



**THE VIABILITY OF THE AIR MOBILITY
COMMAND PURE PALLET PROGRAM FOR US
ARMY REPARABLE RETROGRADE SHIPMENTS**

THESIS

William L. Jackson, Jr., Senior Master Sergeant, USAF

AFIT/GLM/ENS/07-05

**DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY**

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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SHIPMENTS

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William L. Jackson, Jr., BS

Senior Master Sergeant, USAF

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William L. Jackson, Jr., BS
Senior Master Sergeant, USAF

Approved:

//signed//

16 March 2007

Dr. William A. Cunningham (Chairman)

date

//signed//

16 March 2007

Dr. Alan W. Johnson (Member)

date

Abstract

Last year, Congress approved \$17.1 billion dollars, an increase of \$4 billion dollars more than originally was requested by the Bush Administration, for US Army vehicles to be repaired or replaced (commonly referred to as reset) as a result of military operations in Iraq and Afghanistan. A large portion of the repair workload falls upon the Army depots in Anniston and Red River in Texarkana, Texas and must rely on the DOD transportation system for air and surface movement of retrograde cargo deemed serviceable and unserviceable to fill requisitions and backorders for entry into the national supply inventory.

Headquarters Air Mobility Command developed an initiative for distribution to the US Central Command to allow supply requisition shipments to accumulate based on customer defined delivery timelines to a single unit destination to eliminate the need of mixed destinations on a single pallet, thereby avoiding intermediate handling and increase in-transit visibility. This research viewed the depot and the item managers as the customers due to the value they collectively add in equipment repairs and how retrograde is directed to meet the needs of the end user. Subject matter experts from Army Materiel Command provided their inputs through a series of focused interviews to calculate their value placed on transportation system and convergence with a cost comparison of the accumulation principles of the AMC pure pallet program. The results indicated that the AMC pure pallet program was not a viable option due to conflicts with customer requirements, high variability in the volume of retrograde generated to successfully utilize this option despite the savings in using consolidated shipments.

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To my wife

Acknowledgments

I would like to thank my Lord and Savior, Jesus Christ. The last 18 months has been a tremendous period of growth on a spiritual, mental, and professional level. It was only through my faith and trust in Him that I was able to endure this academic experience.

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William L. Jackson, Jr.

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THE VIABILITY OF THE AIR MOBILITY COMMAND PURE PALLET PROGRAM FOR US ARMY REPARABLE RETROGRADE SHIPMENTS

I. Introduction

Background

Beginning in October 2003 with the Defense Logistics Agency (DLA) defense depots and expanding in March 2004 to the CONUS aerial ports of embarkation (APOE), Headquarters Air Mobility Command (AMC) established the Pure Pallet initiative program to consolidate cargo by service and supply support activity (SSA), and then ship it through distribution channels to specified destinations in the US Central Command (CENTCOM) Area of Responsibility (AOR). The initiative entails individual routing plans from Dover, Charleston, and Ramstein Air Base to 55 SSAs in the AOR. As the primary customers, the US Army and Marine Corps specify how long cargo is held at the individual SSAs before pallets are built and shipped to the theater (Lapp, 2006:1). Under this initiative, inbound pure pallets at deployed aerial ports are unloaded from the aircraft and either processed out of the airlift system and immediately placed on a truck, or processed onto another aircraft for movement to the forward operating location. The primary benefits of this service include minimizing intermediate cargo handling at aerial ports of debarkation in theater, minimizing damage, reducing customer wait time (CWT), reducing exposure to the threat of attacks, and maintaining complete in-transit visibility (GAO, 2005:35). Since its inception over three years ago, the pure pallet program is working as it was intended by providing end-to-end distribution to the warfighter while minimizing loss, damage, and excessive handling of shipments (Dye, 2005:100). In only

the first few months, the pure pallet program was deemed successful from the perspective of the warfighter. In his testimony before the House Armed Service Committee, Brigadier General Edward G. Usher III, then Director of Logistics, Policies, and Strategic Mobility, US Marine Corps, had this to say about the pure pallet program.

