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IMPROVING INTERFACE BETWEEN AEROMEDICAL
EVACUATION AND EN ROUTE SYSTEMS

by

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Contents

	<i>Page</i>
DISCLAIMER	ii
PREFACE	iv
ABSTRACT	v
INTRODUCTION.....	1
THE EVOLUTION OF AEROMEDICAL EVACUATION.....	4
AEROMEDICAL EVACUATION MISSION	10
AE Organization and Responsibility	11
LEVELS OF CARE/PATIENT EVACUATION FLOW	17
THE EVOLUTION OF THE EN ROUTE SYSTEM.....	21
INTERFACE FRAMEWORK FOR AE AND ERS.....	27
CONCLUSION	30
GLOSSARY	31
BIBLIOGRAPHY	33

Preface

This paper began as a phone conversation with Lt Col Bruce Hannon as I attempted to find a research topic that interested me and hopefully benefited the Air Force. I fell back on one of my endearing interests—aeromedical evacuation. While I have a good deal of experience in the field, my personal experiences weren't enough to put this paper together. As a result, I must thank a few people who helped me conduct worthwhile research and organize my thoughts. First, Lt Col Hannon at the TACC for his honest ideas of where the issues lie. During my research I happened upon a reference to the AMC Historian's Office. After just one phone call, Betty Kennedy provided me with invaluable materials that helped me frame my paper from both the aeromedical evacuation and airlift perspectives. Additionally, Maj Stephanie Smith led me down the doctrinal path, furnishing me with TTPs, doctrine and the AF aeromedical evacuation tiger team report, which figured so prominently in my paper. Finally, Lt Col Robert Algermissen, my research advisor, whose patience, understanding and support gave me the encouragement to see the project through to completion, even while I was busy at home with a newborn child. Without all of their help, I could not have begun, much less completed, this research endeavor.

Abstract

Both the aeromedical evacuation and airlift en route systems have a long and glorious history. Working separately, they provide vital services to our military. Working in tandem, they represent a precious resource in our national security framework, for they reconstitute US combat capability by evacuating and redeploying combat and combat support personnel. Yet as the US begins its military transformation and fights rapid, short-duration, high-intensity conflicts, the tandem partnership between aeromedical evacuation and the en route system must evolve to handle faster-paced requirements for moving patients both intra- and inter-theater. Examining the organizational structures, missions and governing doctrines of both systems, one finds that there is little interface between the two, and operational success is predicated largely on innovation rather than design. In future operations, innovation may not be enough to guarantee success. As a result, this author recommends an interface framework to better educate the two sides of each other's respective missions, to train together to more fully understand the synergies between the two functions, and to set the stage for better communication in the crunch to ultimately save lives.

Chapter 1

Introduction

Pay every attention to the sick and wounded. Sacrifice your baggage, everything for them. Let the wagons be devoted to their use, and if necessary your own saddles.

—Napoleon I

As the lighter, leaner US military forces deploy to defend our nation's freedom, seamless interface across functions is more critical than ever. Historically, the Air Force Aeromedical Evacuation (AE) system has been instrumental in the lifesaving transport of thousands of America's soldiers, sailors, airmen and Marines in every contingency the US has been engaged in since World War I. As an example, during Desert Shield/Storm, the AE mission involved the largest deployed AE force in history, transporting over 12,000 patients on 671 AE flights with no in-flight deaths—a complete success.¹ In addition, in peacetime and in war, AE has transported thousands of family members who required medical care beyond that available in their local communities.

Despite this success, a 1998 internal review of AE posture revealed a number of critical issues that have significant potential to affect future AE operations. These included the Air Force's evolution into the expeditionary aerospace force (EAF) concept and air expeditionary force (AEF) structure; implementation of TRICARE (insurance for health care in the local area not available on military bases); evolving doctrine; changing patient movement requirements; and the impending retirement of the core strategic

aircraft, the C-141 (currently performs the majority of peacetime intertheater missions) as well as the dedicated intratheater AE platform, the C-9. These challenges are driven by a fundamental change in modern conflict—rapid, short-duration, high-intensity combat has generated casualties with very little lead-time. As a result, there's no time to set up contingency hospitals, and critically ill patients are frequently evacuated long distances to reach comprehensive medical care. This translates to the movement of “stabilized” (rather than fully stable) patients, who often require intensive care during evacuation.² The identification of these issues was the impetus for a re-engineering of AE that has subsequently changed, for the better, how future casualties will be transported worldwide.

A different but just as crucial force enabler of military airlift that enhances global reach is the en route system (ERS). This was evident during Desert Shield/Storm, where “ninety percent of the strategic airlift missions were staged through four en route European bases.”³ Furthermore, Desert Shield/Storm revealed the need for en route stations for crew stages, maintenance, refueling and flow control of aircraft while also highlighting a need for more ground/materiel handling equipment and an in-theater recovery base.⁴ Today's air mobility aircraft travel farther and are more dependable, but they still require fuel and maintenance, plus crews need lodging, food and technical assistance. Yet, there's a finite gap in the functions the ERS provides—there's little consideration or capabilities to interface with AE.

Within the AEF structure, AE has already begun using opportune, non-traditional AE airframes to evacuate casualties, taking advantage of platforms that stop at en route bases. The Director of the AE cell at the Tanker Airlift Control Center (TACC) identified a lack of interface between the ERS personnel and AE crews as an issue that potentially impacts

patients who transit ERS bases.

