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Increased Capacity Utilizing Aggregation and Consolidation of Contingency Cargo

Cassidy L. Wilson

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Increased Capacity Utilizing Aggregation and Consolidation of Contingency Cargo

THESIS

Cassidy L. Wilson, Master Sergeant, USAF

AFIT-ENS-MS-16-M-132

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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Increased Capacity Utilizing Aggregation and Consolidation of Contingency Cargo

THESIS

Presented to the Faculty
Department of Operational Sciences
Graduate School of Engineering and Management
Air Force Institute of Technology
Air University
Air Education and Training Command

In Partial Fulfillment of the Requirements for the
Degree of Master of Science in Logistics and Supply Chain Management

Cassidy L. Wilson, MBA
Master Sergeant, USAF

March 2016

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Increased Capacity Utilizing Aggregation and Consolidation of Contingency Cargo

Cassidy L. Wilson, MBA
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Jeffery D. Weir, PhD
Chair

Capt Michael P. Kretser
Member
Abstract

Maximizing use of limited airlift assets is a common problem during large contingency operations. Requirements often exceed airlift capacity and fiscal constraints driving the need to aggregate conveyance loads both within and across business lines (Unit Line Number (ULN), Special Assignment Airlift Mission (SAAM), and sustainment). Current methods of consolidation are completed by planners at the 618th Air Operations Center. This process is completed by piecing email correspondence and making individual localized decisions which are not always consistent with big picture efficiency. United States Transportation Command requested a study to create standard business rules or a methodology that can benefit both manual and automated airlift aggregation decisions.

Therefore, this research focuses on the opportunities for reducing the required sorties for the 621st Contingency Response Wing’s Joint Task Force through aggregation and/or consolidation of unit type codes. A working group was created from various subject matter experts to create a methodology that would best work for contingency movements. A literature review was conducted to determine multiple aggregation and consolidation methods that subsequently utilize available vertical cargo space on the aircraft. The methods identified and prescribed by this research reduced the number of sorties required from six to four, resulting in a 33% reduction in required airlift.
Dedication

A special thank you to my wife and children for your patience and support; and finally, a heartfelt thanks goes to my parents for your continued support and reassurance.
Acknowledgments

Thank you to my thesis advisor Dr. Jeffery Weir for guiding me throughout this process; to Capt Michael Kretser, my reader for his attention to detail and pushing me to finish; to CMSgt James McElwee for his sponsorship of this research as well as accommodating data collection and personnel to assist in a working group; to the working group of SMEs: MSgt Dan Briscoe, MSgt Crystal “Chea” Sullivan, MSgt Timothy Manning, MSgt Harley Ricketts, TSgt Mitchell Williams that were vital in creating the research methodology; Mr. Christopher Odell for his advice throughout the process; Finally, great appreciation to Lt Col Christopher Lambert and CMSgt Jamie Vanoss for your much needed support in my selection to AFIT.

Cassidy L. Wilson
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I. INTRODUCTION

1.1 Problem Statement

With recent Department of Defense fiscal constraints, it is vital to capture all available cost-savings opportunities. Cost savings measures are being accomplished in nearly all areas of business except for contingency mission execution. These cuts include shrinking the Army to its smallest size since before World War II, as well as eliminating entire fleets from the Air Force fighter aircraft inventory (Simeone, 2014). This research attempts to capture possible savings on real-world contingency missions by seeking all aggregation and consolidation opportunities across Unit Line Number (ULN), Special Assignment Airlift Mission (SAAM), and sustainment missions.

Currently the 621st Contingency Response Wing (CRW) at McGuire AFB, NJ is responsible for deploying a Joint Task Force-Port Opening (JTF-PO) team, which currently requires up to nine C-17 aircraft. Reducing this requirement by even one aircraft would not only help with fiscal requirements but would likely enhance effective mission capability.
1.2 Research Objectives/Questions

The objective of this research is to develop a process to aggregate/consolidate multiple Unit Type Codes (UTCs) from a Time Phased Force Deployment Data (TPFDD) plan to reduce required airlift for the Air Force JTF-PO heavy alert package.

1.3 Research Focus

The focus of this research will be limited to the JTF-PO package currently supported by the 621st CRW. The research will focus on aggregation, consolidation, and load planning techniques that could greatly impact maximum aircraft utilization while maintaining operational requirements and chalk order priority of all cargo.

1.4 Investigative Questions

1. Does the current deployment process allow for full utilization of both pallets and aircraft capabilities?

2. Can aggregation and consolidation of UTCs reduce required airlift for the Air Force JTF-PO heavy alert package?

3. Will aggregation and consolidation of UTCs reduce or mitigate any current CRW capabilities?

4. What other types of deployment movements can benefit from aggregation and consolidation of UTCs or requirements?

5. What are the current limitations that prevent full utilization of pallets and full utilization of Aircraft?

1.5 Methodology

This research will require data from past JTF-PO deployments including: load plans, packing lists, and passenger/cargo manifests. Data from the 618th Air Operations Center (AOC) will be crucial to know how many aircraft were requested versus how many were actually tasked to complete the mission. This data would show how much cargo was required to be pared and
tailored down to meet mission requirements versus aircraft availability, resulting in possible diminished mission capability.

A working group will be utilized to bring the Subject Matter Experts (SMEs) together to create methodology and reproducible business rules to create efficient and effective load-plan techniques to reduce previously required airlift.

1.6 Assumptions

The main assumption is that all Squadrons within the 621st CRW own the same type of cargo within each Unit Type Code (UTC). This assumption is important since regulations allow for suitable substitutes, which can result in the same UTC having different weight and dimensions. This allows each Squadron to purchase similar UTC equipment to meet the needs of their unique mission. Without this assumption, this research would be required for every Squadron within the CRW. Finally, this research assumes that the entire JTF-PO package will be tasked and not pared down to reduce capabilities. It will also be assumed that all current regulated methods pertaining to deploying UTCs can and will be able to be modified. Another assumption is that only C17 aircraft will be utilized for this study. Although future studies can be conducted to compare the best mix of aircraft for each deployment, most taskings for the CRW are completed utilizing the C17.

1.7 Implications

This research will allow all contingency, SAAM, ULN, and sustainment missions to become more efficient and more effective while maintaining fully capable mission requirements.
II. LITERATURE REVIEW

2.1 Introduction

The purpose of this thesis is to define the process of reducing airlift requirement for deploying the Air Force JTF-PO heavy alert package through efficient load-planning techniques, Unit Type Code (UTC) consolidation/aggregation efforts, and the implementation of the Bi-Level Aircraft Loading System (BALS). This chapter defines key terms, definitions and terminology utilized, while establishing a theoretical framework for the research. All key models, prior studies, and case studies that are referenced will be included as supporting research. Finally, this study is defined in the context of explaining the gap in research that this thesis will fill.

2.2 Key Terms

Unit Type Code (UTC)

According to the Air Force Operations Planning and Execution AFI10-401, “UTC is a potential capability focused upon accomplishment of a specific mission that the military service provides.” It can consist of manpower force element (MFE) only, equipment logistics detail (LOGDET) only, or both manpower and equipment (AFI10-401, 2006). The current process is to maintain UTC integrity to ensure full capability is maintained together with each unit. For this study, we will look at not keeping full UTC integrity by utilizing options to move partial UTCs on earlier than planned chalks, while maintaining priority and on-time arrival of the entire UTC.

Joint Task Force Port Opening Team (JTF-PO)

According to William Krahling, “the Expeditionary Theater Opening (ETO) concept formed the Joint Task Force Port Opening (JTF-PO) designed to provide the Geographic
Combatant Commanders (CCDRs) a rapidly deployable force, flexible in employment throughout a full spectrum of military activities. The jointly trained, air and sea port command and control elements effectively addresses many of the issues that hinder regional Combatant Command CCMD and joint force headquarters ability to manage the flow of forces being introduced into a theater of operation” (Krahling, 2013). The JTF-PO concept was intended to eliminate the following capability gaps in rapidly opening a port of debarkation.

