REDUCING AIRCRAFT QUICK-TURN GROUND TIMES IN THE EUROPEAN ENVIRONMENT

GRADUATE RESEARCH PAPER

Karn L. Carlson, Captain, USAF

AFIT/GMO/LAL/99Y-2

DEPARTMENT OF THE AIR FORCE

AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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Presented to the Faculty of the Graduate School of Logistics

And Acquisition Management of the Air Force Institute of

Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Mobility Studies

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1999

Approved for public release, distribution unlimited

Acknowledgments

I would like to express my appreciation to my faculty advisors, Dr. David Vaughan and Major Stephen Swartz, for their guidance and feedback.

I received assistance from numerous people in the completion of this project. If I fail to acknowledge anybody for their assistance, I apologize. Listed in no certain order are those to whom I am indebted:

- Captain Luke Closson and Senior Master Sergeant Thomas Szabo of the 305th Aerial Port Squadron, McGuire Air Force Base, New Jersey.
- Master Sergeant Keith Brown of the 621st Air Mobility Support Group, Ramstein Air Base, Germany.
- Captain Eric Turnbull, Ray Hunt, Senior Master Sergeant Mark Mayo, and Master Sergeant Chris Conway from the Weapons Systems Managers Office, 21st Air Force Logistics Division, McGuire Air Force Base, New Jersey.
- Terrance F. Kerber, Senior Director of Aircraft Maintenance, Continental Airlines, Newark International Airport, Newark, New Jersey.
- Captains Jonathan Elliott and Brad Allen, 633rd Air Mobility Support Squadron, Kadena Air Base, Japan.
- Captains Eric Faison and Rob Reed, 623rd Air Mobility Support Squadron, Ramstein Air Base, Germany.
- Captain Jeri Erginkara, 628th Air Mobility Support Squadron, Incirlik Air Base, Turkey.

- Captain Lisa Houle, 635th Air Mobility Support Squadron, Hickam Air Force Base, Hawaii.
- Major Philip Louden and Captain Mark Leavitt, 627th Air Mobility Support Squadron, Royal Air Force Mildenhall, United Kingdom.
- Captain John Winkler, Detachment 3, 621st Air Mobility Support Group, Aviano Air Base, Italy.

Additionally, I want to thank my children, Bethany and Benjamin, for being the inspiration of my life. Finally, I wish to thank my fiance', Rita Zanin, for everything. Dedicated to my Father, Who gives me strength for life, and life itself.

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Abstract

The Air Force has a limited number of air mobility aircraft and aircrews and these resources are becoming increasingly strained. Added to this, our workload is increasing – we are involved in an ever-increasing number of operations and exercises. Instead of working harder we need to work smarter, by looking for ways to process our aircraft more quickly and efficiently, yet maintain the needed safety standards.

Air Mobility Command is experiencing a significant reduction in the number of mobility aircraft with the retirement of the C-141. If we can process our aircraft more efficiently and quickly, we can ensure more timely and reliable delivery of passengers and cargo. Additionally, we will be able to more effectively utilize limited air mobility assets.

The purpose of this paper is to determine if there are tasks that can be performed concurrently and/or more efficiently. This paper discusses current Air Force guidance and requirements in this area and examines whether current guidance is appropriate and necessary. This study also includes an examination of industry practices to determine if there are any applications we can benchmark. Finally, this researcher provides a summary of findings and recommendations for potential improvements and further research. Several of these findings are based on 'best practices' obtained from operational units.

REDUCING AIRCRAFT QUICK-TURN GROUND TIMES IN THE EUROPEAN ENVIRONMENT

I. Introduction

Background

Air Mobility Command is experiencing a significant reduction in the number of mobility aircraft with the retirement of the C-141. At one time, the C-141 fleet numbered approximately 280 aircraft, but that number is now well below 130 aircraft, with aircraft being retired regularly. All C-141s are scheduled to be retired from the active force by 2003, with Air National Guard and Air Force Reserve Command aircraft being retired by 2006. The C-141 is being replaced by the C-17, which has more pallet positions per aircraft and a significantly higher allowable cabin load, but there will be only 120 C-17 aircraft. This represents an overall capability loss of more than 1,000 pallet positions.

There are other factors affecting the capability of the Air Mobility Command fleet. The reliability of the C-5 fleet has suffered significantly, primarily due to engine problems. The KC-10 and KC-135 aircraft carry cargo, by they are primarily designed for and assigned to air refueling activities. The C-130 is a stalwart cargo aircraft, but it does not have the intercontinental range of the C-17.

Given the significant reduction in aircraft availability and other dwindling resources, combined with an increasing operations tempo, it is necessary that we find more efficient ways to utilize our limited resources.

General Issue

This paper examines ways in which we can more efficiently process our aircraft while they are on the ground to reduce the ground times required – can aircraft processing activities be modified to reduce ground times? If we can reduce the ground time we can utilize the aircraft more effectively and increase cargo and passenger movement. What areas can we explore for possible time savings? This paper will focus primarily on aerial port and aircraft maintenance activities for potential savings. There will be very little, if any, discussion on aircrew, command and control, or other operational activities. To that end, this graduate research paper will answer the following questions:

1. How does current Air Force guidance affect the loading/unloading of passengers and cargo, and maintenance and servicing of cargo aircraft?
2. Are there any aircraft maintenance or servicing activities, including ramp operations, that can be modified to reduce ground processing time?
3. Are there any aerial port activities that can be modified to reduce ground processing time?
4. Can we learn anything from commercial airlines and their ground processing activities?
5. What can we learn from this research and how can we save time?

To get a good idea of current Air Force practices, I contacted personnel at several air mobility support squadrons in overseas locations. The air mobility support squadrons constitute Air Mobility Command's 'en route' structure in the overseas locations. There are six of these squadrons in the European area of responsibility, and six in the Pacific. Additionally, there are smaller detachments and operating locations at numerous other locations. I sent e-mails to flight chiefs and superintendents in the en route units to obtain their viewpoints on this issue. Below is a list of some of the questions I asked:

1. When you are quick-turning an aircraft, what activity or process normally causes the most problems or delays, and why?

