among them are the advantage gained by projecting power faster to a theater of operations, before potential adversaries have time to react, and being able to respond quickly to a humanitarian crisis. A good reason for needing faster responding airlift forces is the Army's goal of transporting a division ready brigade, medium force anywhere on the globe within 96 hours after takeoff.[18]

Third, *natural laminar flow aerodynamics,* such as those incorporated into the design of both the F-22 and the joint strike fighter, will improve.[19] Better aerodynamic designs, in addition to the first two improvements listed previously, will naturally lend themselves to a fourth factor: increased fuel efficiency.

Better fuel efficiency translates to savings for a defense department normally lacking the funding to fulfill many of its requirements. Increased fuel efficiency also equates to longer range, requiring less dependency on air-refueling aircraft and "deliver[ing] more goods *faster* than present [aircraft]."[20]

Last, it is assumed, to support the direct delivery and austere field capability likely desired of the next strategic airlifter, improved lift-over-drag ratios will be developed to allow the aircraft to take off and land in shorter distances.[21] The means exist today to make these operating improvements realities via computer-aided design.

Computer-Aided Design

Computer-aided design, used extensively during the development of the Boeing 777, will likely be the vehicle of choice in designing aerodynamically sound aircraft in the future. Costs for aircraft development are rising, competition is consolidating among aircraft manufacturers, and large numbers of component manufacturers are involved in today's aircraft manufacturing effort. Computer-aided design offers a cheaper, multimanufacturer-linked process for designing aircraft over the conventional method of building and testing prototypes.[22] Computer-aided design potentially lowers research and development costs since initial designs leading to a final product can be tested thoroughly in advance through computer modeling and simulation programs. Once a design prototype has been built, a small-scale version could be validated through wind-tunnel testing. The evolution of these processes will compress the amount of time needed to develop, test, and procure aircraft, allowing the latest technological advances to be incorporated. These technological changes likely will evolve, and enhancements to operating procedures for airlift forces will likely become reality, further driving the overall quality of the design of the next airlifter.

Operating Procedures Enhancements

Operating procedures, in the context used here, denote actions taken by AMC and the United States Transportation Command to minimize limitations of today's airlift forces and their employment. By making assumptions and outlining limitations needing fixes by 2030-2050 and perhaps sooner, the lessons learned throughout the process will allow those results to be considered when the follow-on airlifter is being designed and built. The benefit of the following five enhancements to operating procedures, which are addressed in AMC's *Air Mobility Strategic Plan 2000*, will create new, unforeseen problems that will have to be solved as well. The first regards C-5 dependability problems.

Poor maintenance reliability problems of the C-5 will be tackled vigorously and solved by fiscal year 2011 through a program called the C-5 Reliability Enhancement and Reengineering Program.[23] Since the C-5 is a critical asset for outsized-cargo capability, the Air Force will spend millions and perhaps billions of dollars replacing the engines and upgrading the avionics, "result[ing] in reduced fuel consumption, a 22-percent increase in thrust, and most importantly, [improved] reliability."[24] So much money is being invested in the aircraft because the majority of its service life is yet to come and "the fact that infrastructure, simulators, and spare parts for the airplane 'all exist already,' and flight- and ground-maintenance crews are 'already trained.'"[25] Among other upgrades to the C-5 and *all* mobility aircraft is the Global Air Traffic Management (GATM) program modernization.

GATM is both a communications/surveillance and navigation safety upgrade designed to allow air-mobility aircraft to operate in the increasingly restrictive airspace in high-traffic areas around the world, particularly the North Atlantic Ocean and central Europe. AMC plans to modify its entire fleet to accommodate GATM, to include TCAS, with final completion of the last aircraft slated for fiscal year 2013.[26] Though costly, this operating improvement will reduce adverse flight route changes, increase fuel efficiency and costs, increase cargo loads, and improve situational awareness for flight crews.[27] GATM or its equivalent follow-on will be incorporated into future aircraft architectures, providing greater freedom of operation throughout the world's most saturated airspace. While GATM improves flight-to-ground interface, intransit visibility (ITV) promises to do the same for the ground-to-flight interface.

Intransit visibility allows command and control elements in the air-mobility system to monitor the progress of cargo from origin to destination—similar to the way major commercial-cargo carriers track parcels today. ITV modernization efforts, including components for individual aircraft compatibility, will be integrated, allowing faster, more efficient use of airlift forces. AMC's goal is to upgrade its fixed infrastructure to achieve complete intransit visibility by fiscal year 2005.[28] Although not directly improving the airlift fleet per se, the efficiency resulting from improvements in operating procedures through intransit visibility is synergistic to the entire airlift mission process, yielding greater throughput of cargo than ever before. A fourth operating procedure assumption improving cargo throughput is the addition of KC-10 tankers to the fleet of usable airlift aircraft.[29]

Thirty-seven of the 59 KC-10s in service are considered part of the strategy, while other KC-10s are used to fulfill their role as aerial refuelers in executing the tanker portion of the strategy.[30] This assumption will remain for the foreseeable future because it is viewed as a tremendous force multiplier for airlift until a more permanent solution is found to solve shortages in airlift capacity. Some aircraft manufacturers, like Boeing and Lockheed Martin, have developed concept multipurpose aircraft designed to fulfill both the airlift and air-refueling mission simultaneously.[31]

The last operating procedure enhancement assumption is continued use of Civil Reserve Air Fleet (CRAF)[32] assets to fulfill national requirements for both passenger and cargo movement to a major theater war (MTW). CRAF aircraft are likely to provide nearly 95 percent of all passenger movements and 40 percent of all cargo deliveries if fully activated (Stage III).[33] This assumption is crucial in that CRAF holds the key to the ability of US forces to meet their wartime commitments. Additionally, if CRAF use remains at current levels over the next 30 to 50 years, the airlifter of the future will not have to be built specifically for troop transport (except to meet brigade airdrop requirements) and can focus more on cargo capacity considerations. Associated with continued CRAF use are Boeing's plans, in conjunction with Air Force officials, to market a C-17 commercial variant, the BC-17.[34] Since the Air Force does not always require outsized capacity for day-to-day operations, especially during peacetime, and some areas of the commercial sector *do* have a requirement for outsized capacity (construction companies, oil-drilling firms, and large engine manufacturers), the idea is revolutionary. CRAF participants who purchase or lease the BC-17 would get guaranteed business from the military, while the military gets use of that commercially procured asset without paying the up-front acquisition costs.[35] Other advantages include increased airlift capacity for meeting the two-MTW strategy, conservation of scarce defense funds, and an enhanced partnership with CRAF participants who are required to deliver cargoes to hostile areas alongside their military counterparts. It is a win-win situation for all. In essence, CRAF partnerships with the defense community will drive future airlifter design considerations.

Summary

Thinking about the assumptions and limitations of the airlift picture for 2030 to 2050 indicates the United States is positioning itself to meet future challenges. Operating improvements will transform the capabilities of the airlifter, making use cost-effective and its operation far more efficient. Computer-aided design is the enabler that tests these improvements before full-scale prototypes are built. Computer-aided design will also permit several aircraft component manufacturers to integrate parts into the design early to effectively validate compatibility in the design process, minimizing overall design costs.

AMC initiatives taken now to improve the overall health of the airlift fleet will yield important data to foster improved aircraft designs. It also may provide data on how to extend the service life of aircraft beyond their typical lifespans. This, in turn, ensures modernization efforts will be kept to a minimum and are more cost-effective, thereby allowing funding for other critical programs.

With the changing face of the future strategic environment, a hazy, yet developing, picture of what the future airlifter's characteristics should be is coming into focus. The years ahead will witness leaps and bounds in technology over what is available today; however, many of these technologies will be outgrowths of today's know-how. The next strategic airlifter will have greater range, higher capacity, and increased speed and be no larger than the C-5, if not smaller. However, it must retain the capacity to carry specialized outsized equipment. These features should be seriously considered for the next-generation aircraft, which is where the focus now shifts.

Considerations and Characteristics for the Next Airlifter

> *The required capabilities of the air mobility system in* 2025 *have been identified as follows: point-of-use delivery and extraction, long unrefueled range, total resource visibility, survivability, intermodality, modularity, interoperability, responsiveness, and cost. Each serves an integral purpose in a synergistic whole. If the air mobility tasks required to meet national objectives in* 2025 *are to be accomplished, each of these capabilities must be present in the air mobility system.*
>
> —***Air Force 2025***

To turn the vision of *Air Force 2025* into reality, major changes in technology and how it can be employed better must evolve. These capabilities become a starting point for enabling new ideas to take shape. Both the USAF Scientific Advisory Board's *New World Vistas* and *Air Force 2025* point to capabilities required of airlift forces of the future.[36] Much can also be said about increased airlift-user requirements in recent years. For example, it now takes nearly 100 C-17 flights to transport a Patriot air-defense unit overseas.[37] What if, by 2030, the United States has an operational national missile defense system, as proposed by the new Bush administration, making the Patriot system obsolete? This might significantly reduce the amount of airlift needed to conduct a major theater war if all other planning factors remain the same. Therefore, there are many things to consider for the development of the next airlifter.

Needs Assessment

DoD's acquisition system is driven by the mission-needs analysis process and integrated priority lists generated by the warfighting commanders in chief (CINC).[38] Any future aircraft developed must fully consider the integrated priority lists and Service user's requirements to prevent costly mistakes.[39] Forming user-assessment teams to study the issues in advance may contribute to accurately forecasting needs, capabilities, and requirements. Granted, not everyone on the team will reach full consensus on all issues since CINCs and the Services have competing demands, but an openminded approach is suggested.

Defensive Systems Revisited

Defensive systems are another significant consideration for the environment in which airlift forces operate. AMC listed aircraft defensive systems as its number one acquisition priority in its *Air Mobility Strategic Plan 2000*, highlighting their importance to the command as indicators of where air mobility systems operate now and in the future.[40] Though these systems are costly, the possible risk to aircraft and crew without them outweighs the cost. The flexibility defensive systems offer in terms of where airlifters can safely operate—particularly systems that can detect and defend against infrared surface-to-air missiles—will allow airlifters to operate as close to hostilities as calculated risks permit.[41] One defensive capability to pursue is the directed-energy, self-defense system that uses either laser or high-power microwave technology. According to the *New World Vistas* study, this weapon improves aircraft survivability and increases the chances for mission success against the very real threat of surface-to-air and air-to-air missiles targeted at airlift aircraft performing routine missions.[42] The use of such a system would revolutionize airlift doctrine and deter most aggressors from attacking airlifters, making the cargo and aircraft more survivable in hostile conditions plagued with asymmetric threats. A system like this may also incorporate many of the other defensive systems, reducing crew workload while increasing capacity due to weight savings. Based on the pace of emerging technologies, such a system will weigh less than 500 pounds, be portable if necessary, and take up very little space aboard the aircraft.[43]

Asymmetric Threats

Asymmetric threats and adequate defenses to deter them must also be considered. "US dominance in the conventional military arena may encourage adversaries to use . . . asymmetric means to attack our forces and interests overseas and Americans at home."[44] The next-generation airlifter must incorporate technologies that defend against nuclear, biological, and chemical weapons (NBC) of mass destruction since they pose a very real threat to our forces.[45] Defensive systems that counteract offensive information operations conducted by adversaries to intercept, disrupt, and deter communications and navigation should also be considered. NBC capability in the hands of adversaries could have devastating results for unprotected US forces at relatively little cost to a potential adversary.[46]

Size

The physical size of the next-generation airlifter must be carefully considered. An aircraft no larger than the C-5 will likely suffice for several reasons. First, unless infrastructure and facility upgrades increase to accommodate aircraft larger than the C-5, any future aircraft might not have universal access to airfields. Second, though increased size usually equates to longer range, cost also increases, deterring both DoD and potential buyers.[47] Third, if direct-delivery capability is desired, size will dictate where the aircraft can land, operate, and take off.

Speed

Compatible speed with civil airline aircraft is another consideration. The next airlifter should be capable of speeds necessary to gain access to restricted North Atlantic and European airspace. "GATM [modernization and installation programs] will do us no good unless we can compete with faster airline traffic." Additionally, "speed [equates to] greater throughput [of aircraft] per day."[48] By way of comparison, most modern airline traffic cruises at .80 Mach and greater, while the C-141, C-5, and C-17 cruise between .74 and .77 Mach.[49]

Onboard Materiel-Handling Equipment

Another consideration requiring innovative technological thinking concerns advanced onboard aircraft materiel-handling equipment. One such system, known as *load by wire*, could alleviate some of the problems associated with transporting cargo to austere locations with limited materiel-handling equipment.[50] For example, when en route changes to destination cargoes necessitate the delivery of cargo located in the forward section of the aircraft and the offload site does not have the ability to offload, transport, and store the cargo, load by wire could be employed to perform those functions internal to the aircraft. Load by wire moves cargo within the cargo compartment, making the offload less dependent on external materiel-handling equipment.

A consideration for aircraft with dual-row cargo capability is a revolving floor system that can safely rotate the floor to position pallets at the ramp for more convenient offload. Limitations with radical systems such as this include the cost to develop them (since the concept is revolutionary in nature) and the added weight required to house the components and backup systems in case of critical failures.[51] These systems may also augment a high-precision airdrop system if the aircraft is equipped to perform airdrop operations.[52]

External Design

Finally, the external design of the aircraft itself must be taken into consideration.[53] Boeing has considered a blended-wing aircraft body style, while Lockheed Martin has done the same (Figure 1).[54]

The advantages of designs like this, as stated by Lockheed Martin, include "generous internal volume for fuel and cargo . . . with reduced structural weight."[56] This design also seems to incorporate characteristics of stealth and low-observable technologies—another consideration for the next airlifter. Further analysis and study in this area are required. Another design fielded by Lockheed Martin is the box-wing or joined-wing concept (Figure 2).[57]

Lockheed Martin touts this aircraft as a multirole aircraft with dual aerial-refueling booms maintaining "a full cargo capability including roll-on/roll-off loading of vehicles, equipment, and . . . containers."[59] An advantage of this aircraft is the reduced cost of a multirole aircraft; a disadvantage is the dilution of the core capability necessary for direct delivery. The challenge will be Lockheed Martin's, Boeing's, DoD's, and others' to overcome, if possible and necessary.

Recommendations and Conclusion

Thinking needs to begin now for the next generation airlifter.

—*New World Vistas*, Mobility Applications Volume

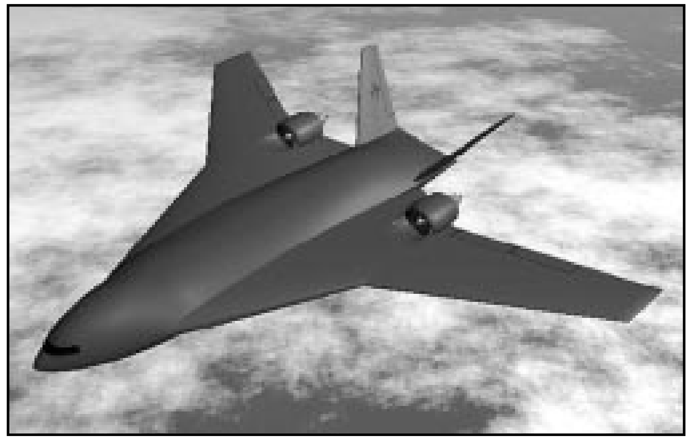

Figure 1 Blended-Wing Body Style[55]

Figure 2 Box-Wing or Joined-Wing Body Style[58]

The evolving nature of technology holds the key to future development of airlift aircraft. Its attributes and capabilities will be inextricably linked to existing capabilities and requirements. Actions taken in the near future to develop an airlifter to meet the needs of next-generation armed forces should begin. The feasibility, capability, signposts, and ancillary capabilities of the next-generation airlifter discussed throughout this article facilitate further thinking and research regarding its development.