1. Ad hoc command and control (C2) of deployment and distribution operations at the Point of Debarkation (POD).
2. Limited ability to establish a theater distribution network.
3. Limited capability to provide movement control at the POD.
4. Inability to coordinate onward movement from the POD.
5. Lack of intransit visibility (ITV) of material and forces transiting through the POD.

“While individual JTF-PO capabilities already existed within the service components, the methodology of a pre-designated, trained and ready force can mitigate many of the shortcomings that occurred at the aerial and seaports in the past. The true value of an on-call, pre-configured deployable element under the control of United States Transportation Command (USTRANSCOM) has the capability arrive ahead of the Time Phased Force Deployment Data (TPFDD) forces” (Krahling, 2013).

**Aggregation**

Dictionary.com explains aggregation as a “sum, mass or assemblage of particulars; at total or gross amount” (Dictionary, 2015). This paper specifically looks at the concept of aggregation as taking two or more UTCs and combining the contents in a way that best fits into maximum aircraft utilization for the JTF-PO. Aggregation will allow for splitting UTCs onto
separate pallets. An example of aggregation would be to break down a baggage pallet and distribute the baggage evenly throughout the other pallets. This concept would eliminate an entire pallet from the load plan.

**Consolidation**

Dictionary.com explains consolidation as “bringing together (separate parts) into a single or unified whole; unite; combine” (Dictionary, 2015). This study defines consolidation as combining complete UTC’s together without splitting pallet contents other than to combine the entirety of the UTCs contents on the same pallet together. Consolidation will allow complete UTC’s to remain on the same pallet and allow for ease of inventory control at the Airfield of Debarkation (APOD). There are two examples of consolidation: first is to take a small baggage pallet and add small loose cargo items to the pallet; the second would be to utilize the Bi-Level Airlift Loading System (BALS) to stack two pallets on one another thereby eliminating a required pallet position from the load plan.

**Maximum Aircraft Utilization**

According to 4500_9_R_Defense Transportation Regulation (DTR) Part III, maximizing aircraft utilization includes maximizing the aircraft by ensuring it is configured and loaded to maximum capacity using the Allowable Cabin Load (ACL), passenger limits, and aircraft load specifications for each aircraft. For the purpose of this study this definition will also include another factor: that all pallet positions PPs will be maximized to include weight, cube, and height.

**Maximum Pallet Utilization**

Per Sandra J. Wilson, “A 463L pallet can be considered max utilized if it is 90% of max allowed weight or 80% of maximum allowed volume” (Wilson, 2011).
This can become difficult to determine since each position on an aircraft can’t sustain the
maximum weight that a pallet can contain. It is also difficult to figure maximum pallet utilization
for outsized pieces of cargo that require a pallet train.

Each military aircraft is broken down into pallet positions (PP) that are either separated
by 108 inches or 88 inches—depending on how the aircraft is loaded. For the purpose of this
study, a PP will be defined as either an 88 x 108 (max height of aircraft available) or 108 x 88
(max height of aircraft available).

**463L Pallet/Rail System**

The current 463L pallet was designed in the 1950s, but was not incorporated into the Air
Force until 1963 (Schroeder, 1997). The purpose of the pallet and rail system was to increase the
upload and download speed of cargo. The pallet is designed of an aluminum skin covering balsa
wood weighing 290 pounds with the dimensions of 108 x 88 inches with six tie down rings on
each 108 inch side and five tie down rings on each 88 inch side. The 463L pallet is susceptible to
damage if not stored properly. There are approximately 120,000 463L pallets in the war reserve
material and nearly 8,000 pallets are returned for repair annually (Schroeder, 1997).

**2.3 Load-Planning Techniques**

Current load planning of the CRW is conducted by the host wing upon deployment,
taking place after the Joint Inspection and is completed according to Priority of cargo and forces
given by the deploying unit. According to the Defense Transportation Regulation (DTR) Part III
Mobility, vehicles must be backed onto both C-130/C-17 aircraft for ease of offload (DTR Part
III, 2015).
2.4 Vertical Utilization

2.4.1 Bi-Level Airlift Loading System (BALS)

The BALS is a revolutionary concept of stacking two 463L aircraft pallets on top of each other to maximize aircraft utilization. The BALS prototype design passed tests in 2004; however, the design was not implemented due to fiscal constraints for the total cost of ownership within Air Mobility Command (AMC) (Vatcher, 2012). The BALS system was selected as the “Proposed Design” to enhance Airlift fuel efficiency through increased utilization of cargo capacity (Reiman, Main, Anderson, 2013). They further state that the capability to break down the system for storage is an added benefit. Unlike the 463L system, the BALS must include the required load limitation on down force for the pallet and cargo that is on top of the stack. Figure 1 shows the current load testing that was required of the new system in accordance with Section V of the Aircraft Dash 1 (Reiman, et al., 2013).

<table>
<thead>
<tr>
<th>Direction</th>
<th>G Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward</td>
<td>3</td>
</tr>
<tr>
<td>Aft</td>
<td>1.5</td>
</tr>
<tr>
<td>Lateral</td>
<td>1.5</td>
</tr>
<tr>
<td>Up</td>
<td>2</td>
</tr>
<tr>
<td>Down</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Table 1 Load Limitations
The following are features/limitations for the BALS (seen in figure 1) in a project review (Vatcher, 2012).

- Attaches to Standard 463L Pallets
- Fits all USAF cargo aircraft logistic rail systems
- One 3/4 in wrench for assembly
- Assembles in 15 minutes
- Folds flat for storage
- Upper pallet height adjustable 48in to 64in (4in increments)
- Struts removable for side loading
- Weight <850lbs
- Capacity: 6000lbs (lower) 3000lbs (upper)
- Meets Mil-Hdbk 1791 Crash Loads requirements
2.4.2 Tonneau covers

Similar to the BALS is the idea of utilizing a tonneau cover or truck bed cover to place cargo on top of a truck bed that otherwise wouldn’t fit into the truck bed. Utilizing this technology would likely enhance the desired airlift capabilities of many military units as to include the 621st CRW. The main benefactor for this technology would be for the transportation of the CRW’s All-Terrain Vehicles (ATVs). With a variety of different options available, tonneau covers can provide much needed relief of unused floor space while utilizing vertical cargo space as seen in figures 3 and 4. One drawback to the addition of this technology to a military vehicle is that all vehicles with this addition would require a new Air Transportation Test Loading Agency (ATTLA) certification to become air worthy on United States Air Force cargo aircraft.
(DiamondBack ATV Series, 2016)

Figure 2. Single Tonneau Cover Large ATV

Figure 3. Tonneau Cover Dual ATVs
2.5 Air Transportation Test Loading Agency (ATTLA)

The Air Transportability Test Loading Activity (ATTLA) is the Department of Defense agency responsible for the approval of airlift cargo (DODI 4540.07) on fixed wing USAF cargo aircraft. An item should be evaluated as an air transportability problem item if it exceeds any of the parameters listed below (see list of parameters). ATTLA gives assistance to all branches of the federal government, and works directly with contractors and procurement offices to ensure the design of new pieces of equipment allows for air transportability. ATTLA also provides evaluation on aircraft aerial delivery systems, air delivery support equipment, airdrop systems and parachute systems, as well as authoring and maintaining MIL-STD-1791 (ATTLA, 2014).

The following parameters are used to determine if an ATTLA certification is required for each cargo item:

- Length: Greater than 20 ft. (commonly palletized outsized cargo such as pipes, wood, helo blades, light oversized cargo, etc. does not require ATTLA Certification)
- Height or Width: 8 ft
- Weight: Greater than 10,000 lbs
- Floor contact pressure: Greater than 50 psi
- Axle loads: Greater than 5000 lbs
- Wheel loads: Greater than 2500 lbs
- Any item which requires special equipment or procedures for loading and/or securing for flight.
- Unfamiliar items designed to be loaded directly into the aircraft rail system.
- Cargo that exceeds the conditions of certification stated in an existing cert letter.