2. What is your top success story in improving the efficiency of processing quick-turns?

3. Is there a requirement, regulatory or otherwise, which you believe unnecessarily hinders or restricts your ability to effectively process a quick-turn?

I also asked the units to send me a copy of their sequences of events (SOEs), a mission management tool within the Command and Control Information Processing System (C2IPS). Additionally, I asked units to give me their top challenges confronted when processing quick-turn aircraft, their top success stories, and their day-to-day activities. This was very helpful and provided many opportunities for improvement.

Overview of Subsequent Chapters

Chapter II discusses current Air Force guidance and requirements for servicing and loading/unloading of aircraft. Chapter III examines some aircraft maintenance and servicing issues, and aircraft ramp operations. How are we applying current guidance in this area? Chapter IV investigates aerial port activities – the processing, loading, and unloading of passengers and cargo, and related actions. Chapter V studies industry practices in the servicing of aircraft – can we learn anything from our commercial partners? Finally, Chapter VI summarizes the research and presents results and recommendations.

II. Current Air Force Guidance

Current Air Force guidance is quite strict concerning aircraft refueling activities, and which may be concurrently accomplished. An aircraft refueling operation is controlled by the servicing supervisor, who is, at minimum, a senior airman, with a 5-skill level and several years' experience. To become a servicing supervisor, an individual must be experienced and knowledgeable in each position, to include refueling panel operator and single point refueling receptacle monitor. Additionally, the supervisor must demonstrate a thorough knowledge of the aircraft type to be refueled, and have a strong knowledge of numerous technical orders relating to the aircraft.

During the refueling operation, the servicing supervisor has several responsibilities, a few of which are listed below:

> b. Control the movement and correct positioning of aircraft and servicing equipment to, from, and within the servicing areas.
> d. Evacuate non-essential personnel and equipment.
> e. Shutdown powered SE (support equipment) not essential to servicing and, if necessary, move to a point where it will not obstruct operations. (Department of the Air Force, 1987:4-2)

Adherence to these restrictions severely limits other activities that can be accomplished while aircraft are being refueled. Aircraft refueling can be a dangerous activity. Since 1959, there have been 26 aircraft accidents involving fuel tank explosions. Half of these involved commercial aircraft (including TWA Flight 800, which exploded near Long Island in 1996) and half were military aircraft. All of the accidents can be grouped into one of four general phases of operation: In-flight (10 accidents); ground maintenance (8); parked or taxiing (4);

ground refueling operations (4) (Dornheim, 1997:61-63). According to Dornheim's article, three of the accidents which occurred during ground refueling operations involved commercial aircraft, but there were no fatalities. The fourth accident involved a military aircraft (KC-135Q), but the number of fatalities, if any, was not released. Additionally, the KC-135 was the only aircraft that was destroyed during ground refueling accidents. It is interesting to note that the total number of fuel-related accidents involving military aircraft equals the number involving commercial aircraft. One might speculate that, given that commercial airlines fly more miles annually than military aircraft, that commercial aircraft would have been involved in more refueling accidents. Perhaps this safety record can be attributed to safety practices adopted by the commercial airlines; I will research these practices in Chapter V of this paper.

The Air Force has taken steps to further improve their safety record regarding fuel handling by changing the type of fuel used in military aircraft. Previously, Air Force aircraft operated on JP-4 fuel, which is similar to the civilian Jet B fuel, which are considered high-volatility fuels. The high-volatility fuels were popular because they had a freezing point of just –72F, compared to low-volatility fuels with freezing points of –40F to –53F. Obviously the lower freezing point of JP-4 is important in Alaska and other cold environments, but to improve safety, the Air Force switched to JP-8, which, like its civilian counterparts, Jet A and Jet A-1, are low-volatility fuels. It is interesting to note that each of the 13 military aircraft fuel tank accidents involved JP-4, the high-volatility fuel, and several of the commercial fuel tank accidents also involved JP-4. Given that the

Air Force has switched from highly volatile JP-4 to JP-8, we should see fewer accidents and improved safety. Additionally, we might have an opportunity to make Air Force safety requirements less stringent and streamline our processes to emulate commercial practices.

To increase the number of activities that can be performed during aircraft refueling operations, the Air Force developed the concurrent servicing concept. Concurrent servicing is defined as "The simultaneous servicing of fuel or oxygen with either passengers on board or the performance of minor maintenance, fleet servicing, or baggage or cargo loading/unloading" (Department of the Air Force, 1987:1-1). The individual supervising the concurrent servicing operation must be experienced and knowledgeable in the refueling operation, but is required to be knowledgeable of many more technical orders than for routine refueling operations.

Concurrent servicing with passengers onboard is not possible on the KC-10 or C-5 aircraft during routine day-to-day missions, and can only be accomplished during contingencies, emergencies, and combat operations with the approval of Headquarters, Air Mobility Command (Department of the Air Force, 1983:8-1 and 1985:10-1). Concurrent servicing with passengers onboard can be accomplished on the C-17 and C-141 aircraft, provided a knowledgeable person is located in the passenger compartment and they are in communication with the refueling crew members (Department of the Air Force, 1988:1-3, 4). The passenger compartments of the KC-10 and C-5 aircraft are fairly high off the ground compared to the C-17 and C-141 aircraft. This would increase the time required for evacuation of passengers from the KC-10 and C-5 in the event of an emergency during the refueling operation. Additionally, the large cargo capabilities of the KC-10 and C-5 aircraft do not make it feasible to keep passengers on board during concurrent servicing. The time required to download and upload cargo on these aircraft is too long to keep the passengers on the aircraft. Some time savings might be realized if concurrent servicing were accomplished with passengers on the C-17 and C-141 aircraft, on a more routine basis.