During OIF, the Marine Corps realized enormous inefficiencies in processing incoming cargo and trying to distribute it to the proper units. “Pure Pallet” builds Marine Corps sustainment cargo pallets and containers for shipment by air/sea, designated to Marine Corps units within a specific geographic location. The “Pure Pallet” initiative, with RFID application, greatly reduces distribution process time-lines and significantly enhances In-Transit Visibility. The pallets are built at distribution centers with RFID and optical memory card technology that will preclude the need to break down the cargo at various stages in the transportation pipeline and greatly improve In-Transit Visibility (House Armed Services (a), 2004:4)

Although the pure pallet program has provided an invaluable service to the warfighter, many major events and policy changes leading up to its implementation helped shape the program into a success. The first development that supported efficient cargo flow was the establishment of the Theater Distribution Center (TDC), initially developed to manage the flow of cargo trucked between the APOD and the SSAs, and its evolution into a pallet cross-dock facility. Secondly, the CENTCOM Deployment Distribution Center (CDDOC) was established in a partnership with DLA and USTRANSCOM to coordinate the flow of strategic and tactical airlift and reduce saturation at APODs and TDCs (Mongold, 2005:37). Perhaps the most significant event was the Secretary of Defense designation of the commander of USTRANSCOM as the Distribution Process Owner (DPO) who is responsible for “directing and supervising the execution of the Strategic Distribution System as well as for improving the overall

efficiency and interoperability of distribution related activities—including deployment, sustainment, and redeployment—during peace and war” (Dye, 2006:1).

With the success of the pure pallet program for distribution, the question arises whether this program can provide the same level of service for the retrograde process (Beckmann, 2006). Retrograde is the “process of collecting, retrieving, and recovering material and supplies and then returning them to units, depots, and pre-positioned stock back in the United States to repair and eventually be placed back on the shelf” (Garfinkel, 2005:191). The terms retrograde and retrograde of cargo are used synonymously through DOD and Department-level publications, policies, and military-directed commercial studies. A reparable is a component or part of a weapon system that can be reconditioned or repaired at an efficient cost (Folkeson and Brauner, 2005: 13). Reparables are important because they are intended to be their own source of future serviceable components (Diener, 2005:xi). Unserviceable assets are considered as retrograde as well but are deemed as “economically un-repairable,” (Folkeson and Brauner, 2005: 2). Unserviceable assets are extracted from end-user items and are used to supplement the production lines at the depot for bringing repairable items to full serviceable status (Folkeson and Brauner, 2005: 25). Therefore, retrograde deemed repairable or depot level repair (DLR) and items declared unserviceable have a reciprocal relationship in meeting customer demand in the event of a backorder or low inventory situation. So, it is worth examining, whether or not the pure pallet process can contribute to greater efficiency in returning these reparable items to their appropriate units to better sustain the supply chain for forces in theater.

In order to establish the proper framework for the retrograde process and its relation to supply chain operations, a brief examination of the basic terminology is required. First, supply chain management (SCM) is a developing concept, resulting in a variety of definitions among entities. Spekman, et al, define SCM as:

The process for designing, developing, optimizing, and managing the internal and external components of the supply system, including material supply, transforming materials and distributing finished products or services to customers, that is consistent with overall objectives and strategies (631).

Lambert, Cooper, and Pagh (2001:38) has a more refined definition of SCM as:

The integration of key business processes from end user through original supplies that provides products, services, and information that add value for customers and other stakeholders.

The Department of Defense defines the supply chain as:

To supply materiel and logistics services to DoD units throughout the world, the DoD Components maintain a supply chain consisting of weapon system support contractors, retail supply activities, distribution depots, transportation networks including contracted carriers, Military Service and Defense Logistics Agency (DLA) integrated materiel managers (IMMs), weapon system program offices, commercial distributors and suppliers including manufacturers, commercial and organic maintenance facilities, and other logistics activities (e.g., engineering support activities (ESAs), testing facilities, cataloging services, reutilization and marketing offices (DOD 4140.1-R, 2003:16-17).

The purpose for the distinction among the three definitions is to gain an understanding of what the supply chain entails and how supply chain management is viewed from varying perspectives. The first definition comes from an article written in the *International Journal of Physical Distribution and Logistics* based on a funded study for Ernst & Young LLP, Center for Business Knowledge, and reflects a unique business perspective (Spekman, 1998:1). The second definition reflects an academic perspective from pioneers in the field of logistics. The last definition is a view unique to the military and its global mission. Parallel distinctions can be found in the literature with respect to

reverse supply chain management and reverse logistics, which apply more specifically to the retrograde process that is the focus of this research.