Exceptions:

- If the cargo exceeds the criteria listed above and load planners/joint inspectors have confirmed an ATTLA Certification letter is not listed on the ATTLA SharePoint site, then the load planner/joint inspector will utilize the following criteria to make the determination if an ATTLA Certification letter is required.

- Items that exceed the allowable loading limits of the aircraft as described in the applicable aircraft TO 1CXXX-9 (Dash -9).

- Items that require special equipment or loading procedures not listed in the applicable aircraft's Dash -9.
- Items designed to interface with the aircraft rail systems (i.e., LSA Adapters) not contained in the applicable aircraft's Dash -9.

- Any type of watercraft/fixed-wing and rotary-wing aircraft not identified in the applicable aircraft's Dash -9.

- Enclosed items (airtight containers, on-board tanks, etc.) not designed with pressure relief devices or items that cannot be configured in a way to allow for aircraft cabin pressure changes.

- Non-palletized items with questionable structural integrity or items with significant damage to the frame or structural components (i.e., Battle damaged equipment).

- Items that cannot be restrained using standard restraint procedures listed in the aircraft's Dash -9 or items requiring specific restraint procedures.

- Items that operate in flight.

- When load planners/joint inspectors make determinations on ATTLA Certification, they must also account for any planned trans-load at downline stations, (i.e., C-17 to C-130, etc.). If an ATTLA Certification letter is required at the trans-load station, load planners/joint inspectors will ensure that the ATTLA Certification letter accompanies the shipment.

- If load planners/joint inspectors cannot determine that an item required an ATTLA Certification letter, contact ATTLA.

Since many of the vehicles already have a certification letter the vital change would be that the tonneau covers would now exceed the conditions of certification stated in the existing certification letter. Therefore, additional certifications could be required for each piece of equipment.

**2.6 Limitations**

One limitation for this study will be the added difficulty of modifying cargo loads to maintain all current safety and security measures. These limitations include hazardous cargo loading criteria, as well as security requirements for sensitive or classified cargo. Many
limitations in transportation are placed on hazardous cargo. There are nine classes and a total of twenty subclasses of hazardous cargo (AFJMAM 24-204, 2012). The subclasses are shown in Figure 4.

<table>
<thead>
<tr>
<th>HAZARD CLASS/DIVISION NUMBER</th>
<th>HAZARD CLASS/DIVISION NAME</th>
<th>HAZARD CLASS/DIVISION NUMBER</th>
<th>HAZARD CLASS/DIVISION NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Explosives (with mass explosion hazard)</td>
<td>4.1</td>
<td>Flammable solid</td>
</tr>
<tr>
<td>1.2</td>
<td>Explosives (with a projection hazard)</td>
<td>4.2</td>
<td>Spontaneously combustible material</td>
</tr>
<tr>
<td>1.3</td>
<td>Explosives (with predominately a fire hazard)</td>
<td>4.3</td>
<td>Dangerous when wet material</td>
</tr>
<tr>
<td>1.4</td>
<td>Explosives (with no significant blast hazard)</td>
<td>5.1</td>
<td>Oxidizer</td>
</tr>
<tr>
<td>1.5</td>
<td>Very insensitive explosives, blasting agents</td>
<td>5.2</td>
<td>Organic peroxide</td>
</tr>
<tr>
<td>1.6</td>
<td>Extremely insensitive detonating substances</td>
<td>6.1</td>
<td>Poisonous (toxic) material</td>
</tr>
<tr>
<td>2.1</td>
<td>Flammable gas</td>
<td>6.2</td>
<td>Infectious substances (etiologic agents)</td>
</tr>
<tr>
<td>2.2</td>
<td>Nonflammable gas</td>
<td>7</td>
<td>Radioactive material</td>
</tr>
<tr>
<td>2.3</td>
<td>Poisonous gas</td>
<td>8</td>
<td>Corrosive material</td>
</tr>
<tr>
<td>3</td>
<td>Flammable liquid</td>
<td>9</td>
<td>Miscellaneous hazardous material</td>
</tr>
</tbody>
</table>

Figure 4. Hazardous Cargo Classes (AFJMAM 24-204, 2012)

The subclasses are then compared further for compatibility. Table 2 explains all of the possible compatible combinations. The letter “X” at the intersection of two classes shows that these hazards must not be loaded, transported, or stored together. The letter “O” at the intersection of two classes shows that these hazards must be separated by at least 88 inches. An “*” indicates that it is a Class 1 material and the Class 1 segregation chart must be utilized for compatibility determination. For this study, the compatibility chart will be utilized as constraints.

All 621st CRW missions will be considered a “Chapter 3” movement. A Chapter 3 movement is approved by USTRANSCOM Deployment Distribution Operations Center (DDOC), for tactical, contingency, or emergency airlift (AFJMAN 24-204, 2012). This
movement type is given the authority to deviate from most compatibility requirements as long as the hazards are separated by the maximum extent possible.

**Table 2. Segregation Table for Hazardous Materials AFMAN 24-204, (2012)**

<table>
<thead>
<tr>
<th>Class or Division Note 7 Note 10</th>
<th>1.1 and 1.2</th>
<th>1.3</th>
<th>1.5</th>
<th>1.6</th>
<th>2.1</th>
<th>2.2</th>
<th>2.3 Gas Zone A</th>
<th>3.1 or Other Than Zone A</th>
<th>4.1</th>
<th>4.2</th>
<th>5.1</th>
<th>5.2</th>
<th>6.1 Liquid Zone A</th>
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**NOTES:**
1. Ammonium nitrate fertilizer may be loaded, transported, or stored with Class 1.1 or 1.5 materials.
2. Do not load, transport, or store fissile class III radioactive material (Class 7) on the same aircraft with any other hazardous material.
3. Normal uranium, depleted uranium, and thorium metal in solid form radioactive materials (Class 7) may be loaded and transported with Class 1.1, 1.2, and 1.5 (explosives).
4. Do not load, transport, or store cyanides or cyanide mixtures (Class 6.1) with any Class 8 materials.
5. Separate nitric acid (Class 8) in cargos by 2.2 m (88 inches) in all directions from other corrosive materials in cargos when loaded on the same aircraft.
6. Do not load, transport, or store charged electric storage batteries (Class 8) on the same aircraft with any Class 1.1 or 1.2.
7. Ship the following materials with each other and with all other hazardous materials without compatibility restrictions (ensure compliance with notes 4, 5, and 6):
8. Class 6.1 toxic solids and liquids (other than PG I, zone A) See Note 4 concerning restrictions for cyanides or cyanide mixtures.
9. Class 8 solids
10. Class 9 (including ORM-D)
11. Excepted Quantities
12. Class 8 corrosive liquids must not be loaded above or adjacent to Class 4 (flammable solid) material or Class 5 (oxidizing) material.
13. Class 2.1 aerosol cans may be shipped with other incompatible items when separated in all directions by a minimum of 88 inches.
14. Items classified by a predominant hazard other than Class 1 but contain small amounts of explosive materials and assigned an explosive compatibility letter for storage may be shipped with Class 1 material according to Table A18.2. For example Class 4.2G may be shipped with Class 1.3G.
III. METHODOLOGY

3.1 Introduction

This section creates a methodology of a reproducible set of business rules for users to utilize for aggregating and consolidating UTCs during contingency deployment operations. Next, these business rules are placed against the specific requirements of the 621st Contingency Response Wings JTF-PO package UTCs. Finally, an analysis of load planning, aggregation/consolidation, and proper use of the BALS is utilized to reduce the airlift requirement for the 621st JTF-PO package.