As is to be expected, concurrent servicing is not practiced on every occasion. Current policies require that, on most airframes, additional personnel must be present during concurrent servicing, both for the servicing and, where appropriate, to monitor any passengers on board the aircraft. Given the increased operations tempo and reduced manning, it is not always possible to provide the required personnel. Therefore, units typically use normal servicing procedures. During normal servicing procedures, very few activities can be accomplished while refueling the aircraft. Typically, the cargo and passengers will be downloaded immediately after the aircraft arrives. Then, if fuel is required, the aircraft will be refueled. After refueling, the outbound cargo and passengers will be loaded. Table 1 below lists quick-turn ground times for mobility aircraft. The times listed in the 'Standard' column are used for normal, day-to-day operations. These times were developed through years of experience. It should be noted that the 'standard' ground time for the C-17, of three hours and 15 minutes, has been temporarily expanded to three hours and 45 minutes, because of the extra pre-flight time required for the C-17's computers.

Table 1. Aircraft Ground Times (Air Mobility Command, 1997:10-15)

Aircraft Type	**Standard**	**Refuel only*** **	**Expedited***** **
C-5	4+15	3+15	2+00
C-141	3+15	2+15	1+15
C-17	3+15	2+15	1+45
KC-10*	4+15	3+15	3+15
KC-135*, **	4+15	3+15	2+45
C-130*	2+15	1+30	0+45

* - AMC cargo missions
** - Assumes palletized cargo, roller-equipped aircraft
*** - 'Refuel only' denotes that cargo will not be off-loaded nor on-loaded during this timeframe
**** - 'Expedited' denotes onload or offload operations only, not both. This timing is used during exercises and contingencies.

III. Aircraft Maintenance and Servicing Activities

As part of this research, I contacted each of the en route units to request data from their sequences of events (SOEs). The SOEs are a tool within the Command and Control Information Processing System (C2IPS). C2IPS is a computer system used by command and control, aerial port, and aircraft maintenance personnel to track the status of mobility missions (airlift and tankers). I only received information from four en route units, so I am not able to draw too many conclusions from the data. In spite of this, I was able to collect some information. A summary of this information is located at the Appendix (in Excel spreadsheet format).

First, I found that not all units utilize the SOEs. All AMC units have C2IPS and use it to collect and report information related to mobility aircraft movements. As was mentioned above, each aircraft has a normal scheduled ground time. The SOE helps to track all activities which must be completed during this time. When an activity is complete, a controller will enter the applicable time in C2IPS to update the SOE. If an activity has not been completed by its required time, C2IPS will alert the controllers to investigate the situation. If a particular mission departs in delay, the SOE can be reviewed to determine which event first caused the ground processing activities to be delayed. This is useful to prevent future delays.

Additionally, I found that the SOE format and timing of the activities varies widely from one unit to another. I expected to find some variations due to infrastructure and manning differences and other influences, but this does not explain the wide variations I encountered. For example, on the C-17 aircraft (which has a standard ground time of three hours and 15 minutes), one unit allocates 45 minutes for cargo uploading, while another unit allocates 69 minutes, a differential of 53%. While these differences do not of themselves contribute to delays, they can contribute to confusion. For example, if a C-17 crew is operating in Europe, they might go to one location and be told that a cargo upload will take 45 minutes, then at another location they are told the cargo upload will take 35 minutes, and at a third location they are told the cargo upload will take 70 minutes. There should be a pre-established time-frame allotted for each activity, assuming normal conditions. If we consider that there are many required ground processing activities, this confusion can multiply. The timing for each activity should be standardized to the greatest extent possible, with only minor variations at each station. Additionally, the formats and sequences of the SOEs should be standardized.

While there are no known statutory or regulatory requirements that C2IPS SOEs be utilized, the system represents a significant investment and a robust tool which should be utilized to the maximum extent.

I found that several units produce their own local version of a maintenance and debrief log, and a similar product for command and control personnel. These forms are used to capture all relevant information about a particular mission. Virtually all of this information can be recorded in C2IPS; recording the information on paper limits its accessibility and currency. Recording the information in C2IPS will reduce duplication of effort; generic mission-related information does not need to be recorded on individual forms. Recording the information in C2IPS will allow personnel throughout the unit to have up-to-the-minute access to the relevant information.

One of the most recent initiatives in Air Mobility Command to reduce ground time is the expansion of engine running operations (ERO) for C-17 aircraft. ERO procedures are used to expedite the flow of aircraft through airfields during airland operations to reduce normal ground times. In effect, the cargo and passengers will be unloaded and loaded on the aircraft while the engines remain running. This eliminates the need to shut down the engines (which only takes a few minutes) and then restart the engines (which can take 20 minutes or more, particularly in the C-17). Originally, ERO procedures were developed for aircraft like the C-130, where operational combat requirements stated that the troops (passengers) were an integral part of the loading operation.

Recently, the 615th Air Mobility Support Group, Hickam AFB, Hawaii, developed a draft operating instruction (OI) to outline guidelines for employment of ERO procedures. The OI states the following:

> The unique engine thrust vectoring capabilities and low engine noise make C-17 Engine Running Onload (ERO) a reduced risk procedure. Longer C-17 engine start up times (35-45 minutes) and high ops tempo makes C-17 ERO a vital component in processing missions and recovering from unplanned breaks in sequence of events. (615th Air Mobility Support Group, 1998:1)

Use of the ERO can significantly decrease the time required to process a C-17 during quick-turn operations. Typically, ERO operations necessitate additional training requirements for aerial port personnel due to the potential dangers of working around operating engines (and in the case of the C-130 aircraft, propellers). Personnel involved in the ERO must also wear safety goggles (in addition to other safety equipment). Additionally, ERO procedures will not be used to load or unload explosive cargo. Aside from these limitations, ERO procedures are becoming more widely used on the C-17 aircraft. This indicates a tremendous potential to reduce quick-turn ground time. In practice, ERO has proven to significantly reduce processing time. I spoke to aerial port personnel at Aviano Air Base, Italy, about an ERO conducted at the beginning of Operation Joint Force in February 1999. The C-17 arrived with a mixed load of palletized and rolling stock (i.e., vehicles) cargo, and the outbound load was similar. The ground support team was able to download and upload all cargo and passengers in a period of just 30 minutes with no safety deviations. This represents a reduction of approximately two hours, 45 minutes, or 85%, from the normal quick-turn ground time.