The analysis will first assess the status of AE to include its place in the air expeditionary force (AEF) structure, its evolving doctrine, the changing patient movement requirements, and the use of opportune aircraft to replace the C-141 and the C-9. Next, it will assess the current state of the ERS. The focus of this paper is to propose a framework of education, communication, and training to improve interface between ERS and AE. Additionally, to improve the integration of these two missions, this paper proposes the permanent addition of a liaison officer to AE crews as well as at each en route base.

Notes

¹ Brig Gen Bruce Green, "Challenges of Aeromedical Evacuation in the Post-Cold-War Era," *Airpower Journal*, Winter 2001, n.p./on-line, Internet, 6 December 2001, available from www.airpower.maxwell.af.mil/airchronicles/apj/apj01/win01/green.html

² Ibid.

³ Danita Hunter, "En route system has come along way" Air Force News, 1 June 2000, available from www.af.mil/news/Jun2000/n20000601_000839.html

⁴ Ibid.

Chapter 2

The Evolution of Aeromedical Evacuation

The Air Force's AE system has a unique heritage that spans 80 years and is a significant piece of our nation's mobility resources. A brief history of AE will set the stage for the current re-engineering and its transformation in the future. In order to support our war-fighting expeditionary forces and our AE mission in peacetime and war, aerospace medical professionals are adopting a strategy of mainstreaming AE and employing a full spectrum of airlift options.

The concept of moving the wounded by air dates back to the World War I era, at about the same time as the advent of fixed-wing aircraft. In 1910, shortly after the Wright Brothers successfully flew their first airplane, two US Army medical officers, Captain George H. R. Gosman and Lieutenant A. L. Rhodes, designed and flew an airplane built to transport patients.¹ Even though their test flight only flew a short distance before crashing, it highlighted initial interest in developing a new means of moving patients. Although the United States began using airplanes for evacuating the injured from the battlefield during World War I, difficulties quickly surfaced because the planes weren't designed for patient airlift. Specifically, the fuselages were too small to accommodate stretchers and the open cockpits exposed patients to environmental elements. As a result, the US Army Medical Corps primarily used airplanes to transport

flight surgeons to airplane accident sites to assist in the ground transportation of casualties.² In 1918, realizing the need to transport the wounded by air, Maj Nelson E. Driver and Capt William C. Ocker converted a JN-4 Jenny biplane into an airplane ambulance.³ Not only did this allow the US Army to transport patients away from the battlefield for the first time, it paved the way for further development of air evacuation.

As AE evolved, it became clear that specially trained personnel were needed to optimize medical care during air transport. In 1941, the first Surgeon of the Army Air Forces (AAF), Lieutenant Colonel David N. Grant, advocated AE as a way to “lighten and speed the task” of casualty transportation. Shortly thereafter in 1942, the first Medical Air Ambulance Squadron was established.⁴ During World War II, the need to transport large numbers of casualties back from distant theaters became apparent, and since designated air-evacuation aircraft didn’t exist, the AAF made it their policy to use transport planes for air-evacuation flights as their secondary mission. By January 1942, Army Air Force C-47 aircraft transported more than 10,000 casualties from Burma, New Guinea and Guadalcanal. As a result, since there weren’t enough physicians to be on every AE flight, Grant proposed establishment of a flight nurse corps. Then in February 1943, the first class of flight nurses graduated from Bowman Field, Kentucky, after a four-week course that included aeromedical physiology, aircraft loading procedures and survival skills.⁵ This specialized training was the beginning of trained medics providing in-flight care—the catalyst for the current AE system.

The emerging importance of AE is reflected in the sheer number of patients transported during WWII. At its peak, the AAF evacuated the sick and wounded at a rate of almost 100,000 per month. A one-day record of 4,704 AE patients evacuated was set

in 1945.⁶ Consequently, then-General Dwight D. Eisenhower said, “We evacuated almost all patients in every one of our forward hospitals by air, and it has unquestionably saved hundreds of lives—thousands of lives.” General Eisenhower placed AE in a class with sulfa drugs, penicillin and whole blood as a primary factor in cutting the fatality rate of battle casualties. Interestingly enough, by 1943, as AE crews became more experienced, the risk of death during AE transport dropped to six patients per 100,000. Furthermore, by the end of the war, the risk had decreased to one and one-half patients per 100,000.⁷ These facts hallmarked AE as one of the most important medical advances in decreasing the mortality rate associated with warfare.

The establishment of the US Air Force in 1947 forever changed the face of the US military AE system. This is primarily because in 1949, the USAF was given the official role of providing AE for the entire US military, thereby assuring AE’s permanent place as a national mobility asset. Along with the establishment of the USAF, the National Security Act also prescribed the consolidation of similar military service functions. This led to the consolidation of the Air Transport Command and the Naval Air Transport Service into the Military Air Transport Service (MATS). MATS assumed the responsibility for the transportation of personnel (including the evacuation of the sick and wounded), material, mail, strategic materials and other cargoes. As an example, MATS used the C-47 and C-54 aircraft for CONUS AE, transporting 12,369 patients from June through December 1948. Additionally, during that same timeframe, 5,151 patients were transported from OCONUS locations to the CONUS on the C-121.⁸ Further discussion of the link between MATS, AE and the ERS is addressed later in this paper.

There's little doubt that WWII highlighted the need and value of AE, but the Korean War substantiated AE as the preferred method of moving US casualties. Although bad weather, mountainous terrain and enemy fire challenged the safety and security of AE, the USAF's rescue helicopters still managed to evacuate the bulk of the war's casualties. Illustrating this, during the course of the war, MATS used C-46, C-47, C-54 and C-124 aircraft to transport an astounding 137,950 patients between overseas stations and from OCONUS to the CONUS. Additionally, MATS provided for the movement of 215,402 patients within CONUS.⁹ These figures reflect countless American lives that were saved through the AE system and by the dedication and efforts of its specially qualified crews.