Needs of potential users, as well as the forecasted strategic environment should be taken into consideration. Since that is largely unknown for an aircraft to be fielded decades from now, the aircraft must be built around emerging threats and requirements of the Services and CINCs at the time of its development.[60] It must be flexible enough to be upgraded (plug-and-play avionics boxes that can be swapped out easily for upgraded ones) since both threats and requirements are subject to change. To lower costs and enhance compatibility, the design effort should be conducted closely with industry manufacturers and CRAF partners from the beginning and should emphasize DoD needs over industry partners to ensure defense requirements and survivable systems are installed. Partnering with industry and CRAF participants allows access to the benefits of commercial-off-the-shelf technologies (COTS).

COTS should be incorporated into the design of the aircraft to the maximum extent possible. It offers several advantages over specially designed military components, including worldwide logistics availability, compatibility to commercial aircraft, and ease of upgrade to newer models—all translating to lower manufacture and maintenance costs. If costs are not kept within reasonable limits, no one outside the United States will be able to afford the aircraft.[61]

Recommendations made by both *Air Force 2025* and the USAF Scientific Advisory Board's *New World Vistas* studies should be considered and implemented as technology and feasibility permit—specifically, those that leverage American technological advantages over potential adversaries such as the development of directed-energy, self-defense systems and information-dominance systems, as well as those providing for physical survivability (defense against weapons of mass destruction and shoulder-fired weapons).[62]

With the absence of the C-17 and C-5 from service between 2030 and 2050, their usable capabilities must be retained in any new design. As a caveat to desired capabilities:

- Improvements to existing physical features and capabilities should first be considered.
- Outsized capacity is absolutely required since none will exist.
- A robust defensive-system suite for operation against asymmetric threats and at austere locations is required. The suite should include infrared countermeasures, countermeasure defense sets, missile-warning systems, chaff, and flares, as a minimum. If the need is substantiated, a directed-energy, self-defense system should be incorporated, depending on the types of threats.
- The aircraft skin must be somewhat resistant to small-arms fire, antiaircraft fire, and certain shoulder-fired weapons.
- The aircraft should also be able to conduct direct delivery to austere locations. Because of the lack of forward-basing options and transformation to expeditionary operations by all the Services, direct-delivery capability ensures a rapid response, negating the need for intermediate stops and permitting the United States to act unilaterally and swiftly in defense of national interests. However, as with other capabilities, direct delivery will depend on the future strategic environment and how often this capability is actually employed by the C-17 by 2030.[63]
- Air-refueling capability enhances flexibility and rapid response time. It is an absolute requirement to retain for the foreseeable future. Its continued use will depend on improvements made to engines as well as improvements in fuel efficiency.
- Airdrop capability will be necessary since none will exist with the departure of the C-5 and C-17.

Special operations characteristics for the next-generation airlifter are nice to have, if feasible, but not required, depending on the capabilities and capacity of the proposed advanced theater transport likely fielded and operational by 2030.[64] Among the most important of these characteristics are NVG capability, JTIDS, and RWR compatibility.

Avionics and defensive systems will improve and evolve into more capable and usable systems for cost-effective inclusion on the next-generation airlifter. Special attention must be given to improvements that will protect the aircraft and crew from predictable and unpredictable threats while allowing it to accomplish its mission with acceptable levels of risk.

Finally, when development of the next-generation airlifter begins, representatives from the CINCs, Services (including operators, engineers, and scientists), industry (including CRAF participants), and DoD should form a working group to consider the characteristics and capabilities of the next airlifter outside the normal mission-needs analysis process. Their inputs should become a template for developers and manufactures to use in designing the most functional aircraft possible.

This article gives insights into the development of the next-generation strategic airlifter. By analyzing current capabilities and emerging technologies, a clearer picture of required capabilities materializes. These required capabilities will, in turn, become the basis for future development. It is crucial to begin this process as early as the requirement for the next airlifter is identified to ensure proper measures are taken at the proper time. Planning for success will result in a superb aircraft ready to perform at the tip of the spear anywhere, anytime.

Notes

1. Author's interview with David Merrill, senior analyst, AMC Studies and Analysis Division, 8 Mar 01. Mr Merrill commented, "No one expects the C-5s to last beyond FY2040." He commented that it was too early to tell what modernization efforts would be made to the C-17 to extend its life until 2030-2050.
2. This article focuses on the development of a from-the-ground-up military aircraft only and does not consider COTS aircraft for several reasons, including their current inability to operate in austere environments or carry outsized cargo, like heavily armored main battle tanks and Patriot missile batteries, and a lack of adequate defensive systems, biological and chemical weapons protection, and airdrop capability. However, the interoperable, universal, and readily available technologies inherent in COTS aircraft that do not detract from the military-specific attributes required for the aircraft to operate in austere threat environments should be used to the maximum extent possible. The legitimacy of a military airlifter over COTS aircraft from a DoD standpoint was announced and justified in Office of Assistant Secretary of Defense. *DOD Announces C-17/NDAA Aircraft Decision*, Washington, DC: *Defense Link*, 4 Nov 95 [Online] Available: http://www.defenselink.mil/news/Nov1995/b110395_bt587-95.html, 9 Nov 00.
3. The National Military Strategy from 1997 derives its guidance from the President's National Security Strategy to "Shape, Respond, and Prepare Now for an Uncertain Future." This translates loosely to readying the Armed Forces to meet any threat encountered with whatever means and capabilities available. DoD, Joint Chiefs of Staff. *National Military Strategy of the United States of America*, Washington DC, 1997, 1.
4. From this point forward, the term *airlifter* will be used to denote strategic airlifter for brevity's sake. The term strategic airlifter implies the ability to perform intertheater airlift between theaters, such as between the United States and Europe. Tactical airlift aircraft such as the C-130 are capable of strategic airlift but are better suited for *intratheater* airlift of forces and equipment within a theater of operations. This distinction is made to merely illustrate the difference in assets used to perform specific missions. Important to note here is that the C-17 is capable of both inter- and intratheater airlift, a concept known as direct delivery, which is described in the Specific Mission Capabilities section.
5. *DOD Announces C-17/NDAA Aircraft Decision*.
6. Seena Simon, "Plan for Costly Upgrade of Aging C-5s Questioned," *Air Force Times*, 30 Oct 00, 18.
7. Bill Sweetman, "Airlifters Rise to Greater Challenges," *Jane's International Defence Review*, Mar 96, 67.
8. MOG refers to an aircraft's ability to operate at a location. Factors in its determination are speed and ease of operations, as well as the actual physical footprint the aircraft makes at that location.
9. RAIM allows the computerized-GPS receiver to maintain self-awareness regarding whether or not it has information from enough GPS satellites (minimum required—five) to reliably calculate position and altitude.

10. An austere airfield is one where minimal infrastructure on the ground site exists and there is a short, usually 3,000-foot, landing strip available.
11. "JTIDS is a communications, navigation, and identification system intended to exchange surveillance and command and control (C2) information among various C2 platforms and weapons platforms to enhance varied missions of each of the Services." Department of Defense, Director, Operational Test and Evaluation FY96 Annual Report. *Joint Tactical Information Distribution System*, Washington DC, 1996 [Online] Available: http://www.dote.osd.mil/reports/FY96/96JTIDS.html, 10 Feb 01. JTIDS provides the operator superb situational awareness of both friendly and adversary aircraft operating in the same airspace.
12. "The RWR system detects, identifies, processes, and displays airborne interceptor, surface-to-air missile, and antiaircraft artillery weapon systems." Federation of American Scientists, Military Analysis Network. AN/ALR-69 RWR, 22 Apr 00 [Online] Available: http://www.fas.org/man/dod-101/sys/ac/equip/an-alr-69.htm, 10 Feb 01.
13. EVS incorporates a FLIR camera that allows the pilot to look through fog and darkness by projecting an infrared real-world image on the HUD. The image provides the pilot the ability to avoid terrain and land the aircraft safely on landing surfaces in very low-visibility conditions.
14. Congress of the United States, A Congressional Budget Office Study, *Moving U. S. Forces: Options for Strategic Mobility*. Washington DC, Feb 97 [Online] Available: http://www.cbo.gov/showdoc.cfm?index=11&sequence=3, 30 Oct 00.
15. *Ibid*. Airborne forces were dropped in Grenada in 1983, in Panama in 1989, and planned to drop on Haiti in 1994. Cargo airdrop, by contrast, is a much more frequent occurrence.
16. Nick Cook, "Briefing: Airlifters," *Jane's Defence Weekly*, 24 Jul 96, 19.
17. David A. Fulghum, "Future Airlifters Promise Global Range," *Aviation Week & Space Technology*, 20 Jan 97, 52.
18. "Air Force Expects to Need More Airlift, but Details on Hold," *Air Force Times*, 11 Sep 00, 29.
19. "Future Airlifters Promise Global Range," 52.
20. Bruce D. Callander, "The Evolution of Air Mobility," *Air Force Magazine*, Feb 98 [Online] Available: http://www.afa.org/magazine/0298, 8 Feb 01.
21. *New World Vistas: Air and Space Power for the 21st Century*, Washington Mobility Applications Vol, Sec 4.1, Washington DC: USAF Scientific Advisory Board, 1995.
22. Bill Gregory, "Tanker-Transports, Future USAF Airlifters Are Likely to Be Versatile Multimission Aircraft," *Armed Forces Journal International*, Dec 97 [Online] Available: http://www.afji.com/mags/1997/Dec/IndTech.html, 30 Oct 00.
23. Department of the Air Force. Headquarters AMC, *Air Mobility Strategic Plan 2000*, C-5 Roadmap, Vol 3, Table 4, Fig 21, Scott AFB, Illinois, 1999.
24. Brian Bender, "USAF Reviews Airlift Fleet Requirements," *Jane's Defence Weekly*, 11 Aug 99, 7; Stephen Willingham, "Despite Leaner Army, Demand for Airlift Should Remain High," *National Defense*, Dec 00,17; Bill Sweetman, "Upgrades Dominate US Airlift Plans," *Interavia*, Apr 00, 40; and Sandra I. Erwin, "Need for Global Mobility Spurs Demand for Airlift," *National Defense*, Dec 98, 19.
25. John A. Tirpak, "Airlift Gets a Boost," *Air Force Magazine*, Dec 97 [Online] Available: http://www.afa.org/magazine/1297airl.html, 30 Oct 00.
26. *Air Mobility Strategic Plan 2000*, GATM Roadmap, Sec 3.6.13.1.
27. *Ibid*.
28. *Air Mobility Strategic Plan 2000*, ITV Roadmap, Vol 3, Sec 3.6.17.
29. MRS-05 currently assumes the use of KC-10 aircraft as part of the two-MTW strategy. Department of Defense. JCS, *Mobility Requirements Study-05* (U), Jan 01, Executive Summary, J-4 (Secret) (information extracted is unclassified) [Online] Available: SIPRnet http://nmcc20a.nmcc.smil.mil/~dj4wichs/MRS_05/, 17 Jan 01.
30. *Ibid*.
31. Boeing's concept B-767 tanker/transport [Online] Available: http://www.boeing.com/defense-space/military/767t-t/ and Lockheed Martin's [Online] Available: http://www.lmasc.com/ama/tanker.htm.
32. CRAF is a three-stage activation plan for contracted air carriers to augment the nation in time of war or national emergency. Activated by CINCTRANSCOM, each level of CRAF, from Stage I to Stage III, commits increasing numbers of assets and requires activation approval from the Secretary of Defense, *Moving U. S. Forces: Options for Strategic Mobility*.
33. MRS-05, Executive Summary, J-12.
34. "Commercial C-17 Buys Would Stabilize Cost, Enhance Reserve Air Fleet," *Inside the Air Force*, 22 Dec 00, 2.
35. *Ibid*.
36. Mobility Applications, and USAF, "The First with the Most," *Air Force 2025 Final Report*, Aug 96, Chap 2, Airlift 2025 [Online] Available: http://www.au.af.mil/au/2025/, 10 Feb 01.
37. "A Clamor for Airlift," *Air Force Magazine*, Dec 00, 26.
38. Before aircraft are developed, a mission-needs analysis is required by law, and AMC would become involved in such a process. Currently, there is no such process for the future strategic airlifter as it is too far into the future to even be considered yet. For an in-depth discussion of the legal requirements of the mission-needs analysis process, see DoD Acquisition Reform [Online] Available: http://web1.deskbook.osd.mil/default.asp, Deskbook Quick Link to keyword mission-needs analysis.
39. Currently, there are no warfighting CINC IPLs for US airlift capabilities. The United States faces a *chicken or egg* argument in this regard in that the CINCs will not ask for a capability that does not exist and the acquisition community will not ask for a weapon system the CINC does not need. As a result, the defense community must see some real paradigm shifting to make a new technology come to fruition; or they need a war, an accident (like the Secretary Brown crash), or other significant global event to show the new need. See Merrill. Gregory, "User concerns like C-17 vortex problems in airdrops or ease of loadability got overlooked."
40. *Air Mobility Strategic Plan 2000*, Acquisition Priority List.
41. John Tirpak, "Airlift Reality Check," *Air Force Magazine*, Dec 99, 36.
42. *New World Vistas*, Mobility Applications; Executive Summary, v; and Table ES-1, vi.
43. *Ibid*.
44. William S. Cohen, Department of Defense. *Quadrennial Defense Review*, Washington DC, May 97, Sec II, 4.
45. This is priority number 14 of 27 on the *Air Mobility Strategic Plan 2000* Acquisition Priority List.
46. *Air Force 2025*, Chap 2, 3.
47. "Airlifters Rise to Greater Challenges," 70.
48. E-mail with Maj Glenn Rousseau, former GATM program manager and senior analyst for strategic mobility, who worked at AMC/XP 1997 to 1998, 3 Oct 00.
49. US Air Force, various aircraft fact sheets [Online] Available: http://www.af.mil/news/indexpages/fs_index.shtml, 10 Feb 01.
50. Lt Col David W. Allvin, *Paradigm Lost: Rethinking Theater Airlift to Support the Army After Next*, Maxwell AFB, Alabama: Air University Press, Sep 00 [Online] Available: http://www.au.af.mil/au/database/research/ay1999/saas/allvin_dw.htm, 10 Feb 01.
51. *Ibid*. Added weight reduces fuel, cargo capacity, and hence, range.
52. Bill Sweetman, "A Rising Imperative: More Demands for Airlift," *Jane's International Defence Review*, Feb 98, 29.
53. The concepts portrayed in the following paragraphs are merely the visions of aircraft manufacturers. The DoD, Air Force, and AMC have not put forward the research, development, training, and execution dollars to explore the possibility of such future airlifter concepts. "Everyone is taking a 'wait and see' what happens in the commercial sector with these platforms. It's not that we are against something new; it's more that we have to prioritize our investments in the health of the current fleet and finish the acquisition of the C-17. I don't see room for either the blended-wing body or the joined-wing design until they have proven themselves in the commercial marketplace." See Merrill.
54. Craig Hoyle, "You Call . . . We Haul." *Jane's Defence Weekly*, 16 Feb 00, 50, and Fulghum, 51.
55. Lockheed Martin Aeronautics Company [Online] Available: http://www.lmasc.com/ama/tanker.htm.
56. Lockheed Martin Aeronautics Company. *Advanced Mobility Aircraft: Tanker/Transport* [Online] Available: http://www.lmasc.com/ama/tanker.htm, 9 Nov 00.
57. *Ibid*.
58. Lockheed Martin Aeronautics Company.
59. *Ibid*.

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In today's technological environment, with weapons serving increasingly in both offensive and defensive roles, the challenge of determining whether a weapon is defensive or offensive is more difficult than ever.