Can EROs be routinely conducted on aircraft other than the C-17? Due to safety considerations, the answer is probably 'no'. On the C-5 aircraft, one of the major factors ruling out the use of ERO is the location of the troop compartment, in the aft section of the fuselage. Passengers disembark from the C-5 by way of a staircase truck parked next to the fuselage just aft of the Number Two engine (left wing, inboard). The thrust from Number Two would make use of this staircase truck hazardous. Additionally, the noise generated by the C-5 engines creates a hazard for passengers, particularly children. The propellers on the C-130 engines create a potential hazard which would endanger ground servicing personnel and passengers, particularly those unfamiliar with C-130 ground operations. The location of the cargo door on the KC-10 and KC-135 aircraft make EROs extremely implausible and hazardous. Passengers disembarking from the aircraft would walk right in front of the engine(s) operating on the left wing. Additionally, the cargo download process on these aircraft is very inexpedient, which does not lend itself to ERO operations. First, aerial port personnel must download the seating pallet(s), then download the appropriate cargo, upload the outbound cargo, and finally upload the seating pallet(s). The C-17 appears to be the appropriate aircraft for routine ERO operations: the engine thrust is vectored away from the cargo doors, making cargo operations safe; the engine inlets are high off the ground, making passenger operations safe; and the engine noise is much lower than other AMC aircraft, reducing noise hazards.

In Section II above I discussed the concurrent servicing concept. Concurrent servicing is routinely practiced at most overseas AMC locations. One exception that I am aware of is at Aviano Air Base, Italy. The AMC unit at Aviano has no aircraft maintenance personnel, so personnel of the host unit's transient alert function perform all routine servicing (fuel, oil, oxygen, etc.). Likewise, the AMC unit at Osan Air Base, Korea, has no assigned aircraft maintenance personnel, but I am not familiar with the impact on that unit's mission. Aviano's transient alert section does receive additional manning authorizations in recognition of their support of the AMC mission, but not all of these authorizations are filled with personnel. Perhaps one solution is to assign aircraft maintenance personnel to the AMC unit at Aviano AB. These personnel would perform concurrent servicing as well as other routine maintenance procedures for AMC aircraft transiting Aviano Air Base.

One area identified by aircraft maintenance personnel as requiring attention is the stock level of spare parts in the forward supply locations. If an aircraft requires maintenance support during a quick-turn, the parts must be readily available or the aircraft departure will likely be delayed. Most AMC locations overseas have a forward supply location, or FSL, with a supply of the most commonly used spare parts. Obviously not every part can be stocked in the FSL, due to resource limitations. Headquarters, Air Mobility Command personnel regularly review the FSL levels at each station to ensure they are adequate.

Another area identified by aircraft maintenance personnel is the fuel load to be serviced on the aircraft. Occasionally, the flight crew will not determine a final fuel load until they have completed their flight planning process. The computerized flight plan will consider prevailing winds over the intended route of flight, the recommended alternate landing locations, and the aircraft's intended payload, to determine a recommended fuel load for the aircraft. The aircrew will typically take this recommendation and round it up to determine their final fuel load. Meanwhile, the maintenance personnel might be waiting at the aircraft for this information. Perhaps predetermined final fuel loads can be established to cover most routes and situations, with last-minute changes to be made in rare situations.

One concern identified by personnel at Ramstein Air Base, but which also has applicability at other locations, is that of early arrival of aircraft. When a schedule of intended aircraft arrivals and departures is established, organizations begin to plan their activities based on this schedule. Aircraft parking locations are allocated, passenger show times are advertised, and refueling support is coordinated. If an aircraft arrives outside of its scheduled time, either early or late, numerous related support activities are affected. If an aircrew desires to depart 20 minutes or more before their scheduled departure time, they are required to obtain approval from the Tanker Airlift Control Center (Air Mobility Command, 1997:29). This is so that all affected stations can determine whether an early departure and subsequent early arrival will adversely impact their schedule.

IV. Aerial Port Activities

Several units identified problems with late or inaccurate manifests of inbound cargo loads. If the load planners receive inaccurate manifests, or they receive the manifests late, they are unable to accurately plan the outbound cargo load. Aerial port activities use a system similar to C2IPS, known as Consolidated Aerial Port SubSystem, or CAPS II, which will be replaced by the Global Air Transportation Execution System, or GATES. When an aircraft departs, aerial port personnel should send a message to CAPS II/GATES within 15 minutes of departure. This will update the central database and notify all downline stations. Occasionally, system problems might lead to late or inaccurate transmissions of these load manifests, but normally the cause is human error. Aerial port personnel should strive to ensure they send accurate, timely load messages. This will allow personnel at the quick-turn stations to more accurately plan outbound cargo loads. Additionally, if quick-turn stations are aware of inbound cargo loads, they will be better prepared to download the cargo. The aerial ports typically attempt to pre-position aircraft materials handling equipment at the intended aircraft parking location prior to arrival of the aircraft. If the load information is incorrect, the aerial port will deploy the wrong equipment.

I interviewed personnel of the 305th Aerial Port Squadron at McGuire Air Force Base, New Jersey and learned that one of their greatest challenges when they prepare an aircraft for departure is delivery of flight meals, as well as the process of collecting funds for the purchase of these meals. The main reason for this is that the McGuire flight kitchen requires an extended advance notice to prepare flight meals. Perhaps one solution to this challenge is to reduce the selection of meals available to passengers. Airlines typically only offer two meal choices on their flights. Air Force flight kitchens could provide a similar option. The flight kitchen should have a set number of meals prepared in advance. As the departure time approaches, the passenger terminal should be able to provide a better estimate of required meals. In recent years there have been many outsourcing initiatives, and while McGuire is not very close to a commercial airport (as is the case with many military bases) and the attendant catering services, there are other options for outsourcing flight meal preparation. The Air Force could enter into a contract with a local restaurant to produce and deliver flight meals. They typically have a wide range of food options that could be prepared with little advance notice, and orders could be placed via fax.