The addition of modernized aircraft better equipped for AE improved in-flight medical care during the Vietnam War. More specifically, rapid evacuation from the battlefields via helicopters was followed by jet transports on new aircraft platforms (C-141, C-130 and the C-9), that were equipped with electrical and oxygen systems which accommodated specialized AE equipment (e.g., iron lung respirator, artificial kidney machine and the orthopedic bed). Additionally, these pressurized aircraft with specifically designed interiors for AE reduced the negative effects of altitude on casualties and medical crews while ensuring more rapid transport to definitive medical care either in the Philippines, Japan or the US. These platforms, designed in part for AE, became the mainstays of today's AE system.

More recently, the vital role of AE, its capability and success were also evident in Operation JUST CAUSE. During the short, violent conflict to oust Panamanian dictator, Manuel Noriega, 276 American soldiers, sailors, airmen and Marines were wounded. AE crews evacuated a total of 257 casualties (192 were evacuated in the first 27 hours of the

operation) from the joint casualty collection point to military hospitals in the US. Overall efforts resulted in a 99.3 percent survivability rate.¹⁰ The successful employment of AE assets in Panama undoubtedly saved many American lives.

Aeromedical Evacuation continued its success story during the Gulf War. Since USCENTCOM predicted as many as 15,000 Americans would be wounded in the early stages of Operation DESERT STORM, an extensive multi-service, multi-theater evacuation chain was set up. As previously mentioned, the AE mission was made up of the largest deployed AE force in history; the AE system evacuated 12,632 patients from August 1990 to March 1991, resulting in no in-flight deaths. In contrast to other contingencies, AE success in the Gulf was partially related to the lesser severity of injuries; the majority of injuries were disease and non-battle types of injuries.

Even today, AE is an integral part of our nation's mobility resources. As part of the homeland defense contingency plan, USAF AE assets were pre-positioned on standby, ready to evacuate casualties from the Pentagon and New York sites, as required, after the terrorist attacks on September 11, 2001. Furthermore, the AE system has once again demonstrated its vital capability while deployed in support of Operation ENDURING FREEDOM. Thus far, from October through December 2001, a total of 91 AE missions have transported 244 casualties.¹¹

Notes

¹ *Annex A: A Brief History of Aeromedical Evacuation*, Aeromedical Evacuation Tiger Team Final Report (U), AMC/Medical Readiness and Aeromedical Evacuation Division (SGX) and AMC/Plans and Programs Studies and Analysis Flight (XPY), September 2000), 252.

² Green, 1.

³ Ibid.

⁴ Aeromedical Evacuation Tiger Team Final Report, 254.

⁵ Ibid., 255.

Notes

⁶ Ibid.

⁷ Green, 3.

⁸ Ibid.

⁹ Aeromedical Tiger Team Final Report, 257

¹⁰ Ibid. 259

¹¹ History, Headquarters Air Mobility Command, February 2002. (U) 1.

Chapter 3

Aeromedical Evacuation Mission

The highly lethal potential of today's battlefield, the reduced medical footprint and the "evacuate and replace" philosophy have made the USAF AE mission even more critical than in the past. In fact, the end of the Cold War and the associated military downsizing necessitated a smaller forward medical presence. OCONUS medical treatment facilities have reduced by two-thirds in the USAF alone.¹ This highlights AE's capability to help conserve the nation's fighting strength and reinforces its key role in US national strategy. Additionally, within the AEF structure, AE will deploy in wartime as they exercise in peacetime—if an AEW is established, AE forces will augment the expeditionary medical system (EMEDS) and will be aligned under the expeditionary operations group.

As such, the mission of the AE system is to rapidly transport casualties (ill or wounded patients), via fixed-wing aircraft under the supervision of specially qualified aeromedical evacuation crewmembers (AECMs). During wartime, AE's role is to move patients from forward airfields in the combat zone to definitive care locations within the combat zone. If necessary, casualties are then transported from the combat zone to more capable medical care facilities either within the communications zone (COMMZ) intratheater or from the COMMZ to CONUS (intertheater).² Therefore, AE operates as

far forward as fixed-wing aircraft are able to conduct air/land operations. Consequently, AE can significantly improve casualty recovery rates by providing movement capability while ensuring appropriate en route medical care is available to patients.

AE Organization and Responsibility

Per joint doctrine, command and control functions exercised over AE missions are consistent with all other air mobility missions and are handled in accordance with C2 structures described in Joint Publication 3-17, *Joint Tactics, Techniques and Procedures for Air Mobility Operations*. Furthermore, patient evacuation from point of injury to initial treatment at a health care facility is a Service component responsibility. This means that the component staff coordinates patient movement within the area of responsibility (AOR) through a joint patient movement requirements center (PMRC), normally located in the joint air operations center (JAOC). The PMRCs, either at the global or theater level, are the single agent responsible for patient movement planning, management and in-transit visibility (ITV) or tracking status of evacuation patients. Additionally, PMRCs have the authority to ensure lift and bed requirements are communicated to supporting agencies.³ Typically, intratheater evacuation of patients refers to movement between points within the theater, while intertheater refers to evacuation of patients between the originating theater and locations outside the theater.⁴ Successful AE missions involve the coordinated use of both intratheater and intertheater evacuation assets.

