

# United States Air Force Aeromedical Evacuation – A Critical Disaster Response Resource

Bruce R. Guerdan, MD, MPH

## Abstract

The use of United States Air Force (USAF) aircraft and personnel to move wartime casualties is well established. This asset is also an integral part of the National Disaster Medical System (NDMS). The Aeromedical Evacuation (A/E) system, a part of Air Mobility Command, is a highly disciplined function capable of transporting thousands of civilian casualties at all levels of criticality. At the time of a large local or regional disaster, civilian medical treatment facilities, if still functional, would be overwhelmed. A core function of the NDMS would be the relocation of civilians currently hospitalized or in need of hospitalization to facilities outside the disaster area. This would be primarily accomplished by the USAF A/E system.

## Introduction

The United States Air Force (USAF) currently lists six unique core capabilities.<sup>1</sup> One of these, Agile Combat Support, includes medical care. The United States Air Force, the United States Army, and the United States Navy provide medical care at all treatment levels. This includes medical evacuation (Medevac) to the initial medical treatment facility. Aeromedical Evacuation (A/E) is a mission solely assigned to the Air Force. In addition to its combat support role, the USAF A/E system is an integral part of the NDMS and is the main point where military and civilian assets interface in the time of regional or national disaster. A core tenet of the NDMS is the ability to move large numbers of casualties to medical facilities outside the affected area. Federal doctrine states that the Department of Defense (DOD) is the single manager for the movement of NDMS in-patients who require in-route care.<sup>2</sup>

## Definitions

The below terms are routinely confused and, therefore, delineated below:

### Case-Evac

The evacuation of casualties outside the organized medical transport system.

### Medevac

Ground or rotary wing evacuation, typically pre-hospital. Medical care at some level is included.

### Air-Evac

The USAF A/E system of fixed wing aircraft and personnel functioning at a hospital level of medical care.

## Aircraft

Despite being involved in two separate conflicts thousands of miles from home, the Air Force has no dedicated Aeromedical aircraft.<sup>3</sup> When the C-9 Nightingale was retired in 2005, the USAF made a conscious decision to abandon the concept of dedicated medical aircraft. Today, through the concept of dual-use aircraft, wounded are evacuated to a higher level of care on the same airframes that may have just delivered dozens of pallets of supplies or fresh warriors to the fight. Medical personnel convert the aircraft into a hospital-like environment using structural equipment specifically designed to hold litters securely while in flight.<sup>3,5,6,10</sup> While a particular mission might be designated as an “aerovac,” the aircraft is not. Indeed, you

**Figure 1:** Aircraft for A/E Evacuation

| Aircraft | Availability   | Range             | Litters | Ambulatory | O2      | Runway      |
|----------|----------------|-------------------|---------|------------|---------|-------------|
| C-130    | Readily        | Intra-continental | 74      | 0          | PTLOX   | Un-improved |
| C-17     | Readily        | Inter-continental | 36      | 54         | Onboard | Un-improved |
| KC-135   | Readily        | Inter-continental | 15      | 8          | PTLOX   | Improved    |
| 767      | Requires refit | Inter-continental | 87      | 40         | Onboard | Improved    |
| C-141    | Retired        | Inter-continental | 103     | 14         | Onboard | Improved    |

Notes:

- 1 - Additional ambulatory patients can be added when less than the maximum litter spaces are used.
- 2 - CCATT patients may need more space/electricity and decrease the maximum litter spaces available.
- 3 - C-141 is listed as a historical reference.
- 4 - The KC-135 and the 767 are unable to load patients from ground level and require additional equipment to complete this task.

will no longer see the red cross on the tail of any USAF aircraft. Essentially, any USAF non-fighter aircraft can be configured to carry patients. Some are much easier to configure as they were initially designed as a dual-use aircraft. Others provide a more inefficient configuration but nevertheless are sometimes the best option.

Since the Vietnam War, the C-130 Hercules is the typical intra-theater aero-vac airframe. The Hercules can be configured to carry a maximum of 74 litter patients and, due to its availability, would be the likely airframe used initially in a disaster response.<sup>5</sup> The C-17 Globemaster is the typical aero-vac airframe for inter-theater transportation. It can carry 36 litters and 54 ambulatory patients.<sup>6</sup> Both the C-130 and the C-17 are capable of landing on unimproved runways. Typically the Hercules is used in tactical (combat) environments. The now-retired C-141 Starlifter was the workhorse of inter-theater aerovac. This aircraft was used from 1963 until 2006 and could carry 103 litter patients.<sup>4</sup> Recently, KC-135 Strato-tankers have been modified to more easily accept A/E patients. Most of the A/E missions from Afghanistan to Germany are on these aircraft. These aircraft have a much longer range, are able to cruise at faster speeds, are more commonly available, and do not impact the highly tasked C-17 schedule. Some of the negatives with this aircraft are the low number of litter patients they can hold,<sup>13</sup> the difficulty loading/unloading litter patients, and an “either too hot or too cold” patient environment. Of these aircraft, only the C-17 has on-board patient oxygen. Portable liquid oxygen (PTLOX) is required on the C-130 and the KC-135.