If all of these functions (latrine servicing, meal and beverage preparation and servicing, etc.) were privatized, aerial port personnel would no longer have to complete these functions and would thus be free to concentrate solely on loading and unloading passengers and cargo. When an aircraft arrives for a quick-turn, the aerial port personnel could meet the aircraft to download passengers and cargo, and the contractor(s) could meet the aircraft to service latrines, remove trash, deliver meals and beverages, etc. This might be more appropriate at stations with a higher rate of aircraft traffic, such as Ramstein Air Base, Germany, or Hickam Air Force Base, Hawaii.

Another challenge identified, and one with which I am familiar, is the need to build up a pallet for passenger baggage. Occasionally, passengers do not arrive at the passenger terminal at the prescribed time, or passenger processing will take longer than anticipated. Whatever the case, the baggage pallet is often the last pallet to be completed. Then, it must be weighed and transported to the aircraft. This process typically delays the completion of cargo loading, and securing cargo doors, which in turn delays loading of passengers.

Many airlines use an ‘igloo’ pallet configuration for small packages, baggage, or both. This is typically a plastic or fiberglass ‘igloo’, normally permanently affixed to the pallet. The ‘igloo’ has an access door on one side of the structure. When the ‘igloo’ is full, the access door is secured and there is no need for cargo nets or straps or plastic coverings. As part of our ASAM curriculum, we visited Emery Worldwide in Dayton, Ohio. Emery uses these ‘igloos’ for virtually all of their airborne cargo. The ‘igloos’ are of uniform dimensions and can be custom-built to conform to aircraft configurations. This is a product which should be considered for Air Force usage. The ‘igloo’ can be used both for passenger baggage, as well as small packages, such as registered mail or high priority spare parts.

The ‘igloo’ would alleviate the need to use nets, straps, and plastic pallet covers for baggage pallets, contributing to a minor time savings during ground processing, as well as reducing wear and tear on nets, straps, and plastic pallet covers. Additionally, if the baggage is weighed at the passenger processing counter, the weights can be totaled, thus eliminating the need to weigh the baggage pallet, further saving time. Finally, it is possible that the baggage pallet could be left on the aircraft, and the baggage would be secured on/in the pallet while onboard the aircraft. This would be particularly appropriate on the KC-10, where the seat pallets and baggage pallet must be downloaded before cargo pallets may be downloaded. This could potentially result in significant time savings but the weak link in this process would be actually loading the baggage on the aircraft, as the aft troop door is very high off the ground. The baggage pallet could be left on cargo aircraft such as the C-17 (if loaded at or near the front of the cargo compartment), but the potential time savings would probably not justify the need to hand-load the baggage through the crew entry door. The igloo-pallet concept is appropriate to virtually all AMC aircraft, with the exception of the KC-135. This is because the KC-135 is rarely configured to carry enough passengers to generate a baggage pallet (normally a baggage pallet is used when 20 or more passengers are carried on an aircraft).

Also identified as a problem when processing passengers is the late notification to the passenger terminal of 'seat releases', or number of seats available on the outbound flight. Until the passenger terminal receives a firm seat release, they are unable to accurately advertise or process the flight, particularly for Space Available passengers. This delays passenger processing, and consequently passenger baggage processing. Occasionally, the passenger terminal will not receive a firm seat release until the aircraft arrives at the quick-turn station. If the passenger terminal is to be able to process passengers more quickly, they must have timely notification of seat releases, typically well before the aircraft arrives at the station.

When processing passengers in to the departure gate just prior to boarding the aircraft, passenger terminal personnel must check all boarding passes and verify that everybody listed on the passenger manifest has actually processed. This ensures that nobody is left behind, contributing to customer satisfaction and aircraft security. Typically this process involves searching the printed passenger manifest for the person's name, and checking off that person's name. At the end of the process, the manifest is reviewed to ensure that everybody has processed. This is a very time-consuming and inaccurate process, particularly when processing 'Patriot Express' contract commercial flights with 300 or more passengers. Commercial airlines have solved this problem by installing machines which read the boarding pass. At the end of the process, they can quickly determine if all passengers have boarded – there is no need to manually check the manifest for each and every passenger.

Several locations identified problems with processing registered mail and signature service items during quick turns. Registered mail and signature service items include low-level classified materials as well as high-value items, both personal property being shipped through the mail service and government property. When a location is shipping registered mail or signature service, they bring the items to the aircraft, and the loadmaster must check each item against the manifest. If there are just a few items, this is not a problem. Occasionally, there can be 50 or 60 pieces, and it can be time-consuming to check each and every piece (similar to the time constraints involved with manually processing each and every passenger through the boarding gate). There are initiatives to place bar codes on each piece of cargo. These bar codes should make this process somewhat easier. Perhaps portable bar code scanners can be employed to scan each piece, rather than manually check each piece against the manifest. Commercial package delivery companies use a similar process. For further information on this technology, please refer to the paper by my colleague, Major Chris Patterson, entitled 'Automatic Identification Technologies: Integrating With Remote Location In-Transit Visibility'.