Similar to other mobility assets, the United States Transportation Command (USTRANSCOM) provides a single point of contact for global patient movement policy while the Tanker Airlift Control Center (TACC) is the Air Mobility Command (AMC),

unit responsible for tasking and controlling operational missions in support of USTRANSCOM's worldwide mission.⁵ The Air Mobility Operations Control Center (AMOCC) is another important facet of the patient movement system. Since the AMOCC is the theater focal point for intratheater air mobility operations, it provides centralized planning, scheduling, C2 and coordination for assigned and attached intratheater mobility assets within a specific AOR. The AMOCC's functions are key to the integration of intratheater and intertheater air mobility operations. Lastly, as the source of AE operational expertise and execution within the AMOCC, the AE cell provides the critical link between C2, operations and medical direction through planning, tasking, scheduling and monitoring of AE assets, while coordinating operations with the PMRC.⁶

At the squadron level, an Aeromedical Evacuation Squadron (AES) is composed of operational medical elements with interrelated functions. These include: AECMs, aeromedical evacuation liaison teams (AELTs), a command and control element known as the aeromedical evacuation control center (AECC), the mobile aeromedical staging facility (MASF) and communications, logistics and support components. Each AE crew is made up of specially qualified personnel: the two flight nurses (FN) are licensed, registered nurses who at a minimum are certified in Advanced Cardiac Life Support and Basic Life Support (BLS), and the three aeromedical evacuation technicians' (AETs) clinical training is in accordance with their Career Field Education and Training Plan (CFETP). Additionally, all AETs are certified as both emergency medical technicians and BLS providers.⁷ The AELT interfaces with the user Service providing the operational, clinical and communications links necessary to prepare patients for flight and

initiate fixed-wing evacuation of casualties. The six members of the AELT include two Medical Service Corps (MSC) Officers who coordinate and oversee AE operations, an FN who provides clinical and patient preparation support, and three communications specialists who operate the team's high-frequency radio systems that provide the direct channel between the requesting unit and the AECC.⁸ The AECC is a sub-element of the air operations center (AOC), that coordinates airlift execution in-theater. As such, the AECC's role includes transmitting mission data and other pertinent data back to the AELT as well as to other elements in the AE system.

Currently, the USAF has 31 AE squadrons: 4 active duty, 17 AFRC and 10 ANG. The Air Reserve Component, with its 27 squadrons comprises 87 percent of the total AE force structure. The 10 ANG squadrons include one C-141 and nine C-130 units; the 17 AFRC squadrons include one C-9, seven C-141 and nine C-130 units. Two of the four active duty squadrons are in CONUS, (including one C-130 and one C-9 unit) with an additional C-9 unit in Europe and the fourth unit, also a C-9 unit is located in the Pacific. Furthermore, two of the active duty squadrons are now assigned to AEWs, and all units will eventually be assigned to one of the 10 air expeditionary forces (AEF).⁹

Aside from the TACC, PMRCs, AMOCC, AE cell and AES, the USAF accomplishes the AE mission through several other organizations. Specifically, this includes 66 aeromedical evacuation staging squadrons (ASTS) and 25 mobile aeromedical staging facilities (MASF) that provide a link between the medical treatment facility and the AE system.¹⁰ The role of both assets is to administratively and physically prepare patients in a holding area prior to AE transportation, although the MASF is generally employed in conjunction with a major theater war (MTW). The nine critical

care air transport teams (CCATT), located at USAF major military medical centers, represent another important adjunct to AE. CCATTs are four member teams consisting of an intensive care or emergency room physician, two critical care nurses and a respiratory care technician. Their role is to augment the AE system by providing a critical care capability in-flight during both peacetime and in war.

In order to accomplish its mission, the AE system relies on airframe availability and a variety of aircraft. The types of airlift include: dedicated, which refers to airlift assets solely apportioned to patient movement; designated, which refers to airlift assets identified to support the patient movement mission on an as needed basis; and opportune airlift which refers to assets obtained through retrograde mission tasking or en route diversion and mission reprioritization.¹¹ Additionally, commercial airlift refers to assets from commercial agencies, usually air ambulance companies or commercial airlines. Commercial platforms only operate in non-hostile and non-contaminated environments. The last type of airlift is the Civil Reserve Air Fleet (CRAF). These are identified airlift platforms, when ordered for use by the President of the United States, which are provided from commercial airlines and are specifically used for patient/casualty movement. More specifically, these Boeing 767s are specially equipped with kits containing AE equipment used to convert commercial passenger aircraft into air ambulances.

AE platforms support patient movement either through dedicated, designated, or opportune types of airlift. The C-9 Nightingale is the only USAF aircraft specifically dedicated to the AE mission. Therefore, the C-9 is the primary CONUS and intratheater AE aircraft during peacetime; they augment the C-130 during contingencies and in war. Subsequently, non-dedicated airlift assets contribute to the success of the AE role during

wartime. Currently, the C-130 is the primary tactical intratheater AE platform employed during contingencies and war. At present, due to their long-range flight capability, the C-141 and C-17 platforms are commonly used solely for intertheater airlift, moving patients from OCONUS back to the US. Other aircraft used to support the AE mission include the C-21, KC-135 and C-5.¹²

Within the AE system and the AEF structure, timely patient evacuation plays an important role in the design of the patient treatment sequence. Presently, the EMEDS sets up the initial medical capability using an incremental building block approach based on the overall size and scope of the contingency. As part of AEF, EMEDS are the tailorable, modular, medical assets that are capable of different levels of treatment (to include surgical requirements) and limited holding capacity. Equipment packages are designed to meet highly mobile and austere conditions.¹³ This tailoring improves the capability to support the entire spectrum of military operations. As previously mentioned, AE assets provide a rapid, flexible and mobile response to the movement of patients. AE supports EMEDS by deploying its assets which in turn, facilitates moving stabilized patients from forward landing zones or established operating bases.