3.2 Method

The scope of this study is limited to the 52 UTCs assigned to the 621st CRW units for the JTF-PO alert package. This scope ensures a set standard package that is utilized (for alert purposes) on a bi-annual basis by multiple units within the CRW. Furthermore, this shows the reproducibility of this research. The methods used are broken down into two segments; first is a qualitative approach using a working group, and second is a quantitative approach utilizing the Integrated Computerized Deployment System (ICODES) load planning software to optimize each deployment chalk.

A qualitative approach is utilized to create a methodology with subject matter experts (SMEs) at 618th AOC/XOPM as well as logistics planners at the 621st (CRW). This working group constructs and states all current limiting factors that are inherent to the unique mission of the CRW.

Currently the consolidation of contingency mission cargo is handled on a case by case basis through email and phone traffic and doesn’t have a set standard which allows
for consistency in a reproducible method to ensure max mission utilization as a whole.

This research creates a working group of subject matter experts in the Aerial Port, Loadmaster, and Logistics Planners career fields. This group creates business rules that are effective, efficient and reproducible. For this thesis, the primary focus is the development of this methodology, specifically for the 621st CRW JTF-PO support package UTCs, which are bound with a short notice mission deployment of as little of 12 hours after notification.

The Quantitative approach for this research uses the Integrated Computerized Deployment System (ICODES) to complete load plans that will utilize the above mentioned constraints set by the working group. With these constraints and new guidelines, the new load plans will be compared to the original load plans created for planning purposes by the CRW.

3.3 Methodology Implementation

Many of the steps below are completed simultaneously, but have been broken down to allow for any or all steps to be completed while leaving others out if they aren’t beneficial to reducing an additional sortie generation.

3.3.1 Step 1

This step requires a pre-load plan to take account of all empty pallet positions on an Aircraft. Empty pallet positions can be seen circled below in Figure 5.
3.3.2 Step 2

Identify all cargo items that are under the height of 64 inches and under 6000 pounds. The typical item could look like the pallet in Figure 8. These items can now be utilized with the BALS system. Once you have identified these items you are able to determine empty pallet positions by dividing the current pallet positions used by these items by 2 which gives you your new available pallet positions.
3.3.3 Step 3

Take all water and food ration pallets and aggregate these pallets with the open space available on each tent pallet (see figure 9). This will allow PPs to be freed up on the load plans as well as allow for expedient delivery once at location.
3.3.4 Step 4

Place all ATVs on available trucks with tonneau covers as seen in Figure 4. This properly utilizes available vertical space, while freeing up pallet positions on the sortie.
3.3.5 Step 5

If needed consolidate and or aggregate all baggage pallets onto available cargo as a secondary load. This frees up additional PPs, but needs to be secured once at destination. This step could be left off if it will not reduce the required sorties for a required mission since it could be difficult to track each passenger’s baggage with the location within each cargo item.

3.3.6 Step 6

Once all newly available/empty pallet positions are identified, a determination is needed to see if you are able to reduce at least one sortie generation. For example, if the mission is given 10 C17 aircraft sorties then the above steps would need to account for at least 18 empty pallet positions to reduce one sortie. If the mission was utilizing a mixture of aircraft then you would use the number of pallet positions of the smallest aircraft as the limiting factor.
3.3.7 Step 7

Once a determination has been made that enough pallet positions are available to reduce a sortie, a load plan can be developed utilizing the empty pallet positions on each sortie. For the CRW it is important to maintain fidelity of priority or chalk order of all cargo. This cargo has been determined by the Contingency Response (CR) Commander as important to complete their required mission. It is also important to maintain ease of download operations of all sorties, but Chalk 1/JAT is the most critical since many missions are conducted with little to no intelligence of the destination location which could result in the expedient departure of all cargo and personnel from the airfield. For this reason, only rolling stock (RS) will be placed on the JAT sortie. This research has determined that the largest drivable RS should be placed on the JAT mission. An All-Terrain (AT) forklift is the most beneficial if it is able to fit. This would allow for 463L pallets to be load planned on all subsequent missions as well as provide for the drivability to exit the airfield if needed.

Once the JAT is complete, all subsequent sortie load plans can be filled utilizing a leapfrog type method. This would bring cargo from later prioritized chalks up to higher priority chalks. For example, you can move a piece of cargo from chalk 3 to chalk 2 but you cannot move a piece of cargo from chalk 2 to chalk 3. This maintains chalk order and allows for the reduction of pallet positions on each sortie with the end goal of reducing entire chalks. This step will require load planners to maintain proper distance for accommodating the proper amount of passengers that the CR Commander has identified for each chalk. This method will allow more flexibility in aircraft selection and reduce sortie generation while maximizing sortie utilization.
IV. ANALYSIS AND RESULTS

4.1 Comparison of New vs. Old load planning

This chapter provides a comparison of the current business rules utilized by the 621st CRW with the new deployment planning and load planning methodology. A step by step analysis for each load plan is given and compared to the current method utilized. The results are clear that there are many opportunities to utilize critical underutilized vertical space on each sortie while maintaining ease of offload as well as integrity of chalk order. When comparing each load plan it can be difficult to compare since the naming of the load plans are different. Table 2 will help ensure that the proper System Chalk #: is matched up with the correct comparable load plans.

Table 3. Chalk Naming Comparisons

<table>
<thead>
<tr>
<th>New Load Plan System chalk #:</th>
<th>Old Load Plan System chalk #:</th>
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</thead>
<tbody>
<tr>
<td>CHALK 1 JAT</td>
<td>CHALK 1 JAT</td>
</tr>
<tr>
<td>CHALK 2 AF1</td>
<td>CHALK 2 AF1</td>
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<tr>
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<td>CHALK 4 AF3</td>
<td>CHALK 6 AF3</td>
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<tr>
<td>CHALK 6 AF5</td>
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4.1.1 Load Plan Layout explanation

Load plans are provided for each chalk starting with the Air Force Chalk 1 which is the JAT sortie. The first load plan is displayed in its entirety for the purpose of understanding what each part of a load plan is, but subsequent load plans will only display the load plan main deck as
well as cargo description, therefore leaving out associated hazards and signature pages. Old load plans will be placed in their entirety in Appendix A, while new load plans can be seen in Appendix B. The associated hazards are not relevant in this study since all hazards are compatible under the chapter 3 movement. All “New” load plans will have each piece of cargo labeled as to which chalk it was originally assigned.

Due to ICODES software issues, the new load plans “Total Cargo Wt.;” is not correct since ICODES is not computing the cargo that was placed utilizing the “onto”, “into”, or “stacked on” features within the software. All weights that are displayed on the actual load plan for individual pieces are correct. Table 3 can be utilized for proper efficiency comparisons between chalks.
4.2.1 Chalk 1 JAT

4.2.1.1 New Load Plan

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<td>Destination airfield:</td>
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Main Deck

Generic chart with load plan details.