Introduction

> *We have learned and must not forget that from now on air transport is an essential element of airpower, in fact of all national power.*
>
> **—General Henry H. "Hap" Arnold, 1945**[1]

How do you reduce forward-deployed forces in order to ease tensions with an adversary yet retain a force perceived as legitimately capable of deterring opportunistic aggression? Enhanced airlift capability is one potential solution to this challenge.

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MAJOR TIMOTHY S. REED, USAF

The Security Dilemma

I observe that you are watching our moves as though we are enemies, and we, noticing this, are watching yours too. I also know that in the past people have become frightened of each other and then, in their anxiety to strike first before anything is done to them, have done irreparable harm to those who neither intended nor even wanted to do them harm.

—Xenophon, 4th Century BC[2]

The first step in constructing a model depicting how airpower might affect the challenges presented in the security dilemma is to understand the dilemma itself. The security dilemma has been a concern as long people have been recording their concerns, just as it continues to foster apprehension today. The security dilemma is present when a state takes national security actions that are observable by other states. Throughout this article, the term *state* will be used as it is commonly used in international system research: to refer to organizations that govern the people of a territory; for example, countries, not the sublevel within country organizations such as the individual states making up the United States.

National security actions that states implement may take a multitude of forms, examples of which include forward deploying of forces, testing of new technology, or entering into mutual defense pacts with other states. State B, having observed the actions of State A, is then faced with a security dilemma—does it increase its own capability or do nothing? The dilemma arises from the choice between two perceived alternatives and significant ambiguity over which alternative is the best.[3] State B may assume State A has only defensive intentions, in which case, no national security response is required. Alternatively, State B may assume State A has offensive intentions and pursue defensive preparations commensurate with the increase in the perceived threat.

State B's lack of perfect information about the intentions of State A is not only the source of the ambiguousness of the alternatives but also compounds the effect of the alternative selected as a course of action. Should State B choose to do nothing and State A have offensive intentions, State B is at risk. On the other hand, if State B takes defensive action of its own and State A has no offensive intent, then State A may perceive State B's response as a threat, which, in turn, requires a response from State A.

Examples of the danger of potential spirals of the security dilemma can be seen throughout history. The security dilemma played an important role in the Peloponnesian War as indicated by the observations of Xenophon and Thucydides. Other examples include Germany's building of a powerful navy prior to World War I,[4] the US-Soviet nuclear buildup of the Cold War,[5] the current military competition between Pakistan and India, and the deployment of US forces in defense of the Republic of Korea.

In one of the most important articles written on the security dilemma,[6] Robert Jervis synthesizes much of the prior research into a succinct conclusion: states seeking only *security* can fuel competition and strain political relations with other states as a result of their actions.[7] As Jervis put it:

> A state which *thinks* that the other *knows* it wants only to preserve the status quo and that its arms are meant only for self-preservation will conclude that the other side will react to its arms by increasing its own capability only if it is aggressive itself. Since the other side is not menaced, there is no legitimate reason for it to object to the first state's arms; therefore, objection proves the other is aggressive.[8]

This observation captures the critical essence of the dilemma—that irrespective of State A's *intent*, it is State B's *perception* that becomes the constructed reality.

If State A's *intent* cannot be determined with complete certainty by State B, the *intent* variable becomes a de facto, dichotomous variable. In other words, State A can either maintain the status quo or opt to change it. The only choice that will not be subject to an analysis by State B (an analysis based on imperfect information) is to do nothing.

Since choosing to remain unresponsive to changes in the environment is unwise, choosing to do nothing is not a realistic option.[9] States concerned with the implications of the security dilemma must focus instead on managing the subjective perceptions of others. This perception of another state's actions must focus on the assessment of whether the change in capability is offensive or defensive.

When discussing offensive versus defensive capability, it is important to note this analysis refers to military technology and, in some cases, tactics, but not national policy.[10] For the purposes of this article, intent (or national policy) is considered to be analytically distinct from technological capability. Determining whether a state's intent is offensive/aggressive or defensive/nonaggressive is an important but distinctly separate consideration.

In today's technological environment, with weapons serving increasingly in both offensive and defensive roles, the challenge of determining whether a weapon is defensive or offensive is more difficult than ever. State B, in forming a perception of State A's change in national security, will, however, seek to determine whether a weapon is primarily offensive, since offensive weapons serve as potential threats. For State B to determine whether a weapon is offensive or not, it must ascertain which of its characteristics indicate it should be considered primarily offensive.

It becomes necessary then to determine the characteristics of those weapons that Hart argued "alone make it possible under modern conditions to make a decisive offensive against a neighboring country."[11] An analysis of the critical attributes of offensive and defensive weapons throughout history by Dupuy and Eliot, Boggs, Wright, and Levy have found that for weapons to be perceived as offensive they must possess two key characteristics: mobility and striking power.[12]

Weapons may be placed on a continuum that ranges from immobility to increasingly higher degrees of mobility and from no striking power to high levels of striking power. As a result, they may be considered more or less offensive, as long as they have both mobility and striking power. A weapon with one but not both characteristics should not be considered offensive. For example, a minefield cannot be moved, yet it possesses striking power. Therefore, it would not be considered offensive in nature. The minefields on both sides of the demilitarized zone in Korea serve as good examples of what an immobile but highly destructive weapon might be. A truck is mobile but contains no inherent striking power; therefore, it would not be considered offensive. This standard for offensive weapons can also be applied to airlift capability. Airlift is mobile yet possesses no inherent striking capability. Therefore, by this standard, it should not be considered offensive.

Further, the proximity of the weapon to the concerned state's territory must be considered. Using the criteria of mobility and striking power, there is no question of the offensive nature of a mechanized infantry division. However, the location of the weapon must also be considered to determine the perception a state has on the offensive threat of the weapon. For example, the weapons arrayed in the 4th Mechanized Infantry Division are clearly offensive in nature, as are those of the 2d Mechanized Infantry Division. Consider the subjective perception of the Democratic People's Republic of Korea. State actors in Pyongyang likely have a much different perception of the offensive nature of the 4th Mechanized Infantry Division at Fort Hood, Texas, than of the 2d Mechanized Infantry Division forward deployed at locations throughout the Republic of Korea. Despite the similar capabilities of these weapons, the close proximity deployment of one division results in a much greater perception of offensiveness than another, similar division.

How, then, does State A, being fully cognizant of the security dilemma and seeking only to enhance its own security, pursue increased security and not exacerbate the dilemma for State B? Furthermore, how does State A best create and maintain a legitimate deterrent to the potential aggressors? A review of literature on the security dilemma suggests a pursuit of nonoffensive technology is the most prudent course of action. Only by choosing such a strategy can State A avoid the ultimate tragedy of the security dilemma, "that mutual fear of what initially may never have existed may subsequently bring about what is feared the most."[13]

To formulate a strategy that will not negatively impact the security dilemma, states must be familiar with the legitimation processes by which perceptions are created. Threats are assessed, offensive versus defensive characteristics are analyzed, and mission capabilities are ascertained by actors in the environment—in time, determining how a change in national security affects not only the nature of the capability but also the legitimacy of the capability.

Legitimacy

Legitimacy is a condition based on the perception by a specific audience of the legality, morality, or rightness of a set of actions. This audience may be the US public, foreign nations, the populations in the area of responsibility.

—Air Force Doctrine Document 3-07[14]

Once one grasps the important characteristics of the security dilemma, a second dilemma emerges—how does a state ameliorate the security dilemma and also maintain a legitimate deterrent? The search for a possible solution to the second dilemma requires that additional questions be answered. What is the relationship between the legitimacy of airpower and the security dilemma? If traditional increases in the legitimacy of a state's military capability increase the tension between two states, are there other means of enhancing military capability that would not increase tensions but would, conversely, ease the security dilemma? Since legitimacy is so fundamental to answering the foregoing research questions, it is necessary to understand clearly the different types of legitimacy and the process by which legitimacy is bestowed.

It is important to note that both individuals and groups of all sizes can be legitimate. For example, pilots may be considered to be legitimate once they successfully complete aviation training and are awarded pilot wings. Each of the organizations the pilot then belongs to also can achieve legitimacy status at its unit of analysis. The pilot's wing gains legitimacy through operational capability rates. The pilot's military service gains legitimacy through the successful completion of its roles and missions. The combined military for the state to which the pilot belongs may gain legitimacy through its demonstrated capability to perform its required role as an instrument of power. For the purposes of simplification of nomenclature, these groups, irrespective of size, will be referred to as organizations.

Three Pillars of Legitimacy

Based on a review of institutional theory, Scott suggested a set of institutional domains he called "pillars of legitimacy": the regulatory, cognitive, and normative.[15]

The *regulatory pillar* is composed of regulatory institutions: the rules and laws that exist to ensure stability and order in societies.[16] Organizations have to comply with the explicitly stated requirements of the regulatory system to be legitimate. Researchers who use the regulative perspective posit that organizations do what they do because they are required to. Notwithstanding the anarchic international system, military organizations earn regulative legitimacy by following international law; for example, the Geneva Conventions and the Nonproliferation Treaty.

Given the dichotomous nature of regulative legitimacy, it becomes clear that an organization either *is* or *is not* legitimate when evaluated through a regulative lens. The organization either *does* meet minimum standards or *does not*. The fighter wing either *is* mission capable or *is not*. Since regulative legitimacy is based on conforming to a minimum set of standards, it is referred to as the *conformance* level of legitimacy. There are no varying degrees of regulative legitimacy. You either have it or you do not. For example, when treaty language specifies the number of nuclear weapons delivery vehicles allowable and a state exceeds that limit, it does not have regulative legitimacy.

The second class of legitimacy, the *cognitive pillar*, draws from social psychology and the cognitive school of institutional theory.[17] When measured through the cognitive lens, organizations must, at a minimum, be consistent with established cognitive structures in society to be legitimate. In other words, what is legitimate is what holds *taken for granted* status in society.[18] A *military organization* must look like and act like a military organization to receive cognitive legitimacy. Society expects those in military organizations to wear similar uniforms, have similar appearances, and conform to a set of standards different from those followed by civilians. These expectations are taken for granted by observers. Scholars using the cognitive perspective believe organizations do things because all the other organizations do them.

It is possible to exceed the minimum or conforming level of cognitive legitimacy. When the minimum levels expected of an organization are surpassed, the organization acquires a higher than minimum or *superordinate* level of legitimacy. Military organizations may acquire superordinate cognitive legitimacy by exceeding standards of performance.

The *normative pillar* goes beyond regulatory rules and cognitive structures to the domain of social values.[19] Legitimacy, in this view, accrues from congruence between the values pursued by the organization and wider societal values.[20]

Researchers from the normative school focus on the goals of the organization (the ends) and their values used by the firm to meet those goals (the means). For example, in sports, an accepted goal may be to win the game. An unacceptable value, however, may be to cheat in order to win. Of course, in war, a different standard of fair play is considered legitimate, including the use of deception and surprise. Normative legitimacy results when both goals and values are acceptable to environmental constituents.

The normative pillar of legitimacy will be the primary type of legitimacy considered in this article. Especially critical are the assessments of the means an organization uses to achieve its stated goals. The broad goals of National Military Strategy include the objectives of Shaping, Responding, and Preparing Now for the future. These ends must be met with identifiable means; otherwise, the goals fail to meet the test of legitimacy. Currently, the goal of being able to respond is pursued with the means of forward-based forces, which, in turn, forces the security dilemma through another spiral cycle.

Superordinate Legitimacy

Cognitive and normative views of legitimacy are more subjective than regulative legitimacy and may be thought of as lying on a continuum. While there may be a minimally accepted level of cognitive and normative behavior, there are certainly higher levels that may be pursued. For example, the operators of a production facility are required to adhere to clean air standards. Either they do, thereby attaining regulative legitimacy, or they do not. The plant may, however, exceed the standards because all other firms in the area exceed the standards (cognitive legitimacy). Alternatively, the company may exceed the standards while other firms do not due to an organizational culture of environmental protection (normative legitimacy). As the clean air example illustrates, firms may gain conformance legitimacy by meeting or conforming to minimum standards, or they may gain higher (superordinate) levels of legitimacy by exceeding the minimum standards.

While the legitimacy attained through conforming is required for membership in the next larger group (for example, a wing must be legitimate to gain and maintain membership in an air force), the role of superordinate levels of legitimacy is vitally important in the assessment of a military's capability and credibility. Conforming legitimacy can be conferred on any group that meets minimum standards. Legitimacy stemming from superordinate standing, on the other hand, demands that organizations meet a higher approval or performance standard.

Institutions of higher learning serve as useful examples of the difference between conforming and superordinate legitimacy. Colleges and universities must meet minimal standards set by an accrediting body. The school must continue to conform to these minimum standards to maintain its membership in the post-secondary, educational institutional group.

These institutions, however, often seek legitimacy above and beyond the minimal levels of the group. Consider the rankings of business schools published by *U. S. News and World Report*. Universities seek out the specific criteria against which they will be evaluated and strive to maximize performance in those specific areas. The schools scoring the highest in the measured categories are awarded superordinate legitimacy by being ranked in the upper percentiles of like institutions.

As indicated in the previous section, organizations can conform by meeting minimum standards of the larger group or attain a greater degree of legitimacy by exceeding those minimums. An organization may look like and dress like an air force. It may fly airplanes and conduct air force missions. It may obey all international air treaties. When it does, it will receive conformance-level legitimacy in all three pillars. But to achieve superordinate legitimacy, the air force must exceed minimums. It must maintain a demonstrable capability that exceeds that of the average or minimum air force. It must also have roles and mission requirements that exceed the conformance level of legitimacy.

This increased level of legitimacy is assessed by the social actors concerned with the legitimacy of the organization in question. The key role played by social actors in the legitimation process leaves us with an important question: do state leaders enact the environment to gain legitimacy, or does the environment bestow legitimacy on organizations?

Potential Impact of Increased Legitimacy

This article follows the strategic perspective that organizations can and do employ a range of tactics in response to environmental conditions. On one hand, groups may choose to obey rules and accept norms to achieve conformance legitimacy. On the other extreme, they may disguise nonconformity, change organizational goals, or attempt to influence institutional constituents.[21] These actions may be pursued to secure or increase higher levels of legitimacy. But just what do organizations hope to gain by pursuing enhanced legitimacy?

An underacknowledged distinction in studies of legitimacy centers on whether the organization seeks active support or merely passive acquiescence. If an organization simply wants a particular audience to leave it alone, the threshold of legitimation may be quite low. In the previous example of university accreditation, a school seeking passive support would seek to meet the minimum standards and avoid any infractions or complaints from or by the internal organization. An institution seeking the active support of published rankings would verify the metrics to be evaluated and maximize the scores earned.

In the international system, a state that merely conforms (or possesses little or no other differentiating evaluative characteristics) is seeking only passive support. Historically, neutral states serve as examples of those seeking only conformance legitimacy. They adhere to established international law but do little to pursue superordinate levels of legitimacy. If, in contrast, a state seeks to have a credible deterrent force to protect its worldwide interests, that state must attain a higher level of legitimacy.

As discussed above, legitimacy is the assessment of an organization by social actors. Given that definition, a key step in understanding the legitimation process is identifying relevant social actors. While there are many environmental constituents, only certain *critical* actors have the standing to confer legitimacy.[22] In the context of this article, pertinent social actors would range from the public, law and policy makers, and alliance and coalition partners to potential threats and adversaries. Each of these actors is evaluating the legitimacy of the organization in question. Each constituent has its own set of criteria to use in its assessment of a capability. Those making force structure and equipment decisions must be aware of the perceptions of each of these actors. In particular, they must be aware that only the final group, adversaries and potential threats, will react to national security alterations in a manner that affects the security dilemma.

Airlift

We must be the world's premier deployer.