Managing the reverse flows of the typical supply chain is called the reverse supply chain management. Reverse supply chain management (RSCM) is defined “as the effective management of the series of activities required to retrieve a product from a customer and either dispose of it or recover value” (Prahinski and Kocabasoglu, 2006:519). Prahinski and Kocabasoglu and Kocabasoglu (2006) defined reverse logistics as one of the components within RSCM (519). So, retrograde or retrograde of reparable is identified as a subset of reverse logistics. The Reverse Logistics Executive Council defines reverse logistics as:

The process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal (Rogers & Tibben-Lembke, 1999).

In the context of military logistics and this thesis research, retrograde will be defined as the ‘reverse’ movement of reparable cargo from a forward operating location back to the depot. The primary emphasis of retrograde of reparable cargo is extracting value and extending the product life cycles of the Army’s major weapon systems. In a recent RAND study of the Army Reverse Logistics Pipeline, Diener, et al., state that “value recovery is an important focus of the US Army reverse logistics pipeline, since component repair is the primary source of inventory replenishment for many expensive Army parts or secondary items”(Diener, 2005:1). The critical need for the value recovery of reparable is highlighted by the US Army’s interest in utilizing Air Mobility Command’s Pure Pallet Program initiative to capitalize on the same benefits that have

been realized for cargo movement through the distribution channels (Wiskow, 2006: Unpublished).

Just as USTRANSCOM is the DPO, responsible for all distribution-related activities, a May 2006 revision by the Deputy Secretary of Defense included both distribution and retrograde operations:

Overseeing the overall effectiveness, efficiency, and alignment of DOD-wide distribution activities, including force projection, sustainment and redeployment/retrograde operations. Establishing the concepts and operational framework relating to the planning and execution of DOD transportation operations (DAU, 2006:1a).

This is a significant change to the original memo as it essentially designates USTRANSCOM as the process owner for distribution *and* retrograde operations for the entire DOD. As in the case with distribution where the warfighter or ultimate customer had one process owner that positively affected change and increased value to the customer in the distribution process, similar benefits could materialize throughout the retrograde process. However, some unique challenges occur in determining the identity of the customer for a given retrograde item. From a process perspective, once an item has been deemed reparable by the forward-deployed mechanic or SSA, it is shipped back through the supply and transportation system to the depot for repair, and then returned to the national inventory for future demands (Folkesson and Brauner, 2005:20). Thus, its status doesn't change and no value is added until after it has been repaired. Since the AMC Pure Pallet program operational parameters are set by the customer for how long pallets are held at the depots before being shipped to SSAs, the identification of the customer and capturing their value or requirements to the entire retrograde process is critical for successful implementation.

In his testimony in a recent GAO Report entitled, *Preliminary Observations on Equipment Reset Challenges and Issues for the Army and Marine Corps before US House of Representatives Subcommittee on Readiness and Tactical Air and Land Force*, Mr.

William M. Solis, Director of the Defense Capabilities and Management stated that:

Age, along with the harsh environment in theater and combat conditions over long periods of time, magnifies an already growing problem of equipment repair, replacement, and procurement that existed even before the onset of combat operations in Iraq and Afghanistan....In addition to the billions of dollars already spent to maintain this well-worn equipment for on-going operations, the Army and Marine Corps will likely incur large expenditures in the future to repair or replace (reset) a significant amount of equipment when hostilities cease....The Army estimates its total reset bill for fiscal year 2006 alone to nearly \$13.5 billion....Equipment used in operations in Iraq and Afghanistan will eventually require more intensive repair and overhaul than what is typically expected in peacetime (GPO, 2006:1).

With no end in sight in the foreseeable future to current military operations in Iraq and Afghanistan, the systemic problems associated with the movement of reparable parts to the depot will only exponentially increase over the coming years. Therefore, this research seeks to examine whether US Army high-valued retrograde Class IX cargo from the CENTCOM AOR can utilize and benefit from the pure pallet program from the deployed aerial ports to the CONUS defense depots.