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For Official Use Only
| 4/M | - | OSI SUPPORT TRAILER | 200 | 98 | 95 | 2465 | 723 | 923 | 822 | Y | N | A |
| 5/M | FFKK04E100010XX | Chalk/1 CONTRACTING KIT | 36 | 24 | 14 | 40 | 730 | 766 | 745 | N | N | A |
| 6/M | AWAYHAA$1000230XX | HP3/C 20KWM/COMM GEN TLR MTD | 195 | 86 | 79 | 4130 | 787 | 952 | 845 | Y | N | A |
| 7/M | - | OSI ARMORED SUV 08 | 264 | 89 | 122 | 7560 | 923 | 1165 | 1089 | Y | N | A | P |
| 8/M | - | J/E1AM HMMV 06L004 | 190 | 65 | 103 | 9040 | 956 | 1176 | 1057 | Y | N | A |
| 9/M | - | Chalk/1/ATV 07X1397S | 90 | 48 | 49 | 910 | 1010 | 1100 | 1065 | Y | N | A | R |
| 10/M | - | Chalk/1/ATV 11X1395S | 88 | 48 | 50 | 870 | 1041 | 1059 | 1057 | Y | N | A | R |
| 11/M | AWAYHAA$1000010XX | M1195A1/TRK UT EXP CAP | 198 | 95 | 97 | 11896 | 1190 | 1385 | 1297 | Y | N | A | RZD |
| 12/M | - | J/E1AM HMMV 10L0051 | 193 | 86 | 93 | 8490 | 1200 | 1393 | 1301 | Y | N | A | R |

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Total # of Subfloors: 0
Weight/Subfloor: 0
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Total Cargo Wt: 78861
%ACL: 68
ACL: 130000
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%ACL: 68
ACL: 130000
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Zero Fuel Moment: 33449
CG Station: 901
%MAC: 54.6

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY
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<td>Date: ______________________</td>
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<tr>
<td>Load approved by: _____________________</td>
<td>Date: ______________________</td>
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FOR OFFICIAL USE ONLY
4.2.1.2 Old Load Plan

The methodology utilized for the JAT mission consisted of bringing large rolling stock from later chalks and placing them on to the JAT mission. This action requires additional space to be created to place the required ATVs. A 6 passenger truck is taken from chalk 6 and utilizing...
a tonneau cover and placing 2 ATVs as seen in figure 4 above. By moving all other assets to the rear, additional PPs were available to also move up a 10K A/T forklift from chalk 2. By placing a forklift on chalk one allows the availability of 463L pallets to be placed on chalk 2 without issue. The addition of three passengers is also included to assist with the driving of additional vehicles.

4.2.2 Chalk 2

4.2.2.1 New Load Plan
### 4.2.2.2 Old Load Plan

**Aircraft type/Config:** C-17/STD-AL  
**Delivery method:** AL  
**Unit Being Assembled:** 321 CRIS  
**Type Movement Plan:** TURBO DISTRO  
**Departure date & time:** 20150224 19:40 UTC  
**Departure airfield:** WRI  
**Destination airfield:** WRI  

**Load Description:**

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**Total # of Pax:** 0  
**Weight/Pax:** 0  
**Total PAX Weight:** 0

**Total # of Subpaks:** 0  
**Weight/Subpax:** 0  
**Total Subpax Weight:** 0

**Total Cargo Wt:** 7440000  
**%ACL:** 74  
**AACL:** 1300000

**Cargo/Mail Wt:** 7440000  
**Cargo/Mail Moment:** 92490  
**Operating Weight:** 209480  
**Operating Moment:** 25091  
**Zero Fuel Wt:** 209480  
**Zero Fuel Moment:** 25091

**CG Station:** 915  
**%MAC:** 39.3

---

**SYSTEMS**

**JTF-PQ TD 16-1**  
**20160125 18:33 UTC**
4.2.2.3 Chalk 2 Comparison

With the additional space from moving the 10K AT forklift in from chalk 2, this sortie is able to include an additional 7 pieces of cargo, while reducing 2 passengers by placing them onto chalk 1. Multiple methods are used in creating the new chalk 2 load plan. Additional PPs are now available for two generators, two ATVs, a truck, a 463L pallet. Another method utilized was to consolidate the ITV equipment pallet with a tent pallet. By consolidating this equipment, an additional PP is available from chalk 3.
4.2.3 Chalk 3

4.2.3.1 New Load Plan

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<td>Type movement plan:</td>
<td>TURBO DISTRO</td>
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<td>Departure date &amp; time:</td>
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<td>Departure airfield:</td>
<td>WRI</td>
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<td>Load Description:</td>
<td>WRI</td>
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MAIN DECK

[Diagram of cargo load plan with dimensions and weights]

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<th>HWT</th>
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<th>WT</th>
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<td>92</td>
<td>11340</td>
<td>400</td>
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<td>797</td>
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<td>A</td>
<td>P6</td>
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4.2.3.2 Old Load Plan

Aircraft type/Config: C-17/STD-AL
Delivery method: AL
Unit Being Airlifted: 321 CRG
Type movement plan: TURBO DISTRO
Departure date & time: 20160925 14:29 UTC
Departure airfield: WRI
Destination airfield: 

Load Description:

MAIN DECK

| SQ/ID | TSN (Pallet ID) | Pallet ID | Product | Model | Nomenclature | LEN | WDT | HT | WT | FSN | TSN | GB | HE | FL | V | D | SH | DEC |
|-------|----------------|-----------|---------|-------|--------------|-----|-----|----|----|-----|-----|----|----|---|---|---|----|
| 1/M   | GMR10555SA/100040XX | 64905 | 12345 | 0123456 | ABCD | 93   | 50  | 50 | 1460 | 386 | 479 | 434 | V | 56% | N | A |
| 2/M   | GFEFF2010/0070XX | 64976 | 12345 | 0123456 | ABCD | 88   | 46  | 46 | 1460 | 413 | 501 | 458 | Y | N | R |
| 3/M   | GMR10555SA/100230XX | 0625924 | 0123456 | 0123456 | ABCD | 204  | 92  | 92 | 11340 | 491 | 699 | 591 | Y | N | A |
| 4/M   | FHF1030/0060XX | 7956 | 12345 | 0123456 | ABCD | 78   | 46  | 61 | 1430 | 515 | 599 | 546 | Y | N | A |

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4.2.3.3 Chalk3 Comparison

Chalk 3 includes two new methods from this research. The first method is to break down every water pallet and distribute it onto each tent pallet. Additionally, two large pieces of rolling stock are moved from the last chalk to ensure the proper amount of passengers could be accommodated on this chalk since passengers cannot be placed next to palletized cargo. Furthermore, the baggage pallet is broken down and loose loaded or stowed on available rolling stock. A reduction of 355lbs each was annotated for the loss of this 463L pallet and nets for the water pallet and baggage pallet. Finally, the Bi-Level Airlift Loading System (BALS) is utilized to stack multiple pieces of cargo. This system allows four light carts to be placed in one PP while making two additional PP available. Additional weight is added to the load plan to account for the additional pallet and structure of each BALS.
4.2.4 Chalk 4

4.2.4.1 New Load Plan

Aircraft type/Config: C-17/STD-L
Delivery method: AL
Unit Being Assisted: 521 CRS
Type movement plan: TURBO DISTRO
Departure date & time: 20190205 1611 UTC
Departure airfield: WRI
Departure airport: WRI
Load Description:

MAIN DECK

---

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Total # of Pax: 41
Total # of Subfloor: 0
Total Cargo Wt: 109182
Cargo/Mail Weight: 109182
Operating Weight: 254985
Zero Fuel Weight: 406199
CG Station: 901

---

45
4.2.4.2 Old Load Plan

Chalk 4 consists of all left over cargo and passengers. Loose water was placed onto the 25K Next Generations Small Loader (NGSL) which replaced a PP. Additionally, loose baggage is floor-loaded on this chalk, but could also be placed on the NGSL, or the tent pallets. The
placement of this cargo is to show the different methods that can be utilized without utilizing a PP, and not necessarily the best or most efficient way to move each particular item.

4.2.5 Chalk 5

4.2.5.1 New Load Plan
4.2.5.2 Old Load Plan

A reduction of one C17 Sortie is achieved.

4.2.5.3 Chalk 5 Comparison

All Cargo on Chalk 5 has been moved to earlier chalks and is no longer needed. A reduction of one C17 Sortie is achieved.
4.2.6 Chalk 6

4.2.6.1 New Load Plan

Aircraft type/Config: C-17/STD-AL
Delivery method: AL
Unit Being Articled: 321 CRS
Type movement plan: TURBO DISTRO
Departure date & time: 20150925 16:45 UTC
Departure airfield: VAF
Destination airfield: VTF
Load Description: 

MAIN DECK

909 (97.2 %)

SQU, TSN, Pallet ID, Bumper, Model, Nomenclature, LEN, WDT, HT, WT, FSN, TSN, CR, HZ, FL, V, D, SH, CCC
4.2.6.2 Old Load Plan

All Cargo on Chalk 6 has been moved to earlier chalks and is no longer needed. A reduction of one C17 Sortie is achieved.