In addition to these military aircraft there is the Civilian Reserve Air Fleet (CRAF). These are commercial airliners which were built specifically as a backup to the USAF fleet. Much of the CRAF are cargo aircraft used to move supplies and equipment. The system also includes an A/E capability. These aircraft are Boeing 767s, which can be converted into Aeromedical airframes. They would be flown by civilian airline pilots and manned with flight attendants who would assist A/E crews. There are currently fifty 767s assigned to the CRAF flying com-

mercially.<sup>7,8</sup> The Air Force maintains approximately forty Air Evacuation Shipsets (AESS). These include all the equipment (and an oxygen subsystem) to transform these aircraft into an A/E configuration. When they are configured, they can carry 87 litter patients and up to 40 ambulatory patients. The process takes approximately 24 hours per aircraft.<sup>7,8</sup> To date CRAF aircraft have not been used in real world A/E missions.

## Aircrew

The personnel assigned to a standard aerovac mission are divided into medical and non-medical components. Typically, there are two pilots. There are one or more loadmasters and on some aircraft a flight engineer. These crew members fly the airplane and make all of the decisions related to flight.<sup>10</sup> The pilot is in ultimate control. Medical personnel are in control of the care of the patients and make all decisions regarding medical care. The medical crew typically consists of two or more flight nurses as well as three or more aeromedical technicians. Mission requirements may require more nurses and technicians. One of the nurses is designated the Mission Commander. Approximately 90% of the aeromedical personnel in the USAF are assigned to the Air National Guard and the Air Force Reserve.<sup>9</sup> School for Flight Nurses (RNs) is 5½ weeks long followed by months of follow-on training before being deemed fully trained. As well, there is constant refresher and upgrade training.<sup>10</sup> Aeromedical technicians are certified Emergency Medical Technicians and require ongoing training as well. Many A/E crew have outside civilian occupations both in and out of the medical arena.

## Critical Care Air Transport

Prior to Desert Storm, aeromedical evacuation (A/E) patients were required to be designated as stable for flight. After Desert Storm there was a significant change in the aeromedical evacuation concept of operations. A/E did not transport critically ill or injured patients.<sup>13</sup> On occasion a Medical Attendant, typically a physician non-crewmember, would accompany a

unique patient and attend to that patient specifically. Critical care equipment was not specifically designed for flight, and A/E crews were not trained to this level. As well, A/E did not have physicians assigned as aircrew.

Critical Care Transport Teams (CCATT) were developed to address this issue. CCAT Teams are composed of a critical care physician, a critical care nurse, and a cardiopulmonary technician (trained in both respiratory therapy and diagnostic cardiology). These teams allowed stabilized but not necessarily stable patients to be moved to a higher level of care. CCATT school is ten days long and is primarily mission-specific versus medically specific. These personnel are considered aircrew and control their patient medically.<sup>12</sup> They are under the control of the A/E Medical Crew Director (Flight Nurse) for mission issues. This is despite rank or level of training.

A/E doctrine defines stable patients as those that do not require advanced airway/ventilatory support, high flow oxygen, cardiac monitoring, pressors, or other cardiovascular agents, while stabilized patients require one or more of these agents or interventions with concurrent in-flight physician management.

### Equipment/Supplies

All medical equipment used by A/E must be cleared for flight on a basis of safety as well as efficacy. Much of the equipment is off-the-shelf civilian medical equipment that is specifically tested and approved for flight. Typically, each patient is transported with three days of medications, supplied by the sending facility, as delays and diversions are possible.

### Support

A/E assets typically have no organic support and require routine support functions such as security, food services, and housing to be provided by the Wing to which they are attached.<sup>10</sup>

### Military Concept of Operations

The organization which manages patient movement is the Global Patient Movement Requirements Center (GPMRC) located at Scott Air Force Base in Illinois.<sup>3</sup> Theater Patient Movement Requirements Centers (TPMRC) are established in a theater of operations and control patient movement on a regional basis. Patients enter the A/E system when they are entered into the United States Transportation Command (TRANSCOM) Regulating and Command & Control Evacuation System (TRAC2ES).<sup>3</sup> This is typically done at the originating medical treatment facility (MTF). Dedicated personnel, an Aeromedical Evacuation Liaison Team (AELT) are sometimes involved. They are cleared for flight by a flight surgeon and are readied for flight at the MTF or transported to a Mobile Aeromedical Staging Facility (MASF) or a Contingency Aeromedical Staging Facility (CASF). These facilities are capable of holding patients for up to seventy-two hours and are located on the flight

line.<sup>11</sup> Intra-theater airlift may move a patient to a higher level of care regionally or to a regional base for transfer to Inter-theater airlift.