Notes

¹ History, Air Mobility Command, CY 1996, 9

² Air Force Tactics, Tools and Procedures 3-42.5, *Aeromedical Evacuation Tactical Doctrine*, 19 July 2001, 5

³ Ibid.

⁴ Joint Publication 4-02.2 Tactics, Tools and Procedures, *Patient Movement Operations*, 30 December 1996, vii

⁵ AFTTP 3-42.5, 11

⁶ Ibid, 12

⁷ Ibid, 45

Notes

⁸ Capt Guy S. Strawder and Capt Kevin F. Riley, "Joint Casualty Evacuation Operations in the Combat Zone," *Army Logistician*, September-October 1995, 31.

⁹ Air Force Tiger Team report, 20

¹⁰ Ibid, 23

¹¹ Ibid, 21

¹² Ibid, 21

¹³ Ibid, 22

Chapter 4

Levels of Care/Patient Evacuation Flow

In joint operations, the health service support (HSS) patient movement mission is designed to minimize the effects of wounds, injuries and disease by the rapid evacuation of ill and injured personnel. In essence, in an attempt to save life, limb and eyesight, patients are transported through various modes between five levels of care extending from action taken at the point of injury, wound or illness through evacuation from a theater for treatment at a CONUS hospital.¹ In general, patient movement forward of level three is a Service responsibility, but if operationally directed, AE may be tasked to go as far forward as there is a suitable airstrip.

Level 1 (L1) **First Responder** care is rendered at the unit level to include self-aid, buddy aid combat lifesaver skills, examination and emergency lifesaving measures such as airway maintenance, control of bleeding, prevention and control of shock and prevention of further injury. Treatment includes restoration of the airway by invasive procedure, use of antibiotics and application of splints and bandages. Elements of medical care and management available are aimed at returning patients to duty or evacuation to a higher level of care.²

Level 2 (L2) **Casualty Collection and Forward Resuscitative Surgery** care includes at a minimum, basic resuscitation and stabilization, advanced trauma

management, emergency medical procedures, limited surgical capability, basic laboratory, pharmacy and temporary holding facilities. This translates to applying emergency procedures to prevent death, loss of limb or loss of body function. At this level of care, patients are either returned to duty or are stabilized for evacuation to a medical treatment facility (MTF) capable of providing a higher level of care.³

Level 3 (L3) **Theater Hospital** care requires clinical capabilities normally found in an MTF located in a lower-level threat environment. The facility is staffed and equipped to provide resuscitation, initial wound surgery, and post-operative treatment. This level of care may be the first step toward restoration of functional health and doesn't usually contain the crisis aspects of initial resuscitative care.⁴

Level 4 (L4) **Mature Theater Hospital** care provides the surgical capabilities found at L3 as well as rehabilitative therapy for those that can return to duty. This level of care may only be available in mature theaters.⁵

Level 5 (L5) **Definitive Care** is convalescent, restorative and rehabilitative, and is usually provided by CONUS-based military, Department of Veterans Affairs, and civilian hospitals. This level may include a period of minimal care and increasing physical activity necessary to restore patients to functional health and allow them to return to duty and/or useful and productive life.⁶

Once patients are identified as requiring a higher level of definitive care, the next step in the sequence is assigning a patient movement priority. Patient movement priorities for AE missions are dependent on the individual patient clinical situation and the MTF limitations for medical care. Therefore, the process of patient categorization or prioritization is the planning factor that typically determines how quickly a patient will be

evacuated within the AE system. This categorization is determined by the physician at the originating medical facility (either wartime forward medical facility or peacetime medical treatment center), and may be upgraded or downgraded at each succeeding level of care. The categories of precedence are: urgent, priority and routine. Patients in the urgent category require immediate, emergency evacuation to save life, limb, or eyesight or to prevent serious complications of injury or existing medical conditions. Patients in the priority category require prompt medical care not locally available. This precedence is used when the medical condition could deteriorate and the patient cannot wait for routine evacuation; therefore, priority patients are moved as soon as possible, usually within 24 hours. The routine category of patients requires medical evacuation, but their condition is not expected to deteriorate significantly. As such, routine patients are normally moved within 72 hours.⁷

In addition to prioritizing a patient's necessity for AE, another key piece of planning and preparing patients for a mission requires consideration of the physiological stresses of flight. Patients in the AE environment are more susceptible to the physiological stresses encountered at altitude. The temperature, pressure, volume and relative mass of gas influence the body's response to barometric pressure changes as the aircraft changes altitude. More specifically, on ascent, gas expands and on descent, gas contracts. Therefore, when trapped or partially trapped gases within the body (GI tract, skull, lungs, middle ear, sinuses and teeth) expand, the increased pressure can cause pain or physical problems. In these instances, an altitude restriction is required. Additionally, as altitude increases, the partial pressure of oxygen decreases, thus decreasing the actual available oxygen to the body tissues.⁸ And so, a patient with compromised respiratory function

will likely require supplemental oxygen in flight. An altitude restriction isn't necessarily prudent in this case because flying at lower altitudes only prolongs the flight and potential exposure to other stresses of flight. Another consideration is thermal changes; the temperature of ambient air decreases at altitude, making in-flight cabin temperature cooler. This in turn increases the body's oxygen requirements. Additionally, mechanical energy from the vibration of the aircraft is transferred to body tissues, which indirectly increases muscle activity. In turn, vibration can cause increased pain for the patient.⁹ Fatigue is considered to be the cumulative effect of all stresses of flight—the predisposing physical condition or injury of the patient contributes to the degree each individual is affected in flight. Appropriate planning and management of the physiologic stresses of flight of evacuation patients can decrease the incidence of complications of their illness—it therefore becomes imperative to communicate and coordinate special needs to the pilot, front-end crew and the ground crew at en route stops and final destination locations.