4.2.6.3 Chalk 6 Comparision
### 4.3 Chalk Efficiency Comparison

#### Table 4. Chalk Efficiency

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<th>OLD LP PPE UTILIZED</th>
<th>OLD LP % PPE UTILIZED</th>
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#### 4.3.1 Chalk Efficiency Comparison Explanation

Table 4 clearly shows the increased efficiency from a sortie perspective. A chalk by chalk comparison shows that the old load plans use only 84% of pallet position equivalents (PPEs). Counting the unused pallet positions, it would appear that only 17 pallet positions are not being utilized and therefore wouldn’t equate to even a single sortie reduction. As shown in Table 4, the new load plans show a 28% increase in ACL utilization while utilizing all available PPE. The new load plans were able to reduce the number of PPEs by an additional 19. Proper vertical space utilization coupled with aggregation and consolidation methods allows for a total reduction of 36 PPE from this mission and the overall reduction of 2 C17 aircraft sorties. An addition of 12,667lbs on the new load plans is accounted for in the addition of the BALS.
4.4 Summary

The results of this research are very clear. There is merit to utilizing an aggregation and consolidation methodology to load planning of UTCs on contingency missions. Although this method might not be able to save multiple sorties on every contingency deployment, it will allow more UTCs to arrive to the fight faster and more efficiently.
V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides answers to the investigative questions from the first chapter. Furthermore, this chapter establishes recommendations for action and finally it discusses recommendations for future research.

5.2 Investigative Questions

5.2.1 Question 1

Does the current deployment process allow for full utilization of both pallets and aircraft capabilities? I conclude that the current process doesn’t allow for full utilization for pallets. Since all cargo is tasked by a UTC that a single unit maintains and is responsible for palletizing (if it is required to be palletized), then it has to arrive ready for palletization at the Joint Inspection line ready for air shipment. Many times this pallet is not maxed out in weight, height, or cube.

5.2.2 Question 2

Can aggregation and consolidation of UTCs reduce required airlift for the Air Force JTF-PO heavy alert package? From this research it is obvious that aggregation and consolidation of cargo could play an enormous role in increasing airlift capability and therefore reducing the required airlift for many CRW taskings, including the Air Force JTF-PO heavy alert package.

5.2.3 Question 3

Will aggregation and consolidation of UTCs reduce or mitigate any current CRW capabilities? Consolidation of UTCs are already done on a small scale within the CRW
squadrons, but with the new methods of tonneau covers and the BALS, it is unlikely that this will diminish any CRW capabilities and in many ways could enhance the mobility of their forces. Aggregation of cargo could possibly have diminished returns if proper tracking of cargo is not maintained. Any time you are forced to break up a UTC and place it on different pieces of cargo or even different sorties, it could have adverse consequences in the event of a delay or diverted sortie.

5.2.4 Question 4

What other types of deployment movements can benefit from aggregation and consolidation of UTCs or requirements? Consolidation of UTCs is valuable technique that should be looked at by all units that own large amounts of small UTCs, such as Aerospace Ground Equipment (AGE) or airlift units that move their own equipment. Units that have a similar mission of rapidly deploying such as the 621st CRW would benefit. Units such as Red Horse and Prime Beef would be perfect candidates for this method.

5.2.5 Question 5

What are the current limitations that prevent full utilization of pallets and full utilization of Aircraft on UTC movements? Current limitations that are preventing full utilization of UTC movements rest in the current regulations and IT systems. For example; if a 621st CRW unit wants to aggregate a water pallet and distribute it throughout four sorties, it has to create four different UTC requirements and then pair them down. This might be easy for a water pallet, but many times a unit doesn’t have four UTC’s in the system to pull from. There needs to be an option to be able to split a UTC or split a Transportation Control Number (TCN) in Logistics Module (LOGMOD).
5.3 Conclusions of Research

This research shows that the current way of deploying the CRW forces is not the most efficient way to complete this movement. This research also gives multiple examples of how to complete various new methodologies to complete this task.

By utilizing the consolidation method of using tonneau covers and/or the BALS; or aggregation of cargo by splitting up water and baggage pallets, it was proven in this research that it can create more efficient load plans and reduce the required sorties. Although consolidation efforts are relatively easy when it comes to load planning and deployment preparation, aggregation is not easy to plan for until a tasking is sent down.

5.4 Significance of Research

This research has the ability to open new ways of viewing the deployment process not only for the CRW, but possibly all deployments. This research can have an immediate impact on the future of all CRW taskings as well as like-minded units that have a deployment only mission.

5.5 Recommendations for Action

The recommended action of this research is to create an investigation into the employment of the BALS technology. This piece of equipment could single handedly reduce required PP on many sorties within the 621st and other like-minded units. The recommendation that this system be purchased by individual units rather than mirroring the 463L asset program managed by Air Mobility Command. This will limit this resource to only units that will benefit heavily from its use and not become a mandated requirement for all units. Although the tonneau cover will require substantial future research and ATTLA certification, it is highly recommended that this be utilized for efficiency and sortie reduction in the future. The focus of utilizing the
excess height in cargo aircraft is not going away, and with the limitations on 463L pallets, utilizing available rolling stock will greatly benefit sortie utilization and possibly benefit ground logistics at downline destinations.

The above recommendations are great, but will still take time to develop and roll out. This research recommends that all future CR deployments that utilize water and food pallets, distribute the water evenly with other cargo pallets. This will immediately reduce required PPs while allowing space for other cargo or to move cargo forward to earlier sorties.

5.6 Recommendations for Future Research

This research is purposely limited to forming a methodology and examining the possibilities of consolidation and aggregation within and throughout UTCs. There are many available directions that future research can explore further. The following are a few examples:

1. Examine a cost benefit analysis of utilizing this methodology.

   This research has shown that it is possible to reduce 6 sorties down to 4 sorties, but will this increase in weight may require more fuel stops, different routings or require additional air refueling, therefore negating the presumed fuel savings of the 2 lost sorties.

2. Conduct a case study on multiple contingency response units to include CRWs, Redhorse or Prime Beef or other like-minded units to align the benefits of the BALS with their individual missions.

   This would allow the individual units to see first-hand the capability of this asset and possibly reveal other uses such as increase ground transportation capabilities.

3. Creation of an IT system that will systematically produce the most efficient way to consolidate/aggregate UTCs utilizing this methodology.

   This would allow logistics planners to definitively tell exactly how many sorties would be required without losing having to drop possible capabilities. This would also provide the lead time required by the users to know where and how their UTCs would need to be prepared.
5.7 Summary

As the Department of Defense’s budget is shrinking each year, it is vital that we are able to find smarter ways of conducting business in every area possible. Contingency deployments are extremely important to the national security of our country, but this research has shown an example of how efficiency can be gained concurrently on the battlefield as well as in the budget. The current mindset of deploying a UTC individually and in its entirety has noble reasoning, but is not efficient and without efficiency it is not 100% effective. It is the hope of this research that in the future, logistics planning will focus on not just UTC efficiency, but the entire mission efficiency. This research has shown that both can be achieved without compromising the other.
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**ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED**

---

**Air Terminal Representative Signature**

**Aircraft Crewmember Signature**

---

**Load planned by: ___________________  Date: ________________**
Aircraft type/Config: C-17/STD-AL  
Delivery method: AL  
Unit Being Airlifted: 321 CRS  
Type movement plan: TURBO DISTRO  
Departure date & time: 20150924 19:40 UTC  
Departure airfield: WRI  
Destination airfield: WRI  
Load Description:

**MAIN DECK**

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- **Total # of Pax:** 36  
- **Weight/Pax:** 210  
- **Total PAX Weight:** 7560