—General John Shalikashvili[23]

General Shalikashvili's observations help us to recall the critical roles that mobility, logistics management, and supply play in the successful conduct of military operations. A review of airlift history indicates that, while airlift was first used to complement military forces as early as 1918, air mobility did not take on a notable role until World War II.[24] During the Second World War, flying over the *Hump* to supply Chinese forces from Burma and India and the massive air deliveries conducted in support of Operation Overlord demonstrated airlift could respond to national and military needs on a moment's notice.

In the post-war era, the use of airpower during the Berlin Airlift allowed airmen and aircraft to change the course of history without firing a shot—through use of airlift capability. Rather than being an instrument of war, in this instance, airlift may very well have prevented a third world war. Breaking the blockade of Berlin clearly demonstrated the value of airlift as an instrument of national policy, diplomacy, and humanitarian assistance.[25]

Strategy of Forward Basing of Forces

The United States emerged from World War II as the most powerful state on the planet. This new superpower role brought with it superpower responsibilities, including the requirement to use all instruments of power to shape events in the rest of the world. To effectively bring a presence to bear anywhere in the world, the United States faced the choice of either permanently stationing forces wherever crises were likely to arise or developing a capability to transport the appropriate forces rapidly to the right place at the right time. The impressive achievements of the Hump and Berlin notwithstanding, the air mobility capability of the United States had not yet reached the point where it could become a continental United States (CONUS)-based deployment force. Subsequently, an expensive policy of forward basing was pursued, due in part to the lack of a legitimate mobility capability. The doctrine and technology of the time also focused heavily on the use of mass to conduct operations.[26] This further required overseas positioning of heavy equipment and military units, as there was no alternative means of moving the personnel and equipment necessary to conduct operations in a timely manner. The forward deployment of forces continued to be foundational to US military strategy throughout the Cold War period.

Maintaining a substantial overseas presence is still seen as vital to ensuring a capability of shaping environments and responding to threats.[27] As Secretary of Defense William Cohen observed, "Overseas presence promotes regional stability by giving form and substance to U. S. bilateral and multilateral security commitments and helps prevent the development of power vacuums and instability."[28] This policy, of course, pays a great deal of attention to the quest for legitimacy at the expense of the security dilemma.

The contributions that a forward presence lends are clear, and some level of forward basing is required to ensure access is guaranteed in time of crisis. As one Army War College scholar put it, "Because presence ensures access, some continuing stationing is necessary everywhere the U. S. wants to retain some level of commitment."[29] This observation suggests that a relatively small forward presence can demonstrate commitment and ensure access should it be required, at levels far short of those threatening neighboring states. Pursuing a forward presence without considering the implications relative to the security dilemma is shortsighted and may well lead to an intractable condition where two massive deterrent forces are dug in to oppose each other. The forces opposing each other on the Korean Peninsula find themselves in just such a situation.

A major shift in force structure began following the Cold War and accelerated after the Persian Gulf War. The number of overseas bases was drastically reduced, as was the overall force structure. Unfortunately, a primary antecedent for the forward basing of forces (strategic placement in lieu of an agile mobility system) was forgotten or disregarded in the face of a large military draw down.

Maintaining a balance in the inverse relationship between forward-deployed forces and airlift capability is essential. The perceived state of balance between these factors plays a critical role in the legitimation of a military response capability.

Maintaining Legitimacy Through Airlift Capability

How do observers in the environment assess the legitimacy of other states' military crisis-response capabilities? A roughly sketched, notional perception is that the level of legitimacy is equal to the percentage of a state's forces that are forward deployed plus the mobility capability to quickly move forces that are not forward deployed to the area in time of crisis. In the simplest terms, the observer asks two questions: (1) how many forces are located in the vicinity, and (2) how many forces can be transported quickly to the vicinity in time of crisis? To maintain legitimacy, if one portion of the equation decreases, the other portion must increase to compensate for the change. The United States has followed a path of force reduction and withdrawal from forward positions since the end of the Cold War. To maintain a legitimate response capability, airlift should have increased proportionately as strategically placed forces were withdrawn.

The impact of the withdrawal of forward-based forces is illustrated in the reversal of the number of joint deployments the Air Force has been involved with. In its first 40 years, the Air Force participated in just ten joint deployments. Those numbers are reversed for 1989-99. In that 10-year period, the Air Force participated in 40 joint deployments.[30] When considering joint military missions and deployments from 1989 to 1999, the number soars from 40 to 80.[31] In fiscal year 1997, the Air Force flew 50,000 mobility missions and flew to every country in the world with a runway, except two.[32] Each of the operations, deployments, and task forces required mobility support from Air Force airlift resources. While the entire burden of the increased operational requirements could not have been borne by forward-based forces, the greater number of forces and their close proximity to the crises would have contributed significantly in mitigating the burden placed on mobility forces. In this case, neither the forward-based forces nor an adequate airlift capability was available since both factors had been reduced. These reductions have resulted in the high operations tempo that has stressed the force for the last decade.

As a result of the increasing burden on mobility forces and the perception that increases in mobility capability have not kept pace with the rate at which forward forces have been withdrawn, a study was commissioned to investigate the future mobility requirements for US forces. The Mobility Requirements Study for 2005 (MRS-05) found a current shortfall in air mobility capability of 10.1 million ton miles per day (MTM/D). MTM/D is a measure of how many tons can be airlifted to a theater in a given day.[33] MRS-05 found that an airlift capability for transporting between 51 and 67 MTM/D would be required to fight two major theater wars (MTW).[34] The level required to fight two nearly simultaneous major theater wars with moderate risk was determined to be 54.5 MTM/D. This requires an airlift capability of moving 5,450 tons across 10,000 miles per day. The current military airlift capability with 100-percent use of air reserve components is 23.9 MTM/D. When all three levels of the Civil Reserve Air Fleet (CRAF) are also utilized, the capability reaches 44.4 MTM/D.[35]

The shortfall in current capability is to be initially addressed by the procurement of 15 additional C-17 aircraft.[36] Adding these aircraft to the airlift fleet is a step toward legitimizing the stated objective of a two-MTW capability. Additionally, MRS-05 finds that a fleet of 156 C-17s may be required to meet the 54.5 MTM/D requirement. It is important to note this shortfall exists before considering lift requirements associated with the Army's transformation plan. The objective of the Army transformation plan is to become a lighter, faster force that will deploy rapidly by air in time of crisis. MRS-05 also does not consider the Army's advertised claim of being able to deploy one brigade in 96 hours, one division in 5 days, and five divisions in 30 days.[37] If implemented, these changes would increase airlift requirements and move a significant portion of the mobility requirement currently covered by sealift to an already stressed airlift capability.

In addition, MRS-05 does not consider the impact of a possible withdrawal of US troops from forward bases. These withdrawals, including those recommended in this article, will further increase the requirement for airlift, at least initially. However, if withdrawal of forces from forward positions eventually results in a reduction in the number of potential contingencies requiring airlift resources (for example, a pullback in Korea that leads to reunification, thereby reducing the probability of a second major theater war), the ultimate impact may be beneficial to the airlift capability gap. Notwithstanding this possibility, the current and projected shortfall in airlift capability indicates that, if the gap identified in MRS-05 is not addressed immediately, the perceived legitimacy of the US military response capability is in jeopardy.

The Air Force has begun to address budget cuts, force reductions, and the reduction of forward-based forces by pursuing a shift in strategy toward fighting as deployed forces from continental United States (CONUS) bases. This change in strategy was effected through the creation of the expeditionary aerospace force (EAF) at the turn of the century. The expeditionary aerospace force was developed out of recognition that the Air Force will operate primarily from permanent US bases. The reduction of forward-based forces has required aerospace forces to reorganize to fight as a deployed force from the United States. The cost savings by reducing overseas infrastructure and consolidating forces in the CONUS are incalculable. Further, our national leadership has increased flexibility to use forces when and where required. In addition to conserving resources and increasing flexibility, the expeditionary aerospace force maintains the legitimacy of the US crisis-response capability through global attack and rapid global mobility.

Airlift's role in the expeditionary aerospace force is critical. The EAF concept relies on a small forward footprint, reachback, and operations in austere environments. All these characteristics highlight the important role played by airlift in the expeditionary aerospace force.[38] The EAF concept would not be possible without the airlift and tanker resources necessary to enable global employment missions. In addition to the increasing demands on airlift, the *expeditionary* paradigm shift also suggests that airlift requirements will increase beyond those forecast in MRS-05.

The Nonoffensive Nature of Airlift

In addition to being a highly flexible force enhancement, airlift is one of very few military capabilities that may be viewed as not being primarily offensive in nature. Given the definition used previously, airlift is clearly mobile yet contains no inherent striking power. As a result, the procurement of additional airlift capability is not in itself an offensive threat to actors in the environment. In fact, given the increasing role played by airlift in humanitarian and diplomatic missions, enhanced airlift capability may be perceived as an enhancement to conducting operations other than war, rather than the patently offensive nature inherent in other military acquisitions.

Airlift does, however, enhance the ability of existing forces to respond in case of a crisis. In this role, airlift enhances the legitimacy of military forces by enabling them to be flexible enough to respond to contingencies anywhere in a rapid fashion. Through either increased acquisition of military airlift resources, commercial sales of C-17s that would then be available in a CRAF-like agreement in the event of a crisis, or enhanced CRAF capability, both airlift legitimacy and overall military legitimacy are enhanced.[39]

Similarly, national planners are faced with a requirement to field lighter, faster, more mobile forces. Planners should also consider the offensive and defensive characteristics of a new acquisition, as well as the legitimizing effect the new capability brings with it. When these criteria are considered, enhanced airlift emerges as a logical foundation in any attempt to fill the requirement.

Airlift capability should cause state actors much less concern than would a mechanized infantry division within hours of their border.

Airlift as a Legitimacy Enabler and Security Dilemma Ameliorator

Often it is the non-lethal application of air mobility that contributes most effectively towards achieving national security objectives.

—Air Force Doctrine Statement 2-6, 21 November 1997[40]

Is there an alternative to the forward basing of massive forces that will ameliorate the security dilemma, maintain the legitimacy of forces, and increase day-to-day force flexibility as well as contingency flexibility? The answer may be airlift.

In an attempt to apply this proposal to an existing environment, consider current force deployments on the Cold War's last battleground: Korea. It must be noted at the outset that the issues tied to Korea (for example, National Missile Defense, Pacific Rim economic policy, and the emergence of China as a potential peer threat) are many and varied and certainly cannot be examined in even a cursory manner in the limited context of this article. At a macrolevel, however, Korea provides a useful example of the interaction of the security dilemma, military capability legitimacy, and potential role of airlift.

Progress has been made in Korea with regard to reducing the production of nuclear weapons, repatriating separated families, and reopening rail links between the divided republics. Yet, there has been no move toward a reduction in the 37,000 forward-based US forces.[41] Observers of the Korean situation are quick to point out there are more than a million men in the North Korean Army, and two-thirds of them are within 50 miles of the South Korean border.[42] Secretary of State Colin Powell has called on Pyongyang to trim its army and signaled that North Korean force reductions might be a precursor to normalization of relations between the United States and North Korea.[43] On the other hand, US leaders indicate that the potential threat of North Korean forces demands the current and continued forward deployment of deterrent forces.

In the context of the security dilemma, the military buildup (on both sides of the demilitarized zone) is understandable. The North Korean force is in place in response to the perceived threat posed by US and South Korean forces massed near its border. The question is how to reduce forces while minimizing the risk that a potentially opportunistic adversary will take advantage of that reduction.

The intricacies of such a plan would involve discussion well beyond the scope of this article. It does seem clear, however, that at some stage of the reduction, perhaps before such a reduction can even begin, an increased airlift capability would be required. Enhancing airlift first requires the addressing of the current planning shortfall detailed in MRS-05. Once this shortfall is addressed, the airlift required for supporting a crisis reinsertion of forces can be determined.

An enhanced airlift capability would ensure withdrawn forces could be reinserted rapidly into the theater and married up with prepositioned material. Forward-operating bases would be maintained in theater by a greatly reduced US force, ensuring access in a potential crisis. South Korean forces would take primary responsibility for homeland defense in a crisis. Further, despite the current discussion of excising the *Halt* phase from military doctrine, it is likely the remaining forces in Korea would conduct operations to halt the enemy advance until forces could be transported via airlift.[44]

The forces withdrawn from Korea would be consolidated at CONUS bases to provide a flexible response to other emerging contingencies. For example, the reorganization of army divisions into brigades capable of autonomous response would increase the flexibility of these units. In the current forward-deployed scenario, the mechanized division in Korea is of no use in an emerging contingency outside the theater. Moving the division to support a contingency without an increased airlift capability to reinsert them quickly would increase the likelihood that a potential aggressor would attempt to take advantage of the situation.

The partial withdrawal of US forces from Korea, coupled with enhanced airlift, would allow the Army to pursue its transition to a lighter, faster force featuring the light armored vehicles that it plans to deploy by air.[45] In addition, forces withdrawn to CONUS bases would be able to maximize their proficiency by accessing CONUS training ranges not available in congested Korea.

The legitimacy of US response capability would be maintained through the regular exercise of a rapid-deployment plan. A demonstration of the capability to reinsert forces quickly, if required, would enhance the legitimacy of the force and, thus, serve as a deterrent toward aggression.

Conclusion

States may seek to gain military capability legitimacy by massing forces along borders with potential adversaries. This is certainly the case in Korea. For nonregional and nonsuperpowers, seeking conformance-level legitimacy via massed troops may be the only course of action available based on their security dilemma perceptions. But for the world's only superpower, there are other options. It should not be enough to merely seek the conforming legitimacy gained through the massing of forces. Enhancing airlift capability would enable the United States to gain superordinate legitimacy by providing not only a legitimate global deterrent capability but also an increased capability to assist the world rapidly in a nonviolent capacity. The deterrent capability would be maintained by having the resources to transport forces rapidly anywhere in time of crisis. Superordinate legitimacy would be gained through use of additional airlift capacity to conduct humanitarian, disaster relief, and other nonoffensive missions when the resources are not required for deterrent or offensive missions. Further, this course of action would demonstrate to the world that options for gaining legitimacy exist beyond the massing of forces. World events have cast the United States as the understudy in the role of *benevolent hegemon*. By attaining superordinate legitimacy, ascension to star status in that role may be possible.

There are also potential financial benefits for all involved. Scarce resources currently employed by both sides to fund the military standoff could be redirected toward economic pursuits in the region. In particular, attention should be paid to the desperate health and nutrition situation associated with the famine in North Korea that has claimed 1 million lives in 3 years.[46] For the United States, resources could be freed up for the Bush administration to pursue its military reform agenda and provide more flexibility in reshaping the military into a lighter, more mobile fighting force.

The Cold War demonstrated that arms buildups and close positioning of opposing forces could lead to an escalation of tensions and an escalation of the cost of defense. It also demonstrated that the amount of time the security dilemma action-reaction spiral takes to reach critical mass differs from situation to situation. A reoccurrence of hostilities in Korea may be avoided if the security dilemma cycle is broken via an increase in airlift capability, enabling the reduction of forward-deployed forces in the region. The United States has historically waited for others to make the first move toward breaking the security dilemma spiral. But there may not be an actor of Gorbachev-like stature in North Korea. It may fall to the world's lone superpower to take the first step in resolving the dilemma in Northeast Asia.

Notes

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notable quotes

I find the greatest thing in this world is not so much where we stand, as in what direction we are moving.

—Oliver Wendell Holmes

Military Logistics and the Warfighter

Colonel Fred Gluck, USAF, Retired

I think we can all agree there is a relationship between the function of military logistics and the warfighter. What is that relationship, and is it correctly defined? In the early 1960s, there was a stated relationship between logistics and the weapons systems: military logistics "support"' the weapons system. At that time, the subject of military logistics was fairly new and, with little ongoing research, very slow in providing greater *understanding* about it. Therefore, during that period, this definition of relationship seemed appropriate. It was not until the late 1970s that several advocates of military logistics came to the realization that logistics *support* of the weapons system was actually creating and sustaining warfighting capability. This warfighting capability was provided to the combat forces in the form of continuing availability of operational weapons systems (the tools of war). This new awareness set up another definition of the relationship: *military logistics creates and sustains warfighting capability*. While many heard the words, few realized their implications.