In 1995, the US Army launched the Velocity Management (VM) Initiative that “focuses on improving the speed and accuracy with which materials and information flow from providers to the end users (Dumond, et al, 2001:ix). As a result of using a process-improvement methodology, the Army was able to streamline its order fulfillment process for spare parts by two-thirds in the CONUS and “75 percent at several major installations” (Folkeson and Brauner, 2005:1). The initial intent of the VM Initiative only applied to distribution, but as efforts developed to extend the initiative to the order-

fulfillment process at the tactical level, initial analysis revealed wholesale backorders were higher than expected (Folkesson and Brauner, 2005:xi). According to a recent

RAND Study entitled, *Improving the Army's Management of Repairable Spare Parts*:

The pattern of high BO rates suggest that improvements are needed in the process for managing and repairing capabilities and capacity can also contribute directly to other depot programs (e.g., components are also used to repair high repairable assemblies and even for end-item overhauls), in addition to returning serviceable assets to the shelf, where they will be available for issue to those Army customers directly responsible for repairing mission equipment (Folkesson, 2005:xi).

This RAND Study identified three critical issues contributing to the challenges in the repairable-management process: (1) demand uncertainty and variability on long-term forecasts, (2) the lack of short-term re-planning, and (3) the inability to respond to changing customer requirements (Folkesson and Brauner, 2005:xii). Folkesson and Brauner position is that the Army repairable-management process “begins with the identification of the malfunctioning component and ends when a serviceable asset is made available through either repair or vendor replenishment to replace the item issued to the mechanic” (Folkesson and Brauner, 2005: xii). This is an important point because this thesis will not only examine the viability of the AMC Pure Pallet program in terms of improving the efficiency and effectiveness of the Army retrograde process, but will also examine the movement of Army repairable parts from a process viewpoint by making clear distinctions on where a component is designated a repairable until the point where value is added in changing the status to a serviceable part or component. To understand the depth of the Army's challenges with maintaining equipment and needed repairs given the harsh environmental conditions in Iraq, Mr. Solis, in the previously mentioned 2006 GAO Report stated that “the Coalition Forces Land Component Commander estimated

that there were approximately 300,000 equipment items in the theater provided equipment (TPE) inventory in Iraq, including more than 26,000 vehicles” (GPO, 2006: 6). With most of this equipment left as early as late 2003 and since maintained at the unit level, the Army has not been able to rotate this equipment back to the CONUS for depot-level maintenance (GPO, 2006:7).

In March 2006, USTRANSCOM and USCENTCOM formed a Tiger Team to examine and map out the entire US Army retrograde process from the deployed location to the defense depots. Their main focus was to maintain in-transit visibility through the application of RFID tags from source to destination on only high-priority, high-cost reparable parts on major weapon systems such as the Bradley fighting vehicle and Blackhawk helicopter (Lapp, 2006:1). In May 2003, USTRANSCOM, at the request of the services, initiated a process by which high-priority Class IX retrograde cargo can be shipped rapidly from the USCENTCOM AOR to the CONUS defense depots at a flat rate of \$3.00 per pound through the use of a JCS Project Code 9GN (USTRANSCOM TCJ5, 2003:1). The intent of the project code was to provide a “port-to-door” service to the depot under an inter-modal billing rate once the cargo arrived at the deployed APOE. Once in the airlift system, the retrograde cargo would be identified for “rapid movement,” to the CONUS APOD, and provided a “cross-dock” type service through the aerial ports to a commercial truck to the depot (USTRANSCOM TCJ5, 2003:1). What makes this action so disturbing is the fact that in the three years of the project code existence as a customer service initiative, the code has only been used in .44 percent of all US Army retrograde air cargo shipments within the Defense Transportation System (Lapp, 2006).

Problem Statement

The *2006 Capability Gaps and Process Opportunities Listing* (USTRANSCOM, 2006:46), a list formed by the general officers at USTRANSCOM and the Defense Logistics Agency (DLA) to identify the most important challenges facing the entire DOD supply chain, cites some of the following problems, lessons learned, and operational impact regarding retrograde scheduling and preparation: “customers not consistently following processes/policies for retrograde”; “retrograde materials frequently not shipped according to disposition instructions causing delays, damage, and unnecessary transportation, processing, and handling costs,” a “lack of retrograde consolidation causing unpredictable receiving and workload at depots and repair facilities” and “insufficient use of backhaul resources and infrastructure” (USTRANSCOM, 2006:46).