Notes

¹ Joint Publication 4-02.2 Tactics, Tools and Procedures, I-1

² Ibid

³ AFTTP, 19

⁴ Ibid, 19-20

⁵ Ibid

⁶ Joint Pub 4-02.2, I-3

⁷ AFTTP, 20-21

⁸ Air Mobility Command Pamphlet 11-303, *Flying Operations*, Access to the Aeromedical Evacuation System, 3 November 2000, 5-6

⁹ Ibid

Chapter 5

The Evolution of the En Route System

Joint Deployment/Rapid Distribution...the process of moving multi-Service forces to an operational area coupled with the accelerated delivery of logistics resources through improved transportation and information networks providing the warfighter with vastly improved visibility and accessibility of assets from source of supply to point of need.

—Joint Publication 3-35, *Joint Deployment/Redeployment Doctrine*

How we accomplish core competencies directly affects the USAF's contribution to our national military strategy. Rapid Global Mobility, one of the five core competencies, is key to our operational success—it refers to our ability to rapidly move combat power to a supported CINC's theater, ready for mission execution.¹ Accordingly, overseas bases are increasingly important for strategic mobility because our CONUS-based force relies on airlift's power projection capability. Specifically designed to support both peacetime workloads and wartime requirements, the En Route System (ERS) is a network of bases that support airlift throughout Europe and Southwest Asia. Since 1950, the en route system expanded and contracted according to US security strategies, shifting alliances (e.g., France, Libya, Iran), and resource allocations.² With today's reduced military footprint and increased involvement in worldwide contingencies, the contributions the ERS makes to airlift, and indirectly to AE, are vital to accomplishing Rapid Global Mobility.

The present US military airlift system is the product of more than six decades of operational, organizational and technological development. In the 1930s, the advent of transport aircraft such as the Boeing 247 and the Douglas DC-2 prompted discussion among Army Air Corps leaders about the options and advantages of military airlift. Shortly thereafter, the legacy of the American WWII experience became the value of air mobility. Because of vast distances and the highly mechanized nature of the war, the speed at which our resources could be transported became essential. As a result, extensive military airlift systems came into being. It was well recognized that the demand for air transport services outstripped resources available and that uncoordinated arrangements threatened the war effort. In 1942, General Hap Arnold attempted to bring some order through his pre-war proposal to include airlift forces sufficient to move an Army corps “anywhere in the world in 72 hours” as a permanent part of the military establishment.³ Not surprisingly, the WWII en route structure developed according to the specific demands of the war, and with the postwar reorganization of the military being charged with eliminating duplication, President Truman sought to consolidate military airlift under the newly established Air Force. Accordingly, as previously noted, the Military Airlift Transport Service (MATS) was established in 1948.

By the late 1950s, the Army’s requirement for strategic airlift had grown to include the movement of the combat elements of two infantry divisions weighing 11,000 tons each anywhere in the world in 28 days. Meanwhile, the USAF focused the force structure of its major, long-range airlift command, MATS, on deploying medium-bomber units to overseas bases in the event of nuclear war.⁴ From the Korean War came the idea that the Air Force ought to develop an aerial port squadron that could perform all

necessary airlift functions. Initially, the Army was responsible for receiving, loading, offloading and manifesting cargo at air terminals/ports. A year later, the Army and Air Force signed a memorandum of understanding that gave the Air Force the responsibility for operating all air terminals, but allowed the Army to establish facilities at the terminals as needed.⁵ As the ERS concept evolved, en route bases became forward supply points, thus enhancing worldwide airlift.

Then in 1966, Military Airlift Command (MAC), which superseded MATS, concentrated on reinforcing NATO in the event of war. This is significant because the NATO requirement to move 259,000 tons of personnel and materiel, including seven divisions and 23 tactical fighter wings from the US to Europe in 10 days, highlights the fundamental definition of the military airlift mission remaining constant for the past 50 years—“Anything-Anywhere-Anytime.”⁶

When Desert Shield/Storm began, MAC drew upon its existing en route bases and added resources as necessary. As in Vietnam, the Air Reserve Component and the commercial carriers augmented the military airlift system extensively. Ninety percent of the strategic airlift missions were staged through four European bases: Torrejon AB, Spain; Rhein-Main AB, Germany; Ramstein AB, Germany; and Zaragoza AB, Spain. The strategic airflow into the area of responsibility averaged about 100 missions per day between August and September 1990.⁷ Several en route lessons learned surfaced from Desert Shield/Storm. Of significance, MAC needed en route stations for staging crews, maintenance, refueling, and flow control; there was a need for more ground handling and material handling equipment as well as more offload bases in the AOR. These lessons learned provided valuable insight to the ERS of today.