I would submit that by providing the pilot with an operational weapon system, which allows him or her to utilize its warfighting capability, ***military logistics*** *creates the warfighter. It does not* ***support*** *the warfighter; it* ***creates*** *the warfighter.*

The level of warfighting capability that logistics provides the combat forces determines the extent to which war can be waged. This in turn limits and shapes how the war will be waged. Warfighting capability is *embedded* in the design of all weapon systems. Advancing technology increases speed, range, maneuverability, ceiling, and firepower, all of which provide more lethal and accurately guided munitions, stealth, and other offensive and defensive warfighting capabilities. They will be embedded into the design of future weapon systems. It is the weapon systems that contain the warfighting capability of military forces. The strength of military forces is no longer measured by the number of men *under arms*. Today, military forces are measured by the number—and warfighting capabilities—of their weapon systems. The Department of Defense has yet to adequately define and manage the total logistics environment (those activities and resources required to create and sustain warfighting capability). While it is said that armies travel on their stomachs, what is usually left unsaid is they perform on the basis of their logistics competency.

Today, as most of you are aware, we have another, more recently defined relationship: *military logistics supports the warfighter*. We know military logistics creates and sustains warfighting capability. We can assume the warfighter fights wars. It would, therefore, appear reasonable to suggest that in order for one to be a warfighter (a pilot in this case) he or she must have the capability to wage war. While weapon systems are designed and created to wage war, people are not. Therefore, in order to become warfighters, pilots must be provided with some level or amount of warfighting capability. I would submit that by providing the pilot with an operational weapon system, which allows him or her to utilize its warfighting capability, *military logistics creates the warfighter*. It does not *support* the warfighter; it *creates* the war fighter. This transformation occurs when a checked-out pilot starts the engine. At that point, the pilot is in control of the weapon system and its warfighting capability. The pilot is now the warfighter. Without the warfighting capability, which the weapons system provides, a pilot is a pilot.

Military logistics creates and sustains warfighting capability; by doing so, military logistics creates and sustains the warfighter.

Colonel Gluck has worked in the field of military logistics for more than 25 years, with assignments in materiel management, maintenance management, procurement, international logistics, management/weapon systems analysis, and logistics plans. He was assistant professor of Logistics Management and chairman of the Department of Management Studies in the Graduate Logistics Management Program at the Air Force Institute of Technology. One of his published works is the original Compendium of Authenticated Logistics Terms and Definitions. He is a charter member of the Society of Logistics Engineers. He is a rated master navigator with more than 4,000 flying hours.

Total Mobility Flow: A Post-Kosovo Role for the DIRMOBFOR

Colonel Nonie Cabana, USAF

Air mobility played a crucial role by enabling and sustaining the air war that ultimately forced Milosevic to NATO [North Atlantic Treaty Organization] demands.[1]

—Lieutenant General William J. Begert,
USAFE Vice Commander

Introduction

The commander in chief (CINC) did not have a total mobility flowmaster fusing the strategic mobility triad (airlift, sealift, and prepositioning) during Operation Allied Force. Rather, he had a director of mobility forces (DIRMOBFOR) whose focus centered on airlift coordination. A sealift and prepositioning coordinator was missing, which resulted in a stovepiped and less-than-optimal mobility flow in the CINC's theater of operations. Simply put, use of airlift was lopsided compared to use of sealift and prepositioned assets.

To capitalize on experience gained during Operation Allied Force, this article investigates the post-Kosovo role of the director of mobility forces in integrating the total mobility system, thus enabling the commander in chief to enhance force buildup and closure capability in the future. Two critical things were not accomplished effectively during Operation Allied Force, which degraded achieving the CINC's objectives. First, establishing various task force (TF) organizations to support different missions, as well as separation of the director of mobility forces and joint forces air component commander (JFACC), disrupted unity of command. Second, there was no single flowmaster to fuse all mobility requirements.

Key players in Operation Allied Force were the director of mobility forces and operational commanders (commander in chief, joint force commander, commander joint task force, and component/functional commanders). The director of mobility forces exercised coordinating authority between the airlift control center, air mobility element, joint movement center, and air operations center to expedite the resolution of airlift problems.[2] The duties and authority of the director of mobility forces were as directed by the commander, commander of Air Force forces (COMAFFOR), or JFACC to satisfy the objectives of the joint force commander.[3] The operational commanders were responsible for accomplishing the objectives of the commander in chief. They are the operators who can make the DIRMOBFOR job easy or difficult, depending on how theater command and control (C2) is organized.

There is general agreement among operational commanders that airlift is the preferred choice for rapid delivery of combat power or humanitarian relief to trouble spots worldwide—specifically, deployment, sustainment, and simply doing good things for Americans and other nations needing help. Colonel Coy, Operation Allied Force Deputy Director of Mobility Forces, affirmed this preference when he said, "Airlift is like candy. Everybody wants some . . . I want it now . . . I want it all."[4] Unfortunately, there is insufficient candy to pass around to everyone. Thus, use of other lift assets, such as sealift, is important and necessary.

When the Cold War ended, the Air Force formulated its Global Reach, Global Power vision. Essentially, Global Reach represented the strategic capability of the mobility air forces to deploy, sustain, and redeploy warfighters and their equipment to any part of the globe. Global Power reflected the combat forces' contribution to the equation. Today, the Air Force vision is the ability to deploy an aerospace expeditionary force to any brewing conflict or contingency on a moment's notice.

Historically, mobility air forces have proven their mettle when confronted with conflicts or contingencies. This was done under the leadership of commanders sporting a variety of titles: *commander of airlift forces* during the Cold War; *commander of mobility forces* during Operation Desert Shield/Desert Storm; and *director of mobility forces* following Desert Shield/Desert Storm, in particular during Operation Allied Force.

Lineage of Mobility Air Forces

The lineage of air mobility forces goes back to the World War II *Hump* airlift experience in Asia. Lieutenant General William H. Tunner controlled theater airlift distribution within China, while Major General Claire Chennault commanded the air combat forces.[5] Tunner believed his controlling airlift both into and within China facilitated the most effective utilization of assets. Chennault argued that, as Burma airlift assets periodically performed air distribution within China, he should control and direct them once they arrived in his theater. However, external developments caused by increased offensive maneuvers from Japanese forces compelled Chennault to concentrate totally on combat operations, allowing Tunner to retain sole control of airlift.[6]

During the Berlin Airlift (1948-49), General Tunner served as the theater airlift commander and worked under the commander in chief, United States Air Forces in Europe (USAFE). Tunner coordinated informally with the Military Air Transport Service, the predecessor of Military Airlift Command (MAC) and today's Air Mobility Command (AMC).[7]

During the Korean conflict, air mobility forces were supported by a divided airlift system operating as part of a divided strategic theater airlift system. The Army and the Air Force operated their own airlift systems, which compounded this division—unity of control was almost nonexistent. This inefficient practice was discouraged when the Secretary of the Air Force was designated as the single airlift manager for the Department of Defense.[8]

The Vietnam War repeated the Korean airlift experience. For example, overlap of responsibilities and functions in the aerial ports was standard. A Corona Harvest report advocated a single airlift manager, and the practice of overlapping responsibilities was stopped in 1974.[9]

Single airlift control, as practiced by MAC between 1974 and 1992, produced seamless airlift that resulted from a system featuring airlift experts who operated at each intra- and intertheater location. They understood airlift's role in transporting people and equipment from the US-based *fort* to the theater *foxhole*.[10]

During this period, the airlift commanders resided in the European and Pacific theaters. In Europe, the commander of the 322d Airlift Division, Ramstein Air Base, Germany, was dual-hatted as commander of airlift forces during contingencies. The commander of airlift forces worked for the JFACC or CINCUSAFE. Similarly, the commander of the 834th Airlift Division, Hickam AFB, Hawaii, performed these same functions. This commander worked for the JFACC or commander in chief, Pacific Air Forces. However, the post-Cold War drawdown and reorganization eliminated this structure.

Background

In 1999, the North Atlantic Treaty Organization executed Operation Allied Force to stop Slobodan Milosevic's *ethnic cleansing* in Kosovo. To achieve the operation's objective, a massive deployment of aircraft, troops, and cargo was required, and a high-tempo sustainment operation was established to put *teeth* into the commitment. Airlift and tanker assets made this effort possible (Tables 1 and 2).[11]

During Operation Allied Force, the director of the combined air operations center resided in Vicenza, Italy. The JFACC empowered the director of the combined operations center to integrate air operations via the air-tasking order. Hence, the director of mobility forces had to maintain dialog with the director of the combined operations center to achieve airlift integration in the air operations scheme.

Airlift			
	Missions	STons	Pax
TF Hawk	737	22,937	7,745
TF Falcon	253	11,886	2,525
Shining Hope	264	6,422	943
Flex Anvil		1,169	1,742
Sky Anvil		889	1,970
Tanker			
Tanker Data	6,959	311,700,000 lbs offloaded	
B-2 global power	48	15,800,000 lbs offloaded	
306 tanker sorties			

Table 1. Airlift and Tanker Report Card

	C-17 Sorties	C-130 Sorties	STons
TF Hawk (8 Apr 99-6 May 99)	442	269	22,937
TF Falcon	253	26	11,948
Joint Endeavor (8 Dec 95-9 Feb 96)	494	791	23,883

Table 2. Intratheater Lift Successes

The director of mobility forces, in concurrence with the COMAFFOR, elected to run operations within the USAFE Air Mobility Operations Control Center (AMOCC) at Ramstein. This decision was reached because the AMOCC had the strongest connectivity and reachback capability and held status as the major airlift hub within the region.[12] *Reachback* is defined as extensive use of forward-deployed sensor platforms while maintaining data reduction and analysis components at the home base.[13] Also, experience and lessons learned from Operation Joint Endeavor supporting humanitarian relief for Bosnia made it a mature theater command and control node.[14]

Airlift contributions to Operation Allied Force were unprecedented. General Charles T. Robertson, Jr, commander in chief, US Transportation Command (TRANSCOM)—in comparing the use of airlift during Operations Desert Shield/Desert Storm and Allied Force—noted, "In ODS 9.6 % of the cargo moved by air, whereas in Operation Allied Force, 62.4 % of the cargo moved by air."[15] Sealift was used to move the Rapid Engineers Deployable Heavy Operations Repair Squadron Engineers construction equipment, Navy Seabee equipment, humanitarian airlift cargo, and ammunition from the continental United States to overseas and within the theater of operations.[16]

Unquestionably, Allied Force airlift broke the model of the traditional deployment and sustainment ratio of 10-percent airlift and 90-percent sealift typical since post-World War II. NATO attributed this unprecedented shift in airlift allocation to the reliance of senior leaders on an air campaign to decrease casualties. Some may claim the shift was caused by the unintended pursuit of using airlift before sealift, understandable because of an instinctive desire to go with the fastest mode when under pressure. But there was a price to pay.

Analysis: One Boss, One Team, and One Mission

Unlike the Berlin Airlift and MAC era when there was a clearly distinct, single airlift *boss*, the Allied Force DIRMOBFOR had to please multiple masters. Some may argue that Operation Allied Force was more complex than the Berlin Airlift because it involved an air-superiority campaign, force buildup, and humanitarian operations. On the other hand, the MAC-era structure may have resolved this dilemma smoothly because of a *single boss* arrangement, which normally simplifies unity of effort.

While the director of the combined operations center was busy fighting the air campaign that lasted for 78 days under one boss, the director of mobility forces was not as fortunate. To support both the air combat forces and air mobility forces, the director of mobility forces had to base the air mobility division (AMD) at two operating locations. One was AMD Forward, located in

NATO's Regional Air Movement Control Center in Vicenza, which integrated airlift operations with the air tasking order. The other was AMD Rear, which was embedded in the AMOCC at Ramstein and coordinated the main air logistics support effort in the region.

This C2 arrangement could have spoiled the DIRMOBFOR's role as the contingency airlift flowmaster. Tasked to support demanding and politically sensitive multiple joint task force (JTF) logistics airlift operations, the consequences to the director of mobility forces could have been devastating. The support included humanitarian relief operations (JTF Shining Hope), Kosovo Forces support (JTF Falcon), a major military operation to stop Serbian atrocities in Kosovo (JTF Noble Anvil), and an Apache helicopter deployment to Tirana (TF Hawk). He also administered support for varied distinguished visitors (operational airlift support) and maintained selective air routes for continuous sustainment.[17]

Needless to say, this multisupport requirement was a coordination nightmare. Each of these complex operations required the director of mobility forces to master the balancing act of serving as airlift flowmaster and as diplomat to satisfy all the customers' needs.

For Operation Allied Force, the director of mobility forces was not located with the JFACC, much the same as in China in World War II, but coordination of airlift was clearly his responsibility, unlike the situation with Tunner and Chennault. From a C2 or airlift management perspective, it was very difficult for the director of mobility forces to support multiple and concurrent task force operations. He was expected to provide equal support to each of the JTF's missions because each mission bore equal importance in order of support due to political and military constraints from higher headquarters.

It would have been simpler for the director of mobility forces to prioritize air mobility assets if there had been a single joint force commander synchronizing the actions of the operational commanders. At least, if this concept of operations had been adopted, it could have streamlined and simplified the airlift request process.

A possible solution might have been for the Supreme Allied Commander, Europe to designate Allied Forces South to serve as the command element for all joint task forces and components or functional commanders. For example, when the director of mobility forces was challenged to concurrently support other joint task forces such as Falcon and Shining Hope with equal importance in mission priority, the C2 issue became more complicated and complex. Specifically, the director of mobility forces had to serve multiple users with different objectives. This type of environment violates two of the nine principles of war: simplicity and unity of command.

Integration of Air Operations Center

In fairness, under the circumstances and mission demands of Allied Force, the CINC's decision to separate the director of mobility forces from the director of the combined operations center allowed the JFACC to concentrate efforts on the battle. He did this by integrating the elements of combat power at his disposal, including theater air defense, combat air refueling, airborne surveillance, and command and control aircraft.

Equally important, the separation enabled the COMAFFOR to sustain air logistics support to a myriad of JTF customers. But what was sacrificed by allowing this separation to occur? According to Service and joint doctrines, the JFACC and COMAFFOR can be a single, dual-hatted position. However, during Operation Allied Force, the commander in chief decided to keep the JFACC separated from the COMAFFOR. The JFACC effectively focused on the fight, with minimum disruptions associated with air logistics support and service administrative control. The JFACC executed the air campaign through the director of the combined operations center responsible for ensuring the air and space planning and execution processes. In other words, he planned, directed, and executed joint air operations in support of the joint force commander's operational objectives.[18] In contrast, the JFACC and the COMAFFOR wore the same hat, which simplified unity of effort for the director of mobility forces to support air logistics operations during Desert Storm.

Conversely, the director of mobility forces did not work under one roof and one boss. He became a man with many homes and masters, who made frequent visits to the area of responsibility to ensure air logistics support was uninterrupted and the coordination chain was not broken. The complexity of this C2 airlift scenario would cause Tunner to turn in his grave.

To compensate for this handicap, the director of mobility forces had to capitalize on the existing infrastructure. By using a hybrid approach, he integrated AMC's air mobility element or air mobility division staff with USAFE's AMOCC staff to combine airlift operations as much as possible.[19] He also established the AMD Forward and AMD Rear, in conjunction with NATO's Regional Air Movement Control Center and AMOCC, to support JTF Noble Anvil's air logistics sustainment for the air fight.