This research will examine the relationship between the AMC Pure Pallet Program, a customer-based initiative, and the influence on the reverse supply chain efficiency and effectiveness for US Army Class IX retrograde cargo from the CENTCOM AOR. Since the program is customer-based, this study will have to define the customer and determine customer value or the expectation the customer places on transportation service within the context of the retrograde process. Typically, this boils down to determining whether the customer values efficiency, where cost is the primary concern or responsiveness where time has the highest priority, regardless of cost. The second portion of the study will use the results of the analysis of value to the customer as the baseline for converging historical transportation data on US Army retrograde cargo to identify any distinct differences between historical air transportation movement data and the requirements of the customer.

Research Question

The research question guiding this study is: “Is the Air Mobility Command Pure Pallet program a viable option for retrograde of US Army Class IX high value reparable pallets from the CENTCOM AOR to DOD CONUS depots?”

Investigative Questions

In order to answer this research question, the following six investigative questions must be answered:

1. How is the commercial industry managing the reverse movement of products and reparable assets and are these viable options for the DOD?
2. Who is the customer in the retrograde process and what does the customer value in the movement of reparable parts from the CENTCOM AOR?
3. What is the current retrograde process for US Army Class IX reparable shipments from the CENTCOM AOR to the defense depots?
4. What contributing factors led to the successful implementation of the AMC Pure Pallet program?
5. Does the intent and business rules of the AMC Pure Pallet Program meet the value expectations and requirements of the customer for movement of high priority US Army retrograde from the CENTCOM AOR?
6. What are the costs of using the AMC Pure Pallet program and the flat rate using the 9GN project code for expedited handling through the aerial ports versus the current transportation billing process?

Research Objectives

The research objectives of this thesis to determine through the research and investigative questions whether the success and benefits associated with this initiative, designed as a customer-oriented solution in the distribution system, can be expected to extend to the retrograde process. Ultimately, this information will provide insight into whether the program increases supply-chain efficiency or effectiveness with limited transportation resources in the retrograde process. Although numerous reports and theses have been accomplished indirectly relating to the Pure Pallet program and reparable shipments in the retrograde process, only three theses from previous AFIT students provide direct relevance to this research proposal.

In his thesis, *Modal Selection Analysis of Depot Level Reparable Asset Retrograde Shipments within the CONUS*, Captain Michael Kossow examined the use of Less-than-Truckload (LTL) trucking for retrograde shipments to CONUS depots versus the use of premium transportation (express overnight air) at higher costs. He states that “Transportation coordinators are compelled by unsynchronized priorities and shipping policies to use express air modes in all cases when the use of LTL modes may be available to meet service level requirements at a lower cost.” He concluded that more efficiency and effectiveness could be realized by consolidation of shipments over multiple origins and destinations and over multiple days (Kossow, 2004:49).

Major Michael Mongold’s goal in his research paper entitled, *Impact of the Pure Pallets on the Effectiveness and Efficiency of the Defense Transportation System* was to assess the impact of the Pure Pallet initiative on the efficiency and effectiveness of the Defense Transportation System (DTS). He cites in his analysis that “senior leadership