V. Industry Practices

To get an idea of how commercial airlines process aircraft during quick-turns, I visited Continental Airlines at their hub at Newark International Airport, New Jersey. I interviewed several maintenance representatives, including Mr. Terrance Kerber, Continental's Director of Maintenance at Newark (Note: Mr. Kerber no longer works for Continental). Additionally, I was able to briefly tour the ramp and watch recovery activities on several aircraft returning to the United States from overseas. Continental faces different challenges when operating international flights to or from Newark. The airport at Newark consists of Terminals A, B, and C. Terminals A and C are for domestic flights, and Terminal B is for international flights. When aircraft arrive at Newark from an international flight, they are parked at Terminal B to download the passengers and cargo. They must be moved from Terminal B within one hour, or the airline begins to incur substantial financial penalties. Typically, therefore, Continental will complete all required servicing activities, except refueling, while the aircraft is parked at Terminal B. Additionally, many of the maintenance defects will be corrected, if possible, at Terminal B.

I observed a DC-10 aircraft arrive from Frankfurt, Germany. As the aircraft was taxiing into position at Terminal B, I noticed numerous personnel and vehicles preparing to meet the aircraft. Within one or two minutes of the aircraft arriving at its gate, personnel and vehicles began servicing the latrines, downloading baggage and cargo, cleaning the aircraft, and uploading fresh meals and beverages. Within 10 minutes of arrival, both the fore and aft latrines had been serviced, catering had begun on both the fore and aft gallies, and baggage and cargo download had begun. Additionally, maintenance personnel were correcting the write-ups. Less than one hour after the aircraft arrived at the gate, it was towed to another location for refueling and upload of cargo, baggage, and passengers. Continental can typically quick-turn a Boeing 777 in one and one-half to two hours, even though the aircraft carries more than 300 passengers, as well as baggage and cargo. The commercial airlines have a profit motive to keep their aircraft flying as much as possible; an aircraft on the ground is not generating revenue.

When Continental aircraft are refueled, only one person is required. That person monitors the fuel gauges (which are located near the refueling receptacle) and the refueling truck or hydrant. Most Air Force refueling operations require numerous personnel. When I participated in KC-135 refueling operations, there were four people involved: the refueling supervisor, the refueling truck or hydrant operator, the fuel gauge monitor (in the cockpit), and the safety monitor. If we follow the commercial example, we could probably eliminate one or two of these requirements. This would free up personnel to perform other tasks (expediting the aircraft's ground time) or to service other aircraft, increasing system capability.

It was interesting to note that Continental only uses two people to tow a DC-10: one in the cockpit to operate the aircraft brakes, and one to operate the tow vehicle. When I worked on KC-135s, we required six people to tow an aircraft: one in the cockpit, one in the tow vehicle, a tow supervisor walking next to the tow vehicle, one person on each wing tip, and one person at the tail of the aircraft. Continental has purchased a new 'super tug' which requires only one person to tow an aircraft. The tow vehicle is positioned at the nose landing gear, and a device on the tow vehicle actually lifts the nose landing gear off the ground, eliminating the need for a tow bar (and reducing the time required for an aircraft tow). While it is very rare in the Air Force to tow an aircraft during a quick-turn, this 'super tug' might save time and personnel if an aircraft tow is required (even for aircraft tows not occurring during a quick-turn). Additionally, virtually all Continental maintenance personnel, with the exception of sheet metal specialists, are cross-qualified. That is, they are qualified to perform multiple tasks on multiple airframes; this is very unusual in the Air Force.

It was also interesting that Continental outsources many of its ground support activities. For example, latrine servicing, aircraft cleaning, and meal and beverage servicing are all performed by contractors (although the meal and beverage servicing is performed by Chelsea, a subsidiary of Continental Airlines). In the Air Force, military personnel or civilian employees accomplish most of these activities (typically, these activities are collectively known as 'fleet services'). Some locations, such as Royal Air Force Station Mildenhall, United Kingdom, have contractors to perform fleet service functions. At virtually every military facility, the base dining facility prepares flight meals. When contract commercial aircraft operate through military bases, they are responsible for contracting for preparation and delivery of all required meals and beverages; in this case, the base dining facility does not prepare flight meals.

VI. Results and Recommendations

I recommend the ideas below be examined and considered for further research and/or implementation. Several of these recommendations represent 'best practices' garnered from several of the en route units.

Sequences of Events (SOEs) in the Command and Control Information Processing System (C2IPS) should be standardized both in format and in event timing, as much as possible, across Air Mobility Command, but most particularly at the overseas en route units. This will be transparent to all ground personnel, but will assist aircrew personnel, because they will have a better idea of expected start and completion times for each activity, regardless of where they are operating. The SOE should be included in the package given to the aircrew immediately upon arrival. Additionally, although this is not directly related to quick-turn missions, I recommend that locally produced mission management and maintenance debrief logs, related to specific missions, be discontinued where possible. This information should be recorded in C2IPS to ensure all personnel in the unit have access to the appropriate information, and that this information is kept as current as possible. Additionally, one station reported that they were successful having their maintenance production superintendents actively monitoring the completion of SOE activities. Perhaps each unit should identify one person who has overall responsibility for oversight of all quick-turn activities.

Consider increasing the manning at Detachment 3, 621st Air Mobility Support Group, Aviano Air Base, Italy, (and any other locations, as appropriate) to add an aircraft maintenance function to facilitate concurrent servicing and aid in other routine aircraft maintenance activities. Failing this, the transient alert function at Aviano AB should receive additional manning for concurrent servicing. On a related matter, during my research several stations noted that they have had great success in the concurrent servicing process when they have a pre-briefing with all affected personnel. The appropriate technical orders require the concurrent servicing supervisor to ensure each member of the servicing team is aware of his or her responsibilities, but it does not mention the forum or the format for these briefings. I recommend that those stations not already doing so to conduct their CSS briefings as a team. This allows each team member to know what his fellow team members will do in the event of an emergency.

Using historical data, develop final fuel loads for routinely traveled routes. Maintenance personnel can then use this information to more accurately prepare for aircraft refueling activities. When they begin to refuel an aircraft to an initial fuel load, they will not have to wait for the aircrew to determine a final fuel load. They can also coordinate the aircraft refueling with other ground processing activities, since they know how much time will be required for the refueling.