Reliance on Airlift Support Exceeded Its Capability

The Allied Force mobility experience was an anomaly in that it was predominately an airlift effort. The multiple and concurrent airlift operations to support deployment and redeployment, humanitarian relief operations, and air campaign sustainment could have reached a culminating point if there had been competing airlift requirements to support another theater of operations.

The Air Force made it clear in a mobility study that its airlift capability can support only one major theater war (MTW). According to TRANSCOM officials, the US military has one MTW [airlift] force to fight a two-MTW strategy.[20] For instance, during Operation Allied Force, the AMC-tasked mobility forces spent two-thirds of the total airlift assets![21]

Should commanders in chief be alarmed by this stretched airlift capability? According to the report to Congress on Kosovo and Operation Allied Force, the proper use of all means of strategic lift, supported by earlier assessment of ground-and-sea infrastructure, might result in faster force closure in future deployments.[22] Accordingly, Brigadier General Robert D. Bishop's (director of mobility forces during Allied Force) joint transportation experience and familiarity with the theater's geography and staff allowed him to effectively recommend usage of other modes of transportation when practical and economical.[23] However, Bishop's effort was not enough to achieve a proper balance of all facets of the mobility triad. Overreliance on airlift during Operation Allied Force affirmed that some operators were unaware of other parts of the strategic mobility triad. The commanders in chief should suggest that TRANSCOM perform a feasibility study that examines the expanding the DIRMOBFOR's role into one of total mobility flowmaster. Presently, no system exists to fuse all lift aspects into a coherent enabling force in a theater. The closest structures in the CINC's staff with an interest in this issue are the Joint Movement Center and Joint Operations Planning and Execution System (also known as *Jopesters)* staffs and the TRANSCOM liaison. However, these staffs normally handle issues at the operational level and may not have an operator's tactical view of the battlefield. One possible solution to alleviate this issue is to integrate a Military Sealift Command and Military Traffic Management Command liaison with the DIRMOBFOR staff to ensure sealift considerations are equally weighed in as airlift. In short, allocation of elements within the mobility triad is fragmented and stovepiped and needs a quick fix to achieve efficiency. An airlift model using the DIRMOBFOR template should be explored for sealift and prepositioning elements to perpetuate an integrated mobility system—responsive, agile, and flexible to the CINC's needs.

What if the air campaign had lasted more than 180 days versus 78 days? Would airlift capability have continued to deteriorate? When factoring in C-141 and C-5 aging because of overuse, reliability problems, and a smaller forward operating base presence, one could envision a *broken* air mobility system!

Even when all C-17s and C-5s are fully operational, the warfighters need to continue capitalizing on use of sealift because the C-141s are overworked and have reached their life expectancy. The Air Force has retired 77 C-141s, but approximately 120 remain in the active duty fleet, with 47 in the Reserves.[24] As of October 1999, only 24 of 163 C-141s and 22 of 126 C-5s were available for missions.[25] Fortunately, Operation Allied Force was already over, thus keeping these poor reliability rates from making a tremendous dent in the mission. The C-5 mission-capable rate has gotten so bad that it compelled TRANSCOM to make two C-5s available for each mission to ensure it had one plane that worked.[26]

Undoubtedly, this condition could pose a challenge for a commander in chief when requesting forces in response to the National Command Authority's mandate. To compensate for this shortfall in organic airlift support, the Secretary of Defense, through TRANSCOM, may have to activate the Civil Reserve Air Fleet to meet a major theater crisis. Another possible alternative is maximizing the use of another element of the strategic triad to reduce the airlift footprint.

The Air Force has 40-plus C-17s in the inventory, and Congress has approved the purchase of a total of 135.[27] This number, however, challenges the flexibility of air mobility forces to satisfy the needs of the commander in chief. In the words of General Robertson:

> The USAF "trading" 217 C-141s for 135 C-17s in a one-for-two swap will cause problems. Despite the C-17's lifting capacity, one airplane cannot be in two places at the same time. What we have is a significant loss of flexibility and capability in peacetime to serve the customers.[28]

An Allied Force success story was AMC's transfer of tactical control of 12 C-17s to the USAFE commander during the deployment of both TF Hawk and TF Falcon.[29] No doubt, this transfer allowed the director of mobility forces to improve airlift effectiveness, efficiency, and synergy. The transfer was possible because USAFE was considered a mature theater with the right reachback and C2 connectivity and Joint Endeavor experience. The practice can best be carried out on a sortie-by-sortie basis when airlift is most effective and economical. This demonstration of operational art enabled the mobility air force team, under the able leadership of the director of mobility forces, to achieve a mission success rate of 93.6 percent.[30]

Suppose the director of mobility forces had resided in the combined operations center under the leadership of the JFACC. Would he have been as successful as working for the COMAFFOR? Some say he would have been more successful because he would have better adhered to the singleness of control fundamental: aerospace power is most effective when it is focused in purpose and not needlessly dispersed.[31] Others would suggest that it does not matter for whom he works; he will get the job done if empowered to handle the entire logistics airlift under well-defined command and control. The real issue is not about who is the boss; it is about the principle of achieving unity of effort by streamlining the C2 layers.

Facing the Future

One Joint Force Commander

The commander in chief needs one joint force commander to effectively, efficiently, and synergistically employ airlift resources. Equally important, a perpetual link between the director of mobility forces and the JFACC or COMAFFOR should be pursued to strengthen the joint force commander's role as a single boss for all airlift apportionment and priority. Moreover, by linking the director of mobility forces to the JFACC, the commander in chief or commander of the joint task force would have a dedicated entry point for logistical air movements. A potential value added exists if commanders in chief and TRANSCOM adopt the proposed DIRMOBFOR's expanded role as the theater's total mobility flowmaster during a contingency. The benefit from this expanded role should provide the commander of the joint task force a dedicated entry point for all logistical movements in the joint area of operations.

Separation of the air mobility operations control center and director of mobility forces could work if reachback capabilities continue to improve. However, separation of the director of mobility forces and the JFACC should be avoided as much as possible to integrate all aspects of air operations. They should be collocated to ensure airlift needs are effectively met. This system worked well during the pre-Desert Shield/Desert Storm period.

The warfighters should exploit the strategic mobility triad to relieve the airlift operations tempo. According to its new vision, the Army intends to create a rapid-deployment force capable of putting combat forces anywhere in the world in 96 hours after lift-off.[32] In the same manner, the Air Force plans to move five aerospace expeditionary forces in 15 days.[33] Surely, this vision is ambitious and calls for full employment of the strategic mobility triad as well as wider accessibility to host-nation support and contingency contracting.

Mobility Flowmaster

To meet this rapid deployment vision, the commanders in chief should consider growing and nurturing a director of mobility forces capable of infusing the strategic mobility triad into a coherent and responsive system. Simply put, the commanders in chief need more than an airlift flowmaster. They need a total mobility flowmaster capable of coordinating all elements of the triad to improve force closure. Similarly, the Services' foreign area officers and Embassy country teams should capitalize on the host-nation infrastructure to complement the critical factors of the triad. When appropriate and relevant, this new role should be integrated into joint training and professional military education to increase situational awareness of the mobility triad.

Recommendations

There is no question that decreased airlift capability and forward-operating bases pose a challenge to the operational commanders. Innovation and increased discipline in enforcing current doctrine could ease their concern. The following recommendations are worthy of exploration:

- Designate a single joint force commander, when possible, to command a major operation. The joint force commander's role as a single point of contact would allow the director of mobility forces to prioritize and apportion limited airlift assets. He does this by supporting the commanders' airlift requirements on a particular day and on a specific mission specified by the joint force commander through the JFACC.
- Make the director of mobility forces and JFACC inseparable. Collocation of JFACC and the director of mobility forces under one roof should be pursued whenever feasible to optimize and simplify working relationships. A total reliance on a reachback capability approach lacks the human touch that works well when working under the same roof, rather than communicating via electrons across the pond.
- Educate and train warfighters in the strategic mobility triad. The fusion of airlift, sealift, and prepositioning elements produces an effective lift capability for the operational commanders. Not everyone can be *first in line* for airlift.
- Expand the DIRMOBFOR's role to become the total mobility flowmaster. This expanded role should allow the commander in chief to enhance force buildup and closure because it would maximize use of all the strategic mobility triad elements.

After a half century of airlift, the possibility of misapplication still lurks. Operation Allied Force nearly caused the airlift system to reach its culminating point in a relatively minor conflict. A team effort from the participants averted this potential downfall. The DIRMOBFOR's utility to the operational commanders can be achieved by properly applying a unity of effort and command principles. The concept of *one boss, one team, and one mission* will streamline and synchronize airlift support. Linking the JFACC and director of mobility forces in the air operations center would effectively match limited assets against unlimited requirements. Educating and training airlift users on the viability of the entire strategic mobility triad may help ease airlift operations tempo.

Conclusion

Allied Force's experience confirmed that all elements of the strategic mobility triad were not fully engaged because there was no single mobility flowmaster dedicated to integrate them into a coherent, agile, and responsive system. In short, there was no DIRMOBFOR-like model for sealift and prepositioning similar to the airlift piece.

Clearly, a commander in chief needs a director of mobility forces who can effectively leverage not only the airlift piece but also the full spectrum of the strategic mobility triad. This expanded role should provide the commander in chief another tool to enhance force buildup and closure capability in the future.

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(Civilian Contract Air Refueling continued from page 3)

the Air Force to pursue a civilian contract air-refueling (CCAR) capability? Civilian contract air refueling is a unique concept that presents a near-term solution to the air-refueling shortfall. The Air Force could realize three advantages from pursuing a CCAR capability. First, it would fill the gap in projected deficiencies—now and in the future. Second, it would give receiver units greater opportunity to maintain currency and proficiency in air-refueling operations. Finally, it would enhance air-refueling flexibility and improve airpower employment effectiveness.

Air Refueling—A National Resource

No single innovation of recent times has contributed more to airpower flexibility than the aerial tanker . . . .

—Major General Perry B. Griffith[8]

Air Force Doctrine Document (AFDD) 2-6.2, *Air Refueling*, summarizes the importance of air refueling to power projection and employment: "Air refueling, when properly employed, enhances, enables, and multiplies the strategic, operational, and tactical effects of any air operation."[9]

Air-Refueling Doctrine

Air and space power employment is guided by the principles of war and tenets of airpower, implemented through core competencies. Airmen must understand these fundamental beliefs as they apply to air and space power.

—Air Force Doctrine Document 1[10]

Air refueling provides the capability to increase levels of mass, surprise, economy of force, and security and concentrates more assets for offensive or defensive operations.[11] The overall effect of this capability is to enhance and multiply airpower employment capabilities. For example, air refueling an attack aircraft en route to its target allows greater payloads, which enhances the ability to achieve mass and concentration of firepower at any level in an adversary's battlespace. It also allows attacking aircraft to use indirect target approaches, terrain masking, and multiple axes of attack to create surprise. Air refueling other support aircraft increases time aloft and decreases the number of aircraft and aircrews needed to build an air bridge or provide 24-hour command and control capability, thus achieving economy of force. It also enhances maneuver by providing additional fuel to attacking aircraft, which generates a valuable maneuver advantage during air-to-air engagements, while putting the adversary at a distinct disadvantage. Air refueling mobility airlift aircraft presents another opportunity to achieve maneuver flexibility. Increasing the range and cargo load of these aircraft increases flexibility by allowing commanders to insert troops and cargo into theaters at decisive moments. Ultimately, this allows maximum use of resources and multiplies the force available, allowing greater persistence in engagements, operations, and campaigns. Finally, because air refueling increases range, airpower assets can be based beyond the effective range of enemy weapons. This increases security and frees up assets for offensive or defensive operations.

Air Force Core Competencies

Six elements comprise Air Force core competencies: rapid global mobility, precision engagement, global attack, air and space superiority, information superiority, and agile combat support. Air-to-air refueling capabilities both enable and are enabled by these competencies as shown in Table 1.

Air Refueling in Action

Air refueling means we can get anywhere very quickly, take off anywhere, attack anywhere and return anywhere, without landing en route. No spot on the globe is more than 20 hours flying from combat aircraft stationed in the United States.

—General Merrill A. McPeak[13]

In June 1948, the Strategic Air Command stood up the first squadron of KB-29M Superfortress tankers and created a unique force capability for worldwide power projection—a completely new military capability.[14] As technology advanced, KB-29s were replaced with KC-97s, and in 1957, KC-135s began replacing the KC-97s. The KC-135 quickly became the workhorse of the tanker force and remains so today—44 years after its initial delivery. Teamed with a growing fleet of B-52s, KC-135s became the backbone of America's nuclear deterrent. While tanker aircraft provided the ultimate force-enhancement capability for Cold War nuclear deterrence, they also have been actively involved in every humanitarian and combat operation since Vietnam.

Vietnam

While the first combat use of air refueling occurred during the Korean War, Vietnam was the first major combat operation that clearly demonstrated the utility of air refueling. In just a little more than 9 years, KC-135s flew 194,687 sorties, conducted 813,878 inflight refuelings, transferred 8.9 billion pounds of fuel, and logged 911,364 flight hours.[15] In an article saluting air refueling's contribution to the prosecution of the Vietnam War, John L. Frisbee wrote:

> They made it possible for Guam-based B-52s to reach their targets and for fighters to range from one end of Vietnam to the other, greatly increasing the flexibility of tactical air operations. Fighter strikes in the northern route packages were totally dependent on the tankers.[16]

Lieutenant General Charles Horner, Vietnam veteran and commander of the Coalition Air Forces during the Gulf War, noted:

> I think in any recent war, if you ask any fighter pilot who his hero is, he'd probably say the air-to-air tanker guys. I myself can remember in Vietnam being over Hainan Island, almost out of gas, and here comes a KC-135, way up north of where he ought to be because of the enemy threat . . . .[17]

Tanker employment procedures matured throughout Vietnam and the Cold War, paving the way for the most intensive operational use of air refueling to date—the Gulf War.[18]

Gulf War[19]

The buildup and execution of the Gulf War relied on air refueling—in fact, 60 percent of all attack sorties required tanker support. It allowed the rapid deployment of fighter aircraft and their support equipment to the theater; more than 1,000 fighter

Rapid Global Mobility	• Accomplished via deployment support. • Reduces reliance on en route staging bases. • Deploys with almost all support equipment, personnel, and supplies on board, allowing immediate operations with minimum impact on the airlift system.
Precision Engagement	• Enhances precision engagement by increasing the range, payload, loiter time, and flexibility of firepower assets. • Allows airlift aircraft to fly from the CONUS and deliver troops against an adversary or supplies into a disaster area. • Increases the loiter time of intelligence, surveillance, and reconnaissance assets, decreasing the number of these assets required to support an operation, while improving the ability to collect and disseminate information. • Enhances the ability of strike aircraft to employ precision weapons anywhere within the battlespace.
Global Attack	• Enables global attack competency. • Provides aircraft tasked with the global attack mission the capability to carry significant payloads to distant theaters, employ their weapons, and then recover to a secure landing base.
Air and Space Superiority	• Enhances air superiority. Aircraft can be based farther from the adversary and still perform assigned missions. • Reduces force-protection concerns and number of aircraft required for defensive operations, which frees aircraft for offensive operations. • Multiplies the effects of offensive operations. Attack aircraft can stay airborne longer outside an enemy aircraft's range and outlast the enemy's endurance. • Provides a distinct advantage in the head-to-head battle for air superiority.
Information Superiority	• Provides force multiplication for information, surveillance, and reconnaissance (ISR) assets. • Increases ISR aircraft loiter time, which reduces the number of aircraft required to support an operation.
Agile Combat Support	• Provides force multiplication for mobility airlift aircraft. • Allows airlift aircraft to deploy from the CONUS directly to distant theaters of operation, eliminating the need for time-consuming en route stops.