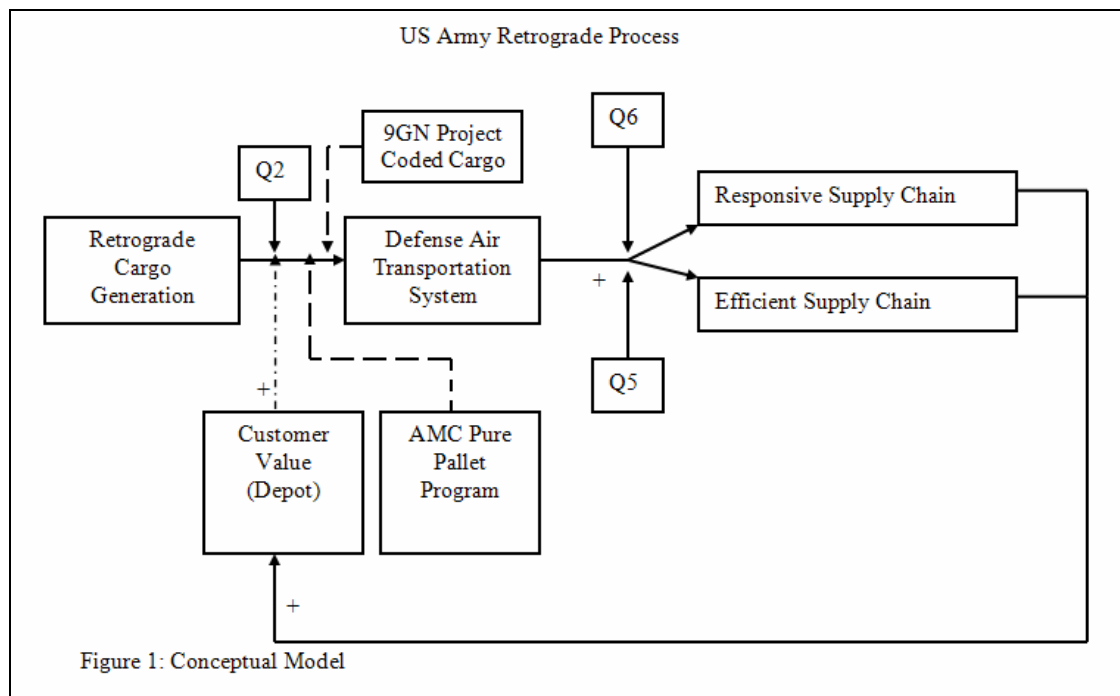
acknowledges that the pure pallet process has greatly reduced distribution times. It has resulted in a more efficient transportation system to speed cargo through transshipment points and reduces the breakout/repackaging of cargo, with quicker arrival at the end user's location" (Mongold, 2005:47). He also acknowledges in his findings that the program causes a slower process at the CONUS aerial ports but reduces cargo handling within the theater. Mongold concludes that the quantitative data from his study positively supports the implementation of the Pure Pallet program, which has resulted in significant reductions in customer wait times for cargo destined to the CENTCOM AOR, thus increasing efficiency and effectiveness of the DTS (Mongold, 2005:63). Although Mongold discusses balancing tradeoffs between costs and velocity with the pure pallet program, he measures efficiency from the provider's perspective by the "acceptable level of usage of limited airlift assets" and not from the customer's perspective of overall reduction in transportation costs (Mongold, 2005: 31-34). Velocity or effectiveness seem to be the overall goal of the customer in the distribution process where defined delays in the acquisition process are acceptable and a "minimum" consolidation level for pallets provides the right balance for the provider to justify the use of airlift assets.

In his thesis, *Perception of the AMC Pure Pallet Program*, Captain Michael Dye's research efforts were focused on whether the program was working as intended and if there was a perception problem among the air transportation community who are responsible for its implementation (Dye, 2006:3). His conclusions were that the events leading to the designation of the Commander of USTRANSCOM as the DPO and the implementation of the AMC Pure Pallet program were producing the desired results of increased effectiveness within the DTS to the warfighter, and the reduction of lost

shipments could be attributed to the implementation of the program (Dye, 2006:100).

Captain Dye's research also revealed that there was indeed a perception problem within the AF transportation career fields. Perception differences occurred between active duty and non-active duty personnel, individuals of lower or higher rank, and individuals with lower and higher time-in-service (Dye, 2006:101). He emphasizes that his point isn't to agree or disagree with their position but to expose commanders to the existence of the issue and the importance of communicating the benefits of the program to the warfighter in the deployed location (Dye, 2006:103).

In the case of Kossow (2004), his research was limited to mode selection of repairable from CONUS aerial ports to the depots, and did not account for the complexity of shipments from overseas deployed locations or any initiatives such as the Pure Pallet program. The other researchers were examining the benefits of shipment consolidation, the original intentions of the AMC Pure Pallet program, or the perceptions of its effectiveness for distribution. This research seeks to address a new area by conducting a comprehensive examination of the AMC Pure Pallet program's viability to improve the current US Army retrograde process, defined below.