Additionally, I recommend that Air Mobility Command and Air Force safety officials re-examine personnel requirements for aircraft refueling operations. Some Air Mobility Command aircraft have fuel gauges near the refueling receptacle, allowing one person to monitor the gauges and the receptacle. Those aircraft where there are no fuel gauges near the refueling receptacle would still require a person in the cockpit to monitor and transfer fuel as it is serviced. Even in this case, it might be possible to have one person monitor the refueling truck or hydrant, and the aircraft refueling receptacle. Also, examine whether a safety monitor is actually required during the servicing operation. If we can reduce personnel requirements for fuel servicing (using the example of commercial airlines), those maintenance personnel can be used for other activities, thus improving the efficiency of our operations.

Reinforce the need for aircrews and command and control agencies to adhere to scheduled departure times. If an aircraft will depart more than 20 minutes before or after the scheduled departure time, either the command and control agency or the aircraft commander, as appropriate, must contact the Tanker Airlift Control Center. This will ensure all down-range stations will be aware of schedule changes, and will be able to plan accordingly. Normally, early departures can be accommodated, but occasionally they negatively impact the flow of activities.

Ensure aerial port personnel submit timely and accurate load message, allowing downline quick-turn stations to more accurately plan outbound cargo loads. Additionally, this will allow those download stations to determine which materials handling equipment they will need to use to meet the arriving aircraft.

Consider privatizing ‘fleet service’ functions (aircraft latrine servicing, trash removal, preparation and delivery of flight meals and beverages, etc.). These are not inherently military functions. Privatization would allow aerial port personnel to concentrate solely on loading and unloading of passengers and cargo. Privatized fleet service personnel would meet the aircraft at the same time as the aerial port personnel and perform their services concurrently. Flight kitchens should be able to prepare, in advance, a number of meals. As the flight departure time approaches, they only need to prepare the last few meals. Each night, the AMCC or command post should fax a copy of the following day's flight schedule, with anticipated passenger loads. This will allow the flight kitchen to better prepare meals. Additionally, if aircrews anticipate they will be ordering flight meals at a down-range station, they can pre-order these meals. For example, let us assume a mission operates from RAF Mildenhall to Ramstein AB, to Aviano AB, and returning to RAF Mildenhall. Before the aircrew departs from RAF Mildenhall to begin the mission, they determine that they will want flight meals on the Ramstein-Aviano leg. The RAF Mildenhall AMCC can take their order and fax this request ahead to Ramstein AB. When the mission arrives at Ramstein AB, the meals are delivered either to the aircraft or to the Ramstein AB AMCC. The aircrew can then give their payment either to fleet service or the AMCC, saving them the need to go to the flight kitchen or any other dining facility. This will significantly reduce required ground time.

To allow the passenger terminal to process passengers in a more timely fashion, I recommend that seat releases be determined earlier. Rather than waiting for the aircraft to arrive, the seat release should be determined earlier. Let us again consider the example of the aircraft operating from RAF Mildenhall through Ramstein AB and Aviano AB before returning to RAF Mildenhall. Let us assume that there are 20 passengers traveling from RAF Mildenhall to Ramstein AB, of which five will go on to Aviano AB. The passenger terminal at Ramstein

AB should be able to advertise the remaining 15 seats, and process passengers to take the flight. As soon as the Ramstein passenger terminal knows how many seats are available and how much cargo is planned for the outbound mission (for weight and balance considerations), the should begin processing passengers for the flight, rather than waiting for the aircraft to arrive at their station. This will save time when the aircraft is on the ground, and will allow aerial port personnel to process the baggage earlier, also reducing ground processing time.

Air Mobility Command should explore the purchase and installation of boarding pass readers for passenger terminals. Some of these readers require magnetic strips on the boarding passes, which would necessitate purchasing new card stock as current AMC boarding passes do not have magnetic strips. Some readers operate on optical character recognition (OCR), which can be accomplished on current card stock (AIT Corporation web site, 1999: n.pag. Siemens Nixdorf corporate web site, 1999: n.pag.). Some software modifications might be required to CAPS II or GATES, but these should be easily accomplished.

The 627th Air Mobility Support Squadron at RAF Mildenhall, United Kingdom completed an action workout on their passenger processing operation. The new operation is streamlined, processing passengers in a more sequential order, and reducing passenger processing time by over 50%. I recommend other aerial port activities examine the results of this workout for applications to their processes. Additionally, if other units conduct action workouts leading to process improvements, the results should be disseminated to all other organizations for potential application.

One location reported that they setup outbound cargo loads on highline docks prior to the arrival of the aircraft, as opposed to keeping the pallets in the grid yard. To the maximum extent possible, the outbound loads are built in the correct sequence on the highline dock. Then the pallets can be transferred directly to the K-loader, and transported to the aircraft. Alternately, each pallet must be taken from the grid yard and placed on the K-loader, in the proper sequence, during the aircraft's ground time. When processing wide-body aircraft, particularly the C-5, personnel at Aviano Air Base locate outbound cargo pallets near the aircraft parking areas. This is because the C-5 parking area is several hundred yards from the freight terminal. This significantly reduces shuttle trips between the aircraft and the freight terminal during the ground time. If other locations have a wide-body parking area located a significant distance from the freight terminal, perhaps they can place a highline pallet dock near this parking area. This would allow them to pre-build the outbound load, correctly sequenced, before the aircraft arrives.

Several locations indicated that they regularly use the Phase II process to load cargo without the aircraft loadmaster. While the Phase II process is used to load cargo on aircraft that remain overnight, the process does spread out the workload. The aerial port can load aircraft during the night hours when there are very few, if any, quick-turn aircraft. This allows them to upload quick-turn aircraft during their limited ground time, rather than dividing limited time, personnel, and resources among several aircraft.

While none of these recommendations individually will lead to significant time savings, each should lead to an increase in efficiency; combined, the time savings will be significant.