Strategic airlift has a significant role as part of the Defense Transportation System (DTS) infrastructure. The DTS consists of common-user military and commercial assets, services and organic systems controlled by DOD. As such, combining the capabilities of transportation assets into an integrated network optimizes the use of airlift.⁸ The CINC of the US Transportation Command (USTRANSCOM), is tasked with providing air, land and sea transportation for the DOD during peacetime and in war. In this capacity, USTRANSCOM is the focal point for the integration of procedures and systems that provide global airlift to meet national security needs. As a transportation component of USTRANSCOM, AMC provides common-user airlift, air refueling and strategic aeromedical evacuation transportation services to deploy, employ, sustain and redeploy US forces globally. Additionally, AMC is the single aerial port manager and operator of aerial ports of embarkation (APOEs) and/ or aerial ports of debarkation (APODs).⁹ Furthermore, as mentioned above, the ERS is a network of bases that support airlift throughout Europe and Southwest Asia that falls under control of AMC's 21st Air Force.

Under the ERS system, major airlift support sites (en route bases) are located from Lajes AB, Azores, to Yokota AB, Japan. Currently, there are nine CONUS ERS bases and 41 OCONUS locations.¹⁰ ERS bases provide personnel and cargo on-load, staging and off-load capabilities at key locations within the air transportation network.¹¹ More specifically, aerial port squadrons are the backbone of the ERS. Basically, an aerial port squadron supports worldwide AMC airlift missions by providing assistance to en route aircraft, personnel and cargo.

The aerial port squadron consists of eight different flights with a wide range of duties and responsibilities. The **Air Terminal Operations Flight** is responsible for aircraft

load planning, airlift capability forecasting, terminal information control, lost/damaged cargo investigations, ramp coordination duties, computer operations and systems administration. The **Air Freight Flight** on-and off loads cargo from aircraft, processes and provides in-transit cargo storage (including hazardous and other special category cargo), maintains and repairs conveyor systems and provides cooperation for in transit freight. The third flight, **Air Passenger Flight**, determines peacetime passenger eligibility, processes inbound, outbound and in-transit passengers and their baggage, and provides terminal security. The **Combat Readiness and Resources Flight** coordinates squadron mobility requirements including the deployment of unit personnel and equipment, and manages unit resources programs. The **Traffic Management Flight** manages and operates the traffic management system for movement of personal property, freight and passengers (is typically located in the transportation squadron). Where assigned, the **Aerial Delivery Flight** builds and rigs airdrop loads, packs, repairs and dries parachutes, schedules and coordinates load operations, performs air drop inspections, material control and drop zone recovery. Removing and disposing of aircraft waste, delivering in-flight meals, potable water and passenger convenience items, cleaning aircraft interiors and galleys fall under the purview of the **Fleet Services Flight**. Finally, the **Mobility Flight** provides additional manpower and equipment to conduct cargo and passenger aircraft operations at deployed locations; has the capability to operate in austere conditions, provides augmentation to fixed aerial port squadrons or en route Air Mobility Support Squadrons as required.¹²

Although ERS bases are strategically located, when contingency operations require airlift into regions where en route base support is unavailable, the Global Reach Laydown

(GRL) branch of the ERS comes into play. The GRL units are ready made packages (including personnel and equipment), that provide the bare essentials to set up and operate an airlift base that requires minimal existing infrastructure.¹³ As part of the ERS, the GRL does provide flexibility and reliability needed to project airpower throughout the world.

Notes

¹ Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, 1 September 1997, 33

² Betty R. Kennedy, *Air Mobility En Route Structure: the Historical Perspective 1941-1991*, Headquarters Air Mobility Command (Scott AFB, IL: Office of History, 1993), 2

³ Lt Col Robert C. Owen, "The Airlift System," *Airpower Journal*, Fall 1995, 19

⁴ Ibid

⁵ Kennedy, *Air Mobility En Route Structure: the Historical Perspective*, 15

⁶ Owen, "The Airlift System," 18

⁷ Kennedy, *Air Mobility En Route Structure: the Historical Perspective*, 28

⁸ Joint Publication 4-01, *Joint Doctrine for the Defense Transportation System*, 17 June 1997, I-1

⁹ Ibid, II-3

¹⁰ AMC History, 84-85

¹¹ Capt James Hodges, "Improving the En Route System," *The Mobility Forum*, September-October 1996, 17

¹² Air Mobility Command Directive 704, Air Mobility Operations Groups and Squadrons, 5 May 1995, 9

¹³ Hodges, "Improving the En Route System," 17

Chapter 6

Interface Framework for AE and ERS

Aeromedical Evacuation and the En Route System are both key pieces of the military airlift—as such, they have related and significant missions. As we move into the EAF era of lighter and leaner force structures, improving interoperability between functions is more important than ever. In fact, the lives of US airmen, soldiers, sailors and Marines may one day depend on the seamless integration of AE and the ERS. This paper proposes a framework of education, communication and training as a means of optimizing the relationship between the two and ultimately the function of each mission. Furthermore, it proposes the permanent addition of a Medical Service Corps officer to each AE crew and to each ERS base as liaison to improve interface between the missions.

The education part of the framework consists of understanding the mission, its operative elements, command and control, constraints and required training. Education could be in the form of a 3-day course taught as part of each respective schoolhouse curriculum, (AE at Brooks AFB, TX and ERS at Keesler AFB, MS) where mid-level NCOs and mid-level officers could learn the didactics of each specialty. Course slots would be open to all MAJCOMs, with priority given to AMC since both missions, directly related to airlift, belong to AMC. Another way to accomplish the education of AE and ERS personnel is to add a block of instruction to the technical training courses of

each airlift function. Additionally, distance learning programs could be developed and added as another means of education for AE and ERS personnel.

Yet another potentially less expensive venue for educating both AE and ERS personnel is to have a team from each functional specialty travel to various installations, as part of an initial “roadshow” education campaign. This option might be the most viable since more personnel could attend the education session without incurring TDY expenses and valuable time away from the mission. Continuing or repeat education wouldn’t be necessary because of the overlap with combined training, the second piece of the interface framework.