Table 1. Air Refueling and Air Force Core Competencies[12]

aircraft, loaded with munitions, deployed nonstop from the United States to Southwest Asia. Deployments covered 6,900 nautical miles, took 15 hours of flight time, and required 7 to 15 air refuelings. The ability to deploy nonstop allowed the first F-15s to be on alert in Saudi Arabia the day after notification and five fighter squadrons to arrive in the region within 5 days. During the 5-month buildup to and 43-day execution of the Gulf War, Air Force tankers flew 141,000 hours, offloaded 1.2 billion pounds of fuel, completed 85,000 refuelings, and transported almost 17,000 passengers and 6,500 tons of cargo.[20] The *Gulf War Air Power Survey Summary* report clearly details the importance of air refueling to the buildup and execution of the Gulf War.

> Air operations without the extensive support of aerial tankers would have changed the character of the war . . . initial deployments to the theater would have been delayed . . . all dimensions of the air campaign would have been altered, [including] the number of sorties a day as well as the operating bases used . . . aerial tankers facilitated the speed and mass of the attacks and provided a margin of safety in air operations . . . the ability to refuel extensively permitted operations from distant, secure bases and provided a buffer of inestimable worth.[21]

In addition to refueling coalition attack aircraft, tankers refueled the entire array of airborne warning, reconnaissance, targeting, and command and control aircraft that provided 24-hour coverage throughout Operation Desert Shield/Desert Storm.

Post-Gulf War

Since the Gulf War, air-refueling support has been used extensively for a wide range of operations. In 1995, tankers flew 383 Operation Deliberate Force support sorties that made the North Atlantic Treaty Organization's 17-day air campaign possible. These air-refueling flights comprised nearly 11 percent of the total missions flown during Deliberate Force.[22] More recently, tankers flew 4,347 sorties, offloading 188,100,000 pounds of fuel to more than 17,750 receivers during Operation Allied Force.[23]

A State of Emergency

If there were no falsehoods in the world, there would be no doubt, if there were no doubt, there would be no inquiry; if no inquiry, no wisdom, no knowledge, no genius.

—Walter Savage Landor[24]

Air-refueling capability has dwindled despite its proven importance to national security. The GAO concluded the DoD is 19 percent short of the air-refueling capability required to execute wartime plans.[25] As air-refueling shortfalls approach a state of emergency, visionaries are focused on a long-term solution: the next generation tanker, dubbed KC-X, which is scheduled to enter the inventory in 2013. However, the shortfall exists today and needs to be addressed with a near-term solution.

Analyzing the-Air Refueling Emergency

The Defense Department would need a one-third increase in budget simply to maintain the forces and capability it already has.

—Secretary of the Air Force F. Whitten Peters[26]

Four factors complicate AMC's long-term solution: force structure determination, one-for-one KC-135 replacement, time line for KC-X delivery, and unknown KC-135 service life, all of which open the door for a unique near-term solution—civilian contract air refueling.

Quantifying Air-Refueling Capability

Current air-refueling capability is defined by two measures of effectiveness: the number of tankers required and amount of fuel offload required. Historically, boom-intensive operations make the number of tankers available the most critical measure of effectiveness during the employment or strike phase of a campaign. Figure 1 shows AMC's current and forecasted air-refueling capability as a function of aircraft availability.

As Figure 1 depicts, there are 547 KC-135s and 59 KC-10s in the Air Force inventory. In 2013, AMC expects to begin replacing KC-135s with KC-Xs on a one-for-one basis, keeping the overall number of tankers at approximately 600.

During the deployment phase of operations, fuel available for offload is the critical measure of effectiveness because CONUS-based fighting forces require large fuel onloads to fly nonstop to distant theaters of operation. Figure 2 shows AMC's current and forecast air-refueling capability as a function of fuel offload available.

As Figure 2 depicts, the current offload capacity is 120 million pounds of fuel per day. Further, it was assumed that offload capability will increase in 2013 when KC-Xs replace KC-135s on a one-for-one basis.

Evaluating Current and Future Air-Refueling Capability

The tanker fleet must be able to support the requirements for both fuel offload and aircraft availability. According to a June 2000 GAO report on military readiness, the KC-135 fleet falls below the required mission capability (MICAP) rates for ensuring execution of wartime plans. In fact, the GAO's findings state KC-135s maintained a 67-percent MICAP rate for execution of wartime plans as opposed to the 85-percent MICAP requirement. While this rate is significantly lower than the requirement, AMC officials claim they could implement management practices to improve mission capability. They cited deferring depot maintenance, accelerating aircraft through their final days of depot maintenance, and flying some aircraft with missing or broken parts, which would not affect flight safety but would normally make them not mission capable (MC), as practices that could improve MICAP rates. While these actions would improve the MICAP rates, the length of time they could be sustained and the extent to which they would counter the nearly 20-percent shortfall are not quantified by AMC officials.[29]

Table 2 and Figure 3 show the KC-135 MC rate of 67 percent,

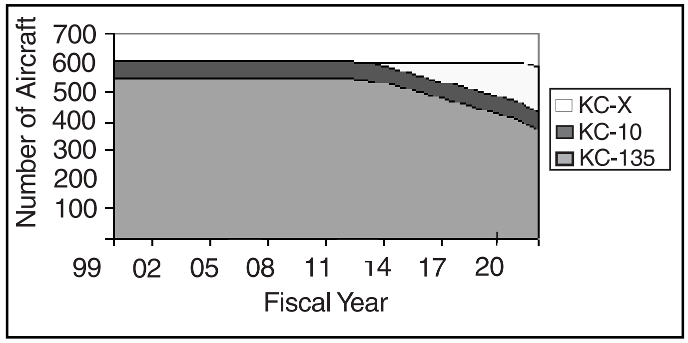


Figure 1. Air-Refueling Capability as a Function of Aircraft Availability[27]

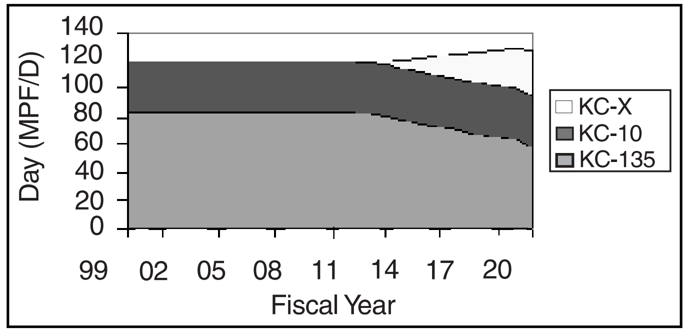


Figure 2. Air-Refueling Capability as a Function of Fuel Offload[28]

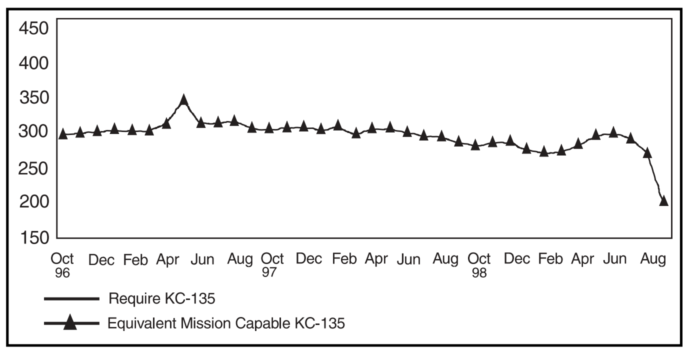


Figure 3. KC-135 AMC Aircraft Required and MC Rates, FY97-99[31]

Type Aircraft	Number Aircraft	Mission-Authorized Aircraft[a]	Standard MC Rates[b]	Equivalent Aircraft Needed[c]	Equivalent Aircraft Mission Capable[d]	Average Aircraft MC Rates[e]	Number Aircraft Short (Over)
C-5	126	104	75.0	78	57	55	21
C-17	52	44	87.5	39	29	66	10
C-141	172	135	80.0	108	83	61	25
KC-135	546	472	85.0	402	317[f]	67[f]	85[f]
KC-10	59	48	85.0	41	42	88	(1)

[a]Excludes aircraft in inventory reserved for backup and training.
[b]Percentage of mission-authorized aircraft needed to meet wartime requirements.
[c]The MC rate times the number of mission authorized aircraft.
[d]The equivalent number of aircraft is based on the number of MC hours units reported.
[e]Actual percentage of authorized aircraft mission capable is based on number of MC hours units report.
[f]AMC tracks only 442 KC-135 authorized aircraft, and 30 KC-135s are assigned to other commands. The 67-percent average MC rate for 442 aircraft was used to compute MC numbers for all 472 aircraft.

Table 2. AMC Airlift and Aerial Refueling Aircraft Data[30]

which, when coupled with the KC-10's 88-percent MC rate, still leaves AMC 84 aircraft short of wartime plan requirements.

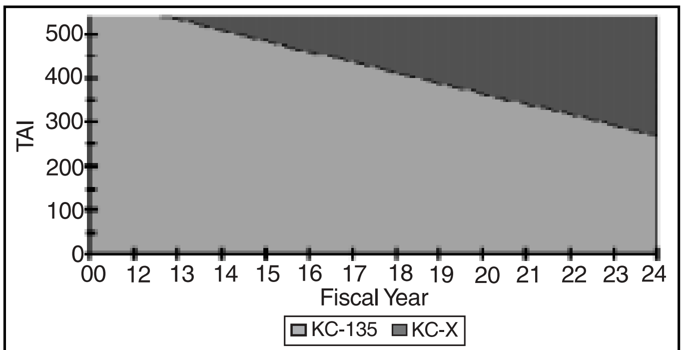
The low MC rates for KC-135s are attributed to two factors: increased depot-level maintenance cycle times and availability of spare parts. Since 1991, depot-level maintenance cycle times have doubled. Secretary Peters described the dilemma to Washington reporters: " . . . 40% of the 40-year old KC-135R tanker fleet is down for repairs at any given time . . . it takes a year to get a KC-135 through depot maintenance because of all the age-related problems discovered during the periodic overhauls."[32] Shortage of spare parts has plagued KC-135 operations for nearly a decade. General Michael Ryan, Air Force Chief of Staff, addressed the issue before the Senate Armed Services Committee in September 2000, "A lack of parts permeates several aspects of readiness: MC rates, cannibalization rates, and added work-hours for our people who try to meet mission demands without the equipment that they need."[33]

Force Structure

- **KC-10**. The newest aircraft in the air-refueling fleet is the KC-10, with an average age of 13 years. The 59 KC-10s comprise only 10 percent of the Air Force tanker fleet but, because of their large offload capability, account for 33 percent of the total available offload capability. In addition to the KC-10's air-refueling role, it also comprises 12 percent of the total military organic airlift capability. The crew ratio for the KC-10 is 2.0 for active duty units and 1.5 for associate reserve units. There are no plans to replace the KC-10 through FY25.
- **KC-135**. With an average age of 41 years, the KC-135 is one of the oldest aircraft in the Air Force inventory. The 547 KC-135s make up 90 percent of the Air Force's tanker fleet but account for only 67 percent of the available fuel offload capability. The crew ratio for CONUS-based, active duty KC-135 units is 1.36. For active duty, Air National Guard, and Air Force Reserve Command forces outside the CONUS, the crew ratio is 1.27. AMC is planning to begin KC-135 replacement in FY13. The current AMC force structure plan is presented in Figure 4.

Force Structure Determination

Despite the value of tankers to airpower projection and engagement, a rather indirect approach is used to determine the tanker force structure. AMC's *Air Mobility Strategic Plan 2000* highlights the shortfalls of this approach:



FY	00	12	13	14	15	16	17	18	19	20	21	22	23	24
KC-135	547	544	532	508	484	460	436	412	388	364	340	316	292	268
KC-X			12	36	50	84	108	132	156	180	204	228	252	276

Figure 4. KC-135 Force Structure[34]

> The tanker requirements study justified the current tanker force structure and identified significant shortfalls in both aircraft and aircrews. This study was based on the requirement statement found in the FY99-03 Defense Planning Guidance (DPG). Unfortunately, the air-refueling requirement was omitted from the FY00-05 and FY01-05 DPG. This omission also eliminated the basis used for determining the tanker requirement.
>
> The current FY01-05 DPG directs the Air Force to program "to sustain at least the current air-refueling support forces (KC-10 and KC-135 aircraft) through the FYDP (Future Years Defense Plan) period." This document no longer contains an actual "requirement" but a fiscally constrained statement that equals the current capability. Primarily due to a large number of PMAI (Primary Mission Aircraft Inventory) aircraft (547 KC-135s and 59 KC-10s), it is widely assumed that tanker support will be available for all contingencies. However, depending upon the scenarios addressed, previous studies have identified significant capability shortfalls in both aircrews and aircraft.[35]

One-for-One Replacement

AMC planners assume a one-for-one replacement of the KC-135 with the KC-X. While a large requirement for aircraft availability exists, no aircraft replacement in recent history has been procured on a one-for-one basis. In fact, the actual procurement numbers of the KC-10, B-1, B-2, and C-17 have fallen well short of the numbers the Air Force said it needed. Robert Wall, in his article "USAF Reviews KC-135 Life Expectancy," noted, "The number of KC-Xs the Air Force would buy to replace the more than 500 KC-135s is still undetermined."[36] Brigadier General Paul W. Essex, who oversees airlift and tanker acquisition programs, is wrestling with the KC-X procurement issue. He believes the KC-X will be more efficient than the KC-135, allowing fewer aircraft to provide a greater amount of offload availability; "a new aircraft would be more efficient and allow for a higher utilization rate, which makes a one-for-one replacement unlikely." Yet, General Essex recognizes the need for *booms in the air*, which drive a large tanker fleet for aircraft availability. "A relatively large number of aircraft would be required because worldwide tanker support couldn't be accommodated with a small fleet."[37] General Robertson, addressing the House Armed Services Readiness Subcommittee in October 2000, emphasized the availability issues that arise when a large force is replaced by a smaller one: "Even though tonnage capabilities remain close to the same, we lose tremendous flexibility with so many fewer tails. The 135 C-17s can be only in half as many places as 270 C-141s."[38] The plan presented in AMC's *Air Mobility Strategic Plan* 2000 fails to account for the possibility that the KC-135 will not be replaced on a one-for-one basis by the KC-X and should investigate a solution that accounts for this very likely contingency.

Time Line for KC-X Delivery

AMC's *Air Mobility Strategic Plan 2000* presents a KC-135 replacement model that assumes the design, testing, procurement, and training cycles for the KC-X will be complete by FY13. While replacing the KC-135 is near the top of the Air Force's priority list, a procurement cycle of this proportion has not been accomplished, in this short a time, for any major weapon system in recent history. As Secretary Peters pointed out, "We have no significant replacement programs on the books for our aging tankers."[39] Given the magnitude of this undertaking, AMC needs to account for the likely contingency that the KC-X will not enter service in FY13.

Unknown Service Life

Currently, the service life of the KC-135 is unknown. AMC's *Air*

Mobility Strategic Plan 2000 points out that the major limiting factor for structural service life of the KC-135 is corrosion.[40] The Air Force is conducting an economic, service-life study because previous studies failed to include corrosion as a factor. As a result of this study, AMC may have to accelerate the retirement of the KC-135 fleet and procurement of the KC-X.[41] Additionally, the current AMC replacement plan counts on the KC-135's continuing in service until FY40. In light of current plans, which indicate half the tanker force will still be KC-135s in FY25, AMC's retirement plan will need updating once the valid service life of the KC-135 is established.