### Civilian-Military Interface

In an NDMS response, Disaster Medical Assistance Teams (DMAT) would provide deployed acute (non-surgical) capabilities at or near the disaster. Those requiring in-patient care, if not locally available, would become the responsibility of USAF A/E. USAF A/E assets fill a void for which there is no civilian equivalent. A/E would be used to airlift these patients to accepting facilities outside the affected region.

The civilian portion of this interface is the Disaster Aeromedical Staging Facility (DASF). This unit has a nearly identical function to the military's CASF. This interface has been recognized as a potential weak link in the chain of response. Variance in-patient care protocols, use of non-flight approved equipment, lack of flight surgeon clearance for flight, and atypical medical conditions are all issues that could confound the efficiency of a disaster response. The care of the elderly, disabled, and small children are potential problems as A/E personnel are primarily involved in the care of otherwise healthy military members.

These issues have been recognized and an emphasis has been placed on increasing the level of coordination for a response. To further integrate their capabilities with the DOD, the Department of Health and Human Services (DHHS), the entity which manages DMATs, has now developed Mobile Acute Care (MAC) Strike Teams. The purpose of the fourteen member MAC Strike Teams is to provide a critical care capability at the DASF. The MAC Strike Teams would provide continuity of care with USAF CCATT personnel. Fifteen MAC Strike Teams began receiving training from the USAF CCATT School beginning in 2010.

### Conclusion

Although primarily thought of as a wartime asset, the USAF A/E system is an integral part of the military's Defense Support to Civilian Authorities (DSCA) mission. Disaster response, no matter what the cause, might require a significant volume of patient evacuations. The USAF A/E system is the only entity in the world capable of moving large numbers of complex patients over long distances. The seamless integration of the civilian and military disaster response resources is vital to a successful disaster response. Coordination between DHHS and the USAF is integral to a successful disaster response.

*Bruce R. Guerdan, MD, MPH, board certified in Emergency Medicine, Disaster Medicine, and Family Medicine, is an Emergency Medicine attending physician at UPMC-Northwest in Seneca, PA, and Lower Keys Medical Center in Key West, FL. He serves as the State Air Surgeon for the Florida Air National Guard and is an experienced Critical Care Air Transport (CCATT) physician.*

*Potential Financial Conflicts of Interest: By AJCM® policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article that might create any potential conflict of interest. The author has stated that no such relationships exist.*

## References

1. About the Air Force: Our Mission. [www.airforce.com/learn-about/our-mission/](http://www.airforce.com/learn-about/our-mission/).
2. National Disaster Medical System. <http://fhpr.osd.mil>.
3. Gooch D. Aeromedical Evacuation: Validating Civil Reserve Air Fleet. 2009, pp 1-40.
4. Joint Health Services Operations. [www.usasam.amedd.army/d/Flight%20Provider](http://www.usasam.amedd.army/d/Flight%20Provider).
5. Factsheets: C-130 Hercules. [www.af.mil/information/factsheets/factsheet.asp?fsID=9](http://www.af.mil/information/factsheets/factsheet.asp?fsID=9).
6. Boeing: C-17 Globemaster III-Technical Specifications. [www.boeing.com/defense-space/military/c17/c17spec.htm](http://www.boeing.com/defense-space/military/c17/c17spec.htm).
7. Bolkcom C. Civil Reserve Air Fleet (CRAF) Congressional Research Service, October 18, 2006.
8. Civil Reserve Air Fleet (CRAF) Aeromedical Evacuation Shipset (AESS) Contractor Logistics. [www.fbo.gov/index](http://www.fbo.gov/index).
9. Aeromedical evacuation 'brings them back.' [www.scott.af.mil/news/story.asp?id=123269274](http://www.scott.af.mil/news/story.asp?id=123269274).
10. Air Force Tactics, Techniques, and Procedures 3-42.5. Aeromedical Evacuation. November 1, 2003, pp 1-41.
11. Air Force Instruction 44-165. Administering Aeromedical Staging Facilities. November 6, 2007, pp 1-28.
12. Air Force Tactics, Techniques, and Procedures 3-42.51. Critical Care Air Transport Teams (CCATT). September 7, 2006, pp 1-49.
13. CCATT Concept of Operations. [Airforcemedicine.AFMS.mil/idc/groups/public/documents...ctb\\_151108.pdf](http://airforcemedicine.afms.mil/idc/groups/public/documents...ctb_151108.pdf).