- **Total # of Subfloors:** 0  
- **Weight/Subfloor:** 0  
- **Total Subfloor Weight:** 0

- **Total Cargo Wt:** 91635  
- **%ACL:** 76  
- **ACL:** 130000

- **Cargo/Mail Weight:** 91635  
- **Cargo/Mail Moment:** 9183

- **Operating Weight:** 284945  
- **Operating Moment:** 25891

- **Zero Fuel Weight:** 398410  
- **Zero Fuel Moment:** 35074

- **CG Station:** 913  
- **%MAC:** 38.6

**SQ/D Flags/Warnings**

1/M  2.2  
1/M  8  
1/M  9  
2/M  2.2  
2/M  3  
2/M  8  
2/M  9  
3/M  2.2  
3/M  3  
3/M  8  
3/M  9  
4/M  2.2  
4/M  3  
4/M  8
**Item by TCN/Pallet ID**

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**Air Terminal Representative Signature**

Load planned by: 

Date: 

**Aircraft Crewmember Signature**

I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(I), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN

**ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE Packaged IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED**
Total # of Pax: 19  Weight/Pax: 210  Total PAX Weight: 3990
Total Cargo Wt: 80701  Weight/Subfloor: 0  Total Subfloor Weight: 0
Cargo/Mail Weight: 80701  Cargo/Mail Moment: 7760
Zero Fuel Weight: 39636  Zero Fuel Moment: 33651
CG Station: 910  %MAC: 37.7

SQ/D Flags/Warnings
1/M 3
1/M 8
1/M 9
2/M 3
2/M 8
2/M 9
3/M 2.2
3/M 3
3/M 8
3/M 9
4/M 9

FOR OFFICIAL USE ONLY

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ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED.

I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(I), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN.

Air Terminal Representative Signature

Aircraft Crewmember Signature

Load planned by: ___________________________ Date: ___________________________

Aircraft type/Config: C-17/STD-AL
Delivery method: AL
Unit Being Airlifted: 321 CRG
Type movement plan: TURBO/DISTRO
Departure date & time: 20150925 15:11 UTC
Departure airfield: WRI
Destination airfield: WRI
Load Description:

MAIN DECK

1/M FGMR08$$A100030XX /GENERATOR 7E1CC 95 68 92 3520 400 495 442 Y N A R
2/M FGMR08$$A100020XX /GENERATOR 7E1CC 95 68 82 3990 401 496 445 Y N A R
3/M FHMHC10XS200070XX /FLOODLIGHT FL-1D 78 48 61 1480 525 603 555 Y N A
4/M FHMHC10XS200030XX /FLOODLIGHT FL-1D 78 48 61 1520 528 606 558 Y N A

S&D TCN/Pallet ID Bumper Model/Nomenclature LEN WDT HT WT FSN TSN CB HZ FL V D SH CCC
1/M FGMR08$$A100030XX -GENERATOR 7E1CC 95 68 92 3520 400 495 442 Y N A R
2/M FGMR08$$A100020XX -GENERATOR 7E1CC 95 68 82 3990 401 496 445 Y N A R
3/M FHHC10XS200070XX -FLOODLIGHT FL-1D 78 48 61 1480 525 603 555 Y N A
4/M FHHC10XS200030XX -FLOODLIGHT FL-1D 78 48 61 1520 528 606 558 Y N A
FOR OFFICIAL USE ONLY

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ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED

I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(l), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN

Air Terminal Representative Signature

Aircraft Crewmember Signature
Aircraft type/Config: C-17/STD-AL
Mission type: Mobility
Delivery method: AL
Mission #: TURBO DISTRO
Unit Being Airlifted: 321 CRS
Type movement plan: TURBODISTRO
Aircraft Tail #: 0001
Depature date & time: 20150925 16:00 UTC
Departure airfield: WRI
Destination airfield: WRI
Load Description:

MAIN DECK

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Total # of Pax: 8
Weight/Pax: 210
Total PAX Weight: 1680

Total # of Subfloors: 0
Weight/Subfloor: 0
Total Subfloor Weight: 0

Total Cargo Wt: 25570
%CACL: 21
ACL: 130000

Cargo/Mail Weight: 25570
Cargo/Mail Moment: 2642
Operating Weight: 284945
Operating Moment: 25891
Zero Fuel Weight: 312195
Zero Fuel Moment: 28533

CG Station: 914
%MAC: 38.9

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Item by TCN/Pallet ID

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ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED.

I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(I), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN.

Air Terminal Representative Signature

Aircraft Crewmember Signature

Load planned by: ___________________________  Date: ___________________________

Aircraft type/Config: C-17/STD-AL
Delivery method: AL
Unit Being Airlifted: 321 CRS
Type movement plan: TURBO DISTRO
Departure date & time: 20150925 16:45 UTC
Departure airfield: WRI
Destination airfield: WRI
Load Description: MAIN DECK

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20160125 18:33 UTC

Aircraft type/Config: C-17/STD-AL
Delivery method: AL
Unit Being Airlifted: 321 CRS
Type movement plan: TURBO DISTRO
Departure date & time: 20150925 16:45 UTC
Departure airfield: WRI
Destination airfield: WRI
Load Description: MAIN DECK

FOR OFFICIAL USE ONLY

66
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ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED

I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(I), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN

Air Terminal Representative Signature

Aircraft Crewmember Signature
APPENDIX B

Aircraft type/Config: C-17/STD-AL
Delivery method: AL
Unit Being Airlifted: 321 CRS
Type movement plan: TURBO DISTRO
Departure date & time: 20150929 13:31 UTC
Departure airfield: WRI
Destination airfield: WRI
Load Description:

MAIN DECK

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**SO/D**: Safety of Flight

**Flags/Warnings**: Special Operating Conditions

**SQ/D Class/Zone**: Special Qualifications/Designations

- **1/M**: 8
- **1/M**: 9
- **1/M**: 9
- **2/M**: 2.2
- **2/M**: 3
- **2/M**: 8
- **2/M**: 9
- **3/M**: 3
- **3/M**: 8
- **3/M**: 9
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- **5/M**: 3
- **5/M**: 8
- **5/M**: 9
- **7/M**: 8
- **7/M**: 9
- **7/M**: 9
- **7/M**: 9
- **8/M**: 9
- **9/M**: 2.2
- **9/M**: 3
- **9/M**: 8
- **9/M**: 9
- **10/M**: 2.2
- **10/M**: 3
- **10/M**: 8
- **10/M**: 9
- **11/M**: 2.2
- **11/M**: 3
- **11/M**: 8
- **11/M**: 9
ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED

I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(I), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN

____________________________  ______________________________
Air Terminal Representative Signature  Aircraft Crewmember Signature

Load planned by: __________________________  Date: ________________
Load approved by: __________________________  Date: ________________
### Aircraft Information

- **Aircraft type/Config:** C-17/STD-AL
- **Delivery method:** AL
- **Unit Being Airlifted:** 321 CRS
- **Type movement plan:** TURBO DISTRO
- **Departure date & time:** 20150924 19:40 UTC
- **Departure airfield:** WRI
- **Destination airfield:** WRI
- **Load Description:**

### Mission Information

- **Mission type:** Mobility
- **Mission #:** TURBO DISTRO
- **Aircraft Tail #:** 00003
- **System chalk #:** CHALK 2 AF1
- **AFMAN 24-204 Chapter 3 Move**

### MAIN DECK

![Main Deck Diagram]

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<th>TCN/Pallet ID</th>
<th>Bumper</th>
<th>Model/Nomenclature</th>
<th>LEN</th>
<th>WDT</th>
<th>HT</th>
<th>WT</th>
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<th>TSN</th>
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<th>D</th>
<th>SH</th>
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FOR OFFICIAL USE ONLY
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Total Cargo Wt: 88890
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ACL: 130000