Operations Tempo and Crew Manning

The combination of increased operations tempo and the lowest manning authorizations of any major weapon system causes problems for both retention and execution of wartime plans. At Grand Forks AFB, North Dakota, for example, KC-135 crews are deployed, on average, 137 days per year. This can aggravate crew-retention problems since crews are required to be away from their families for extended periods. Crew manning and operations tempo not only cause retention problems but also affect wartime plan execution. According to Lieutenant Colonel Scott Wilhelm, chief of the Modeling Branch in the AMC Office of Studies and Analysis, current KC-135 crew manning will leave the Air Force unprepared to meet wartime demands, "There would not be enough crews to do what we want to do."[42] During Operation Allied Force, the Air Force had to resort to an early presidential callup of KC-135 crews because there were not enough active-duty crews to meet the need. In fact, four reserve tanker units were activated under the Presidential Selective Reserve Callup to execute a 78-day air campaign.[43]

Summarizing the Air-Refueling Emergency

The previous discussion presents two factors critical to understanding the air-refueling emergency. First and foremost, the air-refueling shortfall is now. The KC-135 is an extremely old airframe, depot-level maintenance takes more than a year, aircraft availability is decreasing, and MC rates are falling. Second, the shortfalls in aircraft availability will continue after the KC-X is purchased. In all likelihood, AMC will not receive a one-for-one exchange for KC-135s, and the change out will not be instantaneous. Therefore, even if the KC-X delivers an increase in efficiencies that leads to greater fuel availability for the deployment phase of operations, it will not solve the aircraft availability issues associated with the employment phase of operations. Furthermore, KC-135s will still account for half the tanker fleet in 2025, and the problems associated with its maintainability will continue to be persistent. These factors necessitate a near-term solution to the air-refueling emergency.

Civilian Contract Air-Refueling: Innovative or Insane?

> *The single greatest power in the world today is the power to change. The most recklessly irresponsible thing we could do in the future would be to go on exactly as we have in the past ten or twenty years.*
>
> **—Karl W. Deutsch[48]**

The most significant oversight in AMC's plans for addressing the air-refueling emergency is a failure to develop a near-term solution. The shortfall exists today, it will not improve tomorrow, it might get worse before the next generation tanker is delivered, and it is likely the shortfall will not improve entirely after the next-generation tanker is delivered. Secretary Peters described his concerns:

> We have no significant replacement programs on the books for our aging tankers. It is not that we aren't going to have the tankers immediately, but what we are seeing on the KC-135 fleet are what appears to be an increasing mission-incapable rate due to technical surprises . . . . These are the kinds of problems, which can put a whole fleet down, or 200 aircraft down overnight for a period of time and those are the kinds of worries we have.[45]

Solving the Air-Refueling Emergency

In August 1997, the commander in chief of USTRANSCOM, General Walter Kross, directed a feasibility study for a civilian contract air-refueling proposal. Unfortunately, the CCAR proposal was limited to contracting for probe-and-drogue-type refueling only. The feasibility study concluded that a 1-percent increase in wartime capability would cost approximately $25.5M annually.[46] Because of the costs associated with a relatively small increase in wartime capability, excitement for the CCAR concept did not exist at USTRANSCOM or AMC. Undoubtedly, the CCAR proposal that USTRANSCOM studied did not present a viable solution to the air-refueling shortfalls. However, it provides four valuable lessons for a CCAR force. CCAR operations are feasible, must be capable of accomplishing boom and probe-and-drogue-type refuelings, are best suited for deployment and training operations, and are cost-effective.

CCAR Feasibility

First and foremost, the USTRANSCOM report established that CCAR operations are feasible. In its concluding remarks, the report states, "There are no known equipment or technical obstacles to preclude program development."[47] The accuracy of this statement was demonstrated in the fall of 2000 when Omega Air, Inc—an internationally based company specializing in aircraft sales, leasing, and parts—used a modified Boeing 707 to refuel a Navy FA-18C.[48] Omega received certification from the Federal Aviation Authority for the operation, contracted for its own insurance, and paid the Naval Air Warfare Center Aircraft Division $1M to certify the Boeing 707 for air-refueling operations. Following this successful demonstration, the Navy entered into a contract with Omega to provide civilian contract air refueling for its training operations. In addition to its 707s, Omega owns a fleet of about 20 DC-9s and DC-10s that could be modified for air-refueling operations, and recently, the president of Omega, Gale Matthews, voiced interest in purchasing KC-135s for use in Omega's air-refueling program.[49] Clearly, CCAR operations are feasible.

CCAR Operational Suitability

CCAR operations are best suited for deployment and training missions. USTRANSCOM's Concept Development Report concluded, "Due to legal, policy, and liability considerations, the primary utility of contracted aerial refueling is in training and deployment operations outside areas of hostilities."[50]

CCAR Capability Requirements

CCAR capability must include boom-type refueling capability, not just probe and drogue. The reasons for this are twofold. First, AMC annual probe-and-drogue missions do not exceed 2,000 hours.[51] These hours account for a small portion of the nearly 85,000 training hours allocated to tankers and, when divided among the 800 tanker crews, is highly valuable for currency and proficiency. AMC cannot afford to lose a significant portion of this training to a civilian contractor. Second, the preponderance of probe-and-drogue requirements arises during combat-strike operations for which civilian contract air refueling is not suitable. USTRANSCOM's finding about probe-and-drogue operations is valid: "AMC does not have a sufficient amount of peacetime probe-and-drogue refueling business to sustain a useful contracted A/R [air refueling] fleet."[52]

CCAR Operations are Cost-Effective

The report presented initial cost options for CCAR operations that ranged from $4,862 to $9,878 per flying hour and noted, "The figures are not meant to be analyzed from a contract perspective . . . but rather as benchmarks for report purposes."[53] Since USTRANSCOM completed its report in 1999, Omega refined its cost estimate to about $5,500 per flying hour and recently entered into a contract with the Navy to provide air refueling for $5,995 per hour.[54] The KC-135R cost per flying hour was $2,232 in FY99 and increased by more than 50 percent between FY99 and FY01 to its current cost of $3,673 per flying hour, primarily because of maintainability issues.[55] While the cost projections Omega presented for CCAR operations are higher than reimbursement rates for KC-135Rs, it is proportionately lower than the KC-10s. According to Air Force Instruction (AFI) 65-503, *US Air Force Cost and Planning Factors*, the FY01 reimbursement rate for KC-10s is $7,527 per flying hour.[61] At approximately $5,500 per flying hour, the cost of CCAR operations fits squarely in the middle of organic air-refueling costs ($3,673 to $7,527 per flying hour), and when compared to reimbursement rates for organic tankers, civilian contract air refueling presents a cost-effective option.

Contract Air Refueling: A Near-Term Solution

I think and think for months and years. Ninety-nine times, the conclusion is false. The hundredth time, I am right.

—Albert Einstein[56]

The importance of air refueling to airpower employment cannot be stressed enough. Keith Hutcheson, in *Air Mobility: The Evolution of Global Reach,* masterfully records air refueling's contribution.

> A robust aerial-refueling force provides numerous force multipliers that are critical in today's global environment. It gives virtually "unlimited" range to any air asset (bomber, fighter, airlift, special forces, or rescue) that has aerial refueling capability—U. S. or allied . . . it gives military leaders tremendous flexibility in both planning and execution. It makes one fighter capable of doing the job of several by increasing the time it can stay aloft and the number of targets it can strike. It permits heavy airlift aircraft to carry greater payloads over much longer distances in significantly less time. An aerial refueling force makes all U. S. military forces (Army, Navy Marine, and Air Force) more influential and more capable. Aerial refueling is an incredible force multiplier.[57]

Civilian Contract Air Refueling: The Findings

Civilian contract air refueling is a unique concept that presents a near-term solution to AMC's air-refueling shortfall. The Air Force could realize three advantages from pursuing a CCAR capability. First, it would fill air-refueling deployment gaps in wartime plan deficiencies—now and in the future. Second, it would give receiver units a greater opportunity to maintain currency and proficiency at air-refueling operations. Finally, it would enhance air-refueling flexibility and improve airpower employment effectiveness.

CCAR Fills the Gap in Wartime Plan Deficiencies. AMC needs a cost-effective, near-term measure to fill the gap in wartime plans and relieve the peacetime operations tempo. As previously noted, the KC-135's increased depot-level maintenance cycles have decreased peacetime aircraft MICAP rates to almost 20 percent below those acceptable for wartime mission accomplishment.[58] Additionally, the service life of the KC-135 is still unknown, operations tempo is at an all-time high, and AMC says crew manning is at a level below that required for mission execution.[59] Finally, AMC does not have a plan to fill near-term requirements, and its long-term KC-135 replacement plan ignores the historical and financial realities of garnering a one-for-one replacement for any major weapon system. A CCAR force would help eliminate these shortcomings.

CCAR Increases Training Opportunities. CCAR capability serves two roles: force deployment and training enhancement. In its force deployment role, it would be available to relieve air-refueling tanker taskings and ensure AMC's ability to execute wartime plans. Additionally, it could be used to relieve tanker taskings during air expeditionary force swap-outs, giving overtasked tanker crews a relief from the demanding operations tempo. In the training role, it is available to meet receiver air-refueling currency and proficiency requirements.

CCAR Increases Airpower Flexibility. Air refueling, when properly employed, enhances, enables, and multiplies the strategic, operational, and tactical effects of any air operation.[60] Air refueling allows airpower forces to increase levels of mass, surprise, economy of force, and security and concentrates more assets for offensive and defensive operations. Since its inception, air refueling has been the force multiplier that is inherently critical to achieving the rapid, global mobility essential to maintaining deterrence—first line of national security for the United States. Moreover, air refueling's second role, force enhancement, is critical to winning the nation's wars—the bottom line of national security.[61] Increasing the availability of air-refueling assets with a CCAR capability is of insurmountable value to the flexibility required in peacetime operations and wartime mission execution. Undoubtedly, a CCAR capability would increase that flexibility and capability.

Civilian Contract Air Refueling: The Desired End State

Given the magnitude of air refueling's importance to national security and the dwindling state of air-refueling capability, the recommendation is singular: USTRANSCOM, in conjunction with AMC, should actively pursue a civilian contract air-refueling capability.

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(18 Hours on Green Ramp continued from page 13)

Examination of current methods for determining the readiness of AMC to support the DRB revealed the absence of an effective system. Consequently, the question posed by this article really remains unanswered. This could have an adverse affect on training, safety, and the ability to accomplish the mission. Areas identified for possible improvement include regulatory guidance, organizational structure, inspections, exercises, and training, equipment, and personnel. Additionally, a DOC statement with a clearly defined mission would assist in overcoming the current absence of concise regulatory guidance. Finally, an organizational structure with effective command and control (an air mobility support group) would ensure synchronization of effort in the DRB-support role.

A clearly defined mission and organizational structure will ensure development of an effective inspection program designed to examine mission capability and support operations. In turn, the exercise program should focus on meeting established mission requirements, such as responsiveness to the DRB. Clear guidance in these areas will help facilitate development of effective training programs, equipment and infrastructure improvements, and personnel assignments focused on mission success.

In a time of fiscal constraint and apparent uncertainty for the future of air mobility (and a rapid deployment force), these proposals may seem trivial. The importance of the DRB is often underappreciated during times of peace. At this very moment, a brigade of the 82d stands ready to guard America's national interests. The organizations supporting Green Ramp represent a vital ingredient for ensuring this capability. An effective system must be in place to determine their readiness.

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(Looking Ahead: Future Airlift continued from page 23)

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Multinational Operations, the Key to Our Military Future

The Army Logistics Management College at Fort Lee, Virginia, has developed a course to prepare military and civilian personnel for positions in which they will be involved in multinational logistics. The pilot offering of the 1-week **Multinational Logistics Course** will begin 30 September 2002. The course will discuss logistics organizations and support within the North Atlantic Treaty Organization (NATO), the United Nations, and coalitions and provide an overview of US and multinational doctrine, information, and guidance. It will cover the new Joint Publication 4–08, *Joint Doctrine for Logistics Support of Multinational Operations,* and discuss a number of related topics, such as interoperability, host-nation support, interagency operations, acquisition cross-service agreements, and NATO standardization agreements.

The intended audience for the course is majors and lieutenant colonels in all Services and components, GS–12 to GS–14 civilians, international officers, and contractors (who must pay to attend). Waivers are available for captains and colonels. Students normally will be employed in or en route to a job that will involve multinational logistics. However, because multinational operations can occur on very short notice, all officers at appropriate levels should consider taking the course.

For more information on the Multinational Logistics Course, call (804) 765–4341 or DSN 539–4341 or send an e-mail to weatherille@lee.army.mil.

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Volume XXVI,
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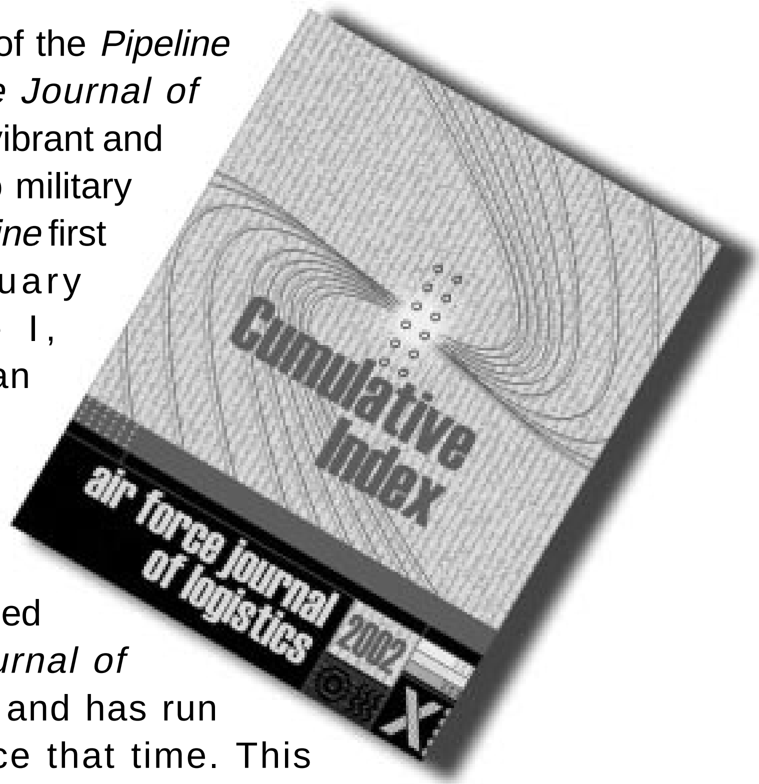

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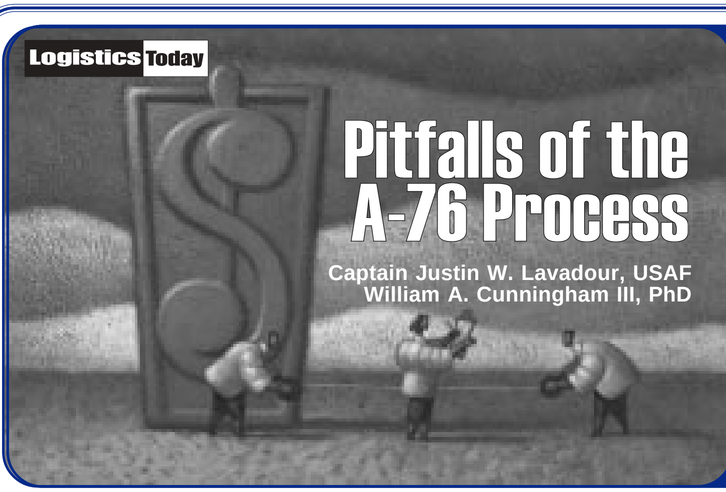

The Editorial Advisory Board selected "Pitfalls of the A-76 Process"—written by Captain Justin W. Lavadour and Dr William A. Cunningham III—as the most significant article to appear in the *Air Force Journal of Logistics*, Vol XXV, No 4.