Appendix: Quick-turn Processing Activities

Military Airlift Aircraft

C-17	LTAG	EGUN	LIPA	PGUA	Average
Ground time	3+15	2+15**	3+15	3+15	
Arrival until pax download begins	25	20	15		20.00
Pax download time	10	9	10		9.67
Cargo download time	30		50	45	41.67
Fleet service time	24	44	*10	15	27.67
Fuel service time	60			35	47.50
Cargo upload time	69		45	50	54.67
Pax upload time	19	19	10	10	14.50
Pax upload until blockout	11	11	20	10	13.00

C-141	LTAG	EGUN	LIPA	Average
Ground time	3+15	3+15	3+15	
Arrival until pax download begins	25	25	15	21.67
Pax download time	10	10	10	10.00
Cargo download time	30		50	40.00
Fleet service time	24		*10	24.00
Fuel service time	60			60.00
Cargo upload time	69	59	50	59.33
Pax upload time	19		10	14.50
Pax upload until blockout	11		10	10.50

C-5	LTAG	EGUN	LIPA	PGUA	Average
Ground time	4+15	3+15	4+15	4+15	
Arrival until pax download begins	25	25	15		21.67
Pax download time	10	10	10		10.00
Cargo download time	60	60	75	45	60.00
Fleet service time	105	44		20	56.33
Fuel service time	85		60		72.50
Cargo upload time	53	113	75	90	82.75
Pax upload time	20	19	20	15	18.50
Pax upload until blockout	10	11	20	15	14.00

C-130	LIPA	PGUA	Average
Ground time	2+15**	3+15	
Arrival until pax download begins	15		15.00
Pax download time	10		10.00
Cargo download time	20	45	32.50
Baggage download time	10		10.00
Fleet service time		15	15.00
Fuel service time	20	35	27.50
Cargo upload time	30	50	40.00
Pax upload time	10	10	10.00
Pax upload until blockout	10	10	10.00

* - Aviano's fleet time is for baggage upload only

** - 2+15 ground time does not include aircraft refueling, only cargo/pax upload/download

LTAG = Incirlik AB, Turkey EGUN = RAF Mildenhall, UK

LIPA = Aviano AB, Italy PGUA = Andersen AFB, Guam

Appendix: Quick-turn Processing Activities

Military Tanker Aircraft

KC-10	EGUN	Average
Ground time (arrival to departure)	3+15	
Arrival until pax download begins	15	15.00
Pax download time	20	20.00
Bag download time		
Fleet service time	44	44.00
Fuel service time		
Bag upload time	44	44.00
Pax upload time	19	19.00
Pax upload until blockout	11	11.00

KC-135	EGUN	LTAG	LIPA	Average
Ground time (arrival to departure)	4+15	3+15	3+15	
Arrival until pax download begins	25	15	15	18.33
Pax download time	10	15	10	11.67
Bag download time			5	5.00
Cargo download time	60	30	40	43.33
Fleet service time	44			44.00
Fuel service time		45	30	37.50
Bag upload time	44		10	27.00
Cargo upload time	113	30	40	61.00
Pax upload time	19	15	10	14.67
Pax upload until blockout	11	20	10	13.67

Appendix: Quick-turn Processing Activities

Commercial Aircraft

B-757	LTAG	Average
Ground time (arrival to block-out)	4+55	
Arrival until pax download begins	15	15.00
Pax download time	15	15.00
Bag download time	30	30.00
Fleet service time	25	25.00
Fuel service time	70	70.00
Bag upload time	70	70.00
Pax upload time	30	30.00
Pax upload until blockout	15	15.00

L-1011	LTAG	LIPA in*	LIPA out*	Average
Ground time (arrival to block-out)	4+35	1+50	2+10	
Arrival until pax download begins	15	15	15	15.00
Pax download time	25	20	20	21.67
Bag download time	35	20	25	26.67
Fleet service time	35			35.00
Fuel service time	70	20	20	36.67
Bag upload time	70	30	30	43.33
Pax upload time	30	20	20	23.33
Pax upload until blockout	15	10	10	11.67

* - this mission operated through Aviano to Incirlike and back to Aviano

DC-10	LTAG	Average
Ground time (arrival to block-out)	2+35	
Arrival until pax download begins	20	20.00
Pax download time	20	20.00
Bag download time	50	50.00
Fleet service time	45	45.00
Fuel service time	60	60.00
Bag upload time	60	60.00
Pax upload time	35	35.00
Pax upload until blockout	15	15.00

DC-8	LTAG	LIPA	Average
Ground time (arrival to block-out)	3+35	1+50	
Arrival until pax download begins	15	15	15.00
Pax download time	15	5	10.00
Bag download time	30	5	17.50
Fleet service time	25		25.00
Fuel service time	30	20	25.00
Bag upload time	30	10	20.00
Pax upload time	40	10	25.00
Pax upload until blockout	20	10	15.00

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Vita

Captain Karn L. Carlson was born on 29 May 1963 in Brainerd, Minnesota. He graduated from Bemidji High School in May, 1981. He joined the Air Force in March, 1981. After basic and technical training as a KC-135 maintenance team member, his first assignment was at Wurtsmith AFB, Michigan. In January 1983, he was assigned to Royal Air Force Mildenhall, United Kingdom. In December 1986, he left the Air Force to attend Bemidji State University, earning a Bachelor of Science degree in Business Administration in November 1988. He was commissioned through Officer Training School in May 1989. His first assignment was at Ellsworth AFB, South Dakota, where he served as an adjutant and later, emergency actions officer. In February 1992, he was assigned to Kunsan AB, Korea, where he served as an operations plans officer and later, emergency actions officer. In February 1993, he was assigned to Royal Air Force Mildenhall, United Kingdom as an air mobility control center duty officer and later became Chief, Command and Control Flight. In June 1996, he was assigned to Aviano AB, Italy, as Commander, Detachment 3, 621st Air Mobility Support Group. In May 1998 he entered the Advanced Study of Air Mobility Program at the Air Mobility Warfare Center. Upon graduation, he will be assigned to Headquarters, US Southern Command, Miami, Florida.

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