Cargo/Mail Weight: 88890
Cargo/Mail Moment: 9240

Operating Weight: 284945
Operating Moment: 25891

Zero Fuel Weight: 383895
Zero Fuel Moment: 35131

CG Station: 915
%MAC: 39.3

5Q/D Flags/Warnings

5Q/D Class/Zone
1/M 2.2
1/M 3
1/M 9
2/M 3
2/M 8
2/M 9
3/M 3
3/M 8

FOR OFFICIAL USE ONLY

3/M 9
4/M 2.2
4/M 8
4/M 9
5/M 2.2
5/M 3
5/M 8
5/M 9
6/M 2.2
6/M 3
6/M 8
6/M 9
7/M 3
7/M 8
7/M 9
10/M 3
10/M 9
12/M 2.2
12/M 3
12/M 9
14/M 2.2
15/M 3
ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED

I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(I), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN

Air Terminal Representative Signature

Load planned by: __________________________ Date: __________________________

Load approved by: __________________________ Date: __________________________

Aircraft Crewmember Signature

Aircraft type/Config: C-17/STD-AL
Delivery method: AL
Unit Being Airlifted: 521 CRS
Type movement plan: TURBO DISTRO
Departure date & time: 20/150925 14:29 UTC
Departure airfield: WRI
Destination airfield: WRI
Load Description:

MAIN DECK

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Total # of Pax: 19
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Total # of Subfloors: 0
Weight/Subfloor: 0
Total Subfloor Weight: 0

Total Cargo Wt: 102621
%ACL: 82
ACL: 130000

Cargo/Mail Wt: 102621
Cargo/Mail Moment: 9769

Operating Wt: 284945
Operating Moment: 25691

Zero Fuel Wt: 397381
Zero Fuel Moment: 35660

CG Station: 897
%MAC: 33.5
ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED

I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(I), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN

______________________________  ________________________________
Air Terminal Representative Signature  Aircraft Crewmember Signature

Load planned by:  ___________________________  Date:  ________________

Load approved by:  ___________________________  Date:  ________________
Aircraft type/Config: C-17/STD-AL
Mission type: Mobility
Delivery method: AL
Mission #: TURBO DISTRO
Type Being Airlifted: 321 CRS
Aircraft Tail #: 00006
Type movement plan: TURBO DISTRO
System chalk #: CHALK 4 AF3
Departure date & time: 20150925 15:11 UTC
AFMAN 24-204 Chapter 3 Move
Departure airfield : WRI
Destination airfield: WRI
Load Description:

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**Operating Weight:** 284945  
**Operating Moment:** 25891  
**Zero Fuel Weight:** 406199  
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**%MAC:** 34.6

**Flags/Warnings**

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**ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED**

**I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(I), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN**

---

**Air Terminal Representative Signature**

**Load planned by:** ___________________________  
**Date:** ________________

**Load approved by:** ___________________________  
**Date:** ________________

---

77
Aircraft type/Config: C-17/STD-AL
Delivery method: AL
Unit Being Airlifted: 321 CRS
Type movement plan: TURBO DISTRO
Departure date & time: 20150925 16:00 UTC
Departure airfield: WRI
Destination airfield: WRI
Load Description: 

**MAIN DECK**

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Aircraft Crewmember Signature

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Aircraft type/Config: C-17/STD-AL
Delivery method: AL
Unit Being Airlifted: 321 CRS
Type movement plan: TURBO DISTRO
Departure date & time: 20150925 16:45 UTC
Departure airfield: WRI
Destination airfield: WRI
Load Description:

### Load Description

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- Weight/Pax: 0
- Total PAX Weight: 0
- Total # of Subfloors: 0
- Weight/Subfloor: 0
- Total Subfloor Weight: 0
- Total Cargo Wt: 0
- %ACL: 0
- ACL: 130000
- Cargo/Mail Weight: 0
- Cargo/Mail Moment: 0
- Operating Weight: 284945
- Operating Moment: 25891
- Zero Fuel Weight: 284945
- Zero Fuel Moment: 25891
- CG Station: 909
- %MAC: 37.2

### SQ/D Flags/Warnings

### SQ/D Class/Zone

ALL HAZARDOUS MATERIALS COVERED BY THIS LOAD PLAN HAVE BEEN INSPECTED AND FOUND TO BE PACKAGED IN THE PROPER OUTSIDE CONTAINER FREE OF VISIBLE DAMAGE AND LEAKS AND IS PROPERLY CERTIFIED

I HAVE BEEN BRIEFED ACCORDING TO AFMAN 24-204(I), PARAGRAPH 1.2.9, ON HAZARDOUS CARGO COVERED BY THIS LOAD PLAN

---

Air Terminal Representative Signature

Aircraft Crewmember Signature

Load planned by: __________________________ Date: ________________

Load approved by: __________________________ Date: ________________
**Problem Statement**

Capture possible savings on real-world contingency missions by seeking all aggregation/consolidation opportunities.

**Consolidation Opportunities**
- Tonneau Covers
- ATV’s
- Bi-Level Airlift Loading System
- Small/light weight UTCs

**Aggregation Opportunities**
- Water Pallets
- Baggage Pallets

**Question 1:** Does the current deployment process allow for full utilization of both pallets and aircraft capabilities?

**Question 2:** Can aggregation and consolidation of UTCs reduce required airlift for the Air Force JTF-PO heavy alert package?

**Question 3:** Will aggregation and consolidation of UTCs reduce or mitigate any current CRW capabilities?

**Question 4:** What other types of deployment movements can benefit from aggregation and consolidation of UTCs or requirements?

**Question 5:** What are the current limitations that prevent full utilization of pallets and full utilization of Aircraft?

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**Results**

- Achieved a 33% sortie reduction with consolidation and aggregation efforts.
- Increased Allowable Cabin Load (ACL) utilization by 28%.
- Increased Pallet Position Equivalent utilization by 16%

**Significance of Research**

This research has the ability to open new ways of viewing the deployment process not only for the CRW, but possibly all deployments. This research can have an immediate impact on the future of all CRW taskings as well as like-minded units that have a deployment only mission.

**Conclusion**

As the Department of Defense's budget is shrinking each year, it is vital that we are able to find smarter ways of conducting business in every area possible. Contingency deployments are extremely important to the national security of our country, but this research has shown an example of how efficiency can be gained concurrently on the battlefield as well as in the budget. The current mindset of deploying a UTC individually and in its entirety has noble reasoning, but is not efficient and without efficiency it is not 100% effective. It is the hope of this research that in the future, logistics planning will focus on not just UTC efficiency, but the entire mission efficiency. This research has shown that both can be achieved without compromising the other.
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# Increased Capacity Utilizing Aggregation and Consolidation of Contingency Cargo

**Maximizing use of limited airlift assets is a common problem during large contingency operations. Requirements often exceed airlift capacity and fiscal constraints driving the need to aggregate conveyance loads both within and across business lines (ULN, SAAM, and sustainment). Current methods of consolidation are completed by planners at the 618th Air Operations Center. This process is completed by piecing email correspondence and making individual localized decisions which are not always consistent with big picture efficiency. United States Transportation Command requested a study to create standard business rules or a methodology that can benefit both manual and automated airlift aggregation decisions. Therefore, this research focuses on the opportunities for reducing the required sorties for the 621st Contingency Response Wing’s Joint Task Force through aggregation and/or consolidation of unit type codes. A working group was created from various subject matter experts to create a methodology that would best work for contingency movements. A literature review was conducted to determine multiple aggregation and consolidation methods that subsequently utilize available vertical cargo space on the aircraft. The methods identified and prescribed by this research reduced the number of sorties required from six to four, resulting in a 33% reduction in required airlift.**

**Contingency Mission UTC Aggregation/Consolidation**

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<td>(937) 255-6565, x 4523 (<a href="mailto:Jeffery.Weir@afit.edu">Jeffery.Weir@afit.edu</a>)</td>
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