Research Significance

As stated in the problem statement, the current Army retrograde process faces a number of challenges. The costs to reset (repair or replace) US Army equipment are totaling billions of dollars annually, compounded by an inefficient retrograde process for reparable parts resulting in transportation delays and additional costs for movement to the defense depots. The retrograde process is extremely complex, cumbersome and doesn't lend itself to any simple solutions. It is the intention of this researcher to weave together previous studies and commercial and military research into a comprehensive picture of the current retrograde process and status and determine whether the AMC Pure Pallet program can mitigate to some extent the degree of uncertainty, volatility, and transportation costs of retrograde movement from the CENTCOM AOR.

Scope and Limitations

Since reverse logistics and retrograde covers a wide range of functions such as the disposal of hazardous waste, disposition of items through the Defense Reutilization and Marketing Service (DRMS), reparable cargo (parts for tanks, aircraft, ships, etc.) from all of the services across the Department of Defense, this research will be limited to only US Army reparable retrograde movement originating from Kuwait and Iraq.

Summary

The goal of Chapter 1 is to provide the reader with a basic understanding of the AMC Pure Pallet program and its associated benefits to the warfighter, to emphasize the importance of one process owner for distribution and retrograde, to assess the current state and significance of addressing the Army retrograde process, and to introduce the problem statement and investigative questions for this thesis research. Chapter 2 will provide an extensive literature review beginning with an in-depth analysis of the relevant material from the commercial sector on the definition and applications of reverse supply chain management and reverse logistics network design, the Army's reparable-management system from a process perspective to the defense depot, and the creation of the AMC Pure Pallet program. Chapter 3 consists of the research methodology and data analysis model. The analysis and results of this research study along with the assumptions and limitations are stated in Chapter 4. Finally, conclusions, future recommendations and viability of commercial concepts within the DOD will be provided in Chapter 5.

II. Literature Review

Process is a technical term with a precise definition: an organized group of related activities that together create a result of value to customers...People performing different steps of a process must all be aligned around a single purpose, instead of focusing on their individual tasks in isolation.

-Dr. Michael Hammer
The Agenda

Chapter Overview

This chapter provides a literature review to establish the framework of the US Army retrograde process. Many of the Army's current policies and practices as they relate to reverse logistics, as well as the broader context of supply chain management, were benchmarked from the commercial sector. Therefore, the first section of this chapter will provide a background on reverse logistics concepts as they are applied within commercial industry. It will include a detailed overview of reverse supply chain management, reverse logistics network design, current applications and methods regarding value recovery of reparable parts, and the incentives used to encourage commercial industry companies to adopt the principles and concepts of reverse supply chain management. This section will provide the reader with a greater understanding of the components of the reverse supply chain from a commercial perspective as it applies to the profit model, the importance of a methodical approach to the network design, how the type and value of products drive the design of the reverse supply chain, and the value of incentives used by the commercial sector to encourage the right attitude towards remanufacturing, as it is the closest commercial equivalent to military retrograde. Over the past two decades, most of the emphasis in both the commercial and military sectors within the context of supply chain management has been on optimizing the distribution

process, focusing on ways to increase visibility, and improving responsiveness to customer needs. However, the same zeal is not reflected in the development of the reverse supply chain. Some conventional thinking is that the design of the reverse supply chain is symmetrical to the forward supply chain. However, this is not precisely the case in the military, as the customer or customers may represent “links” in the network with the forward deployed location as the ultimate end user. In their article, “A Facility Location Model for Logistics Systems Including Reverse Flows: The Case of Remanufacturing Activities,” Lu and Bostel (2005) state that:

Generally, because of the presence of recovery activities (recovering/reusing used products or materials), reverse logistics imposes some new characteristics on the management of the logistics system. For example, it is recognized that the system network of reverse logistics is not usually the symmetrical image of the traditional network. This means that new functions or new participants can be introduced into the system e.g. the implementation of back-shipments of reusable materials or the location of collection, testing and sorting, or recovery centers. From the nature of the system, reverse logistics is of a convergent structure of a network from many sources to a few demand points (2-3).

The prevailing focus has been on optimizing only individual portions of the process, leading to a sub-optimal result system-wide. The preferable solution is to achieve global optimization across the entire reverse supply chain. This section encompasses a significant portion of this chapter due to the importance of understanding reverse logistics principles and the importance of optimizing reverse logistics across the entire supply chain.

The second section will cover the implementation of supply chain management within the Department of Defense