Education and training are usually closely associated, but as a means of highlighting the importance to AE/ERS interface, this framework proposes initial education of personnel, followed by the incorporation of combined annual training at the Joint Readiness Training Center (JRTC) and BLUE FLAG (part of Air Combat Command) exercises. At JRTC, incorporating ERS personnel into a scenario would give them first-hand knowledge of the intricacies of aeromedical evacuation, including the mission, capabilities, stresses of flight, patient preparation/pre-flight considerations, patient movement precedence, AE equipment, litter loading/off-loading procedures and configuration. The benefits of ERS personnel experiencing the AE system in a training scenario are two-fold. First, it allows a better appreciation for the mission on both sides and second, it would likely increase interface at ERS bases, and in turn decrease the possibility of patient complications. For example, if an “urgent” patient AE mission lands to refuel, ERS personnel may be more diligent in coordinating the ground time because they would understand that “urgent” means to save life, limb or eyesight.

Likewise, incorporating AE personnel in a training scenario with ERS personnel at BLUE FLAG would give them an appreciation for conducting contingency operations and the deployment of mobility forces. Participation in joint command mobility exercises could alleviate a portion of disconnects between commands. Increasing AE personnel's understanding of the details of deploying mobility assets would likely improve interface at ERS bases. For example, when a routine AE mission was diverted to pick up cargo, AECMs could better communicate and coordinate potential on-load/off-load procedures with the ERS ground crew, thus decreasing potential hazardous safety conditions inherent with using heavy machinery.

The third element of this interface framework, well-established communication, can enhance any operation. More specifically, strengthening dialogue between the AE and ERS personnel through educational courses, training scenarios or through video teleconferencing facilitates information exchange which may highlight potential issues and solutions to accomplishing the mission. Additionally, by attending annual conferences (ERS-Airlift Tanker Association; AE-Aerospace Military Surgeon of US), ERS and AE senior staff could strengthen their working and training relationships.

As a final recommendation, locating AE assets at ERS bases and adding a member to AE crews would facilitate the entire interface framework. Specifically, the permanent addition of an MSC officer to the AE crew is beneficial because it adds a liaison to communicate and coordinate specific AE patient considerations and work issues or problems with ERS ground crew personnel while allowing the AECMs to give uninterrupted patient care. Locating the MSC or other AECM members at ERS bases would facilitate a cross flow of education, communication and training opportunities.

Chapter 7

Conclusion

In order to guarantee our nation's freedom, the US military forces will most likely be called upon to travel around the world and fight future wars against our adversaries. Unfortunately, casualties are an unavoidable consequence of war. Therefore, airlift will forever be an integral part of the interface between the transportation of troops, equipment and supplies to the battlespace and the evacuation of casualties to definitive medical care. Historically, the AE system has been instrumental in saving the lives of hundreds of thousands of American soldiers, sailors, airmen and Marines. Improving the seamless interface between the ERS and AE functions can only enhance the synergistic effect of our priceless national mobility assets in the future.

Accordingly, by adopting the interface framework this paper proposes, the ERS and AE functions will have a better working relationship, thus enhancing the overall effectiveness of both missions. Additionally, the addition of a MSC officer to the AE crew and AE assets at ERS bases serves as a key link to the education, communication and training opportunities for both functions. This serves to continue to guarantee the rapid evacuation of the casualties of war, only in a more seamless way.

Glossary

AAF	Army Air Forces
AB	Air Base
AE	Aeromedical Evacuation
AECC	Aeromedical Evacuation Control Center
AECM	Aeromedical Evacuation Crewmember
AEF	Aerospace Expeditionary Force
AELT	Aeromedical Evacuation Liaison Team
AES	Aeromedical Evacuation Squadron
AET	Aeromedical Evacuation Technician
AEW	Aerospace Expeditionary Wing
AFRC	Air Force Reserve Command
AMC	Air Mobility Command
AMOCC	Air Mobility Operations Control Center
ANG	Air National Guard
AOR	Area of Responsibility
APOD	Aerial Port of Debarkation
APOE	Aerial Point of Embarkation
ASTS	Aeromedical Evacuation Staging Squadron
BLS	Basic Life Support
C2	Command and Control
CCATT	Critical Care Air Transport Team
CFETP	Career Field Education and Training Plan
CINC	Commander-in-Chief
COMMZ	Communications Zone
CONUS	Continental United States
CRAF	Civil Reserve Air Fleet
DOD	Department of Defense
DTS	Defense Transportation System
EAF	Expeditionary Aerospace Force
EMEDS	Expeditionary Medical System
ERS	En Route System
FN	Flight Nurse

GI	Gastrointestinal
GRL	Global Reach Laydown
HSS	Health Services Support
ITV	In-Transit Visibility
JAOC	Joint Air Operations Center
JRTC	Joint Readiness Training Center
MAJCOM	Major Command
MASF	Mobile Aeromedical Staging Facility
MATS	Military Airlift Transport System
MSC	Medical Service Corps
MTF	Medical Treatment Facility
MTW	Major Theater War
NATO	North Atlantic Treaty Organization
OCONUS	Outside the Continental United States
PMRC	Patient Movement Requirements Center/Cell
TACC	Tanker Airlift Control Center
TDY	Temporary Duty
TRICARE	Military Health Insurance System
TTP	Tactics, Techniques and Procedures
US	United States
USAF	United States Air Force
USCENTCOM	United States Central Command
USTRANSCOM	United States Transportation Command
WW I	World War I
WW II	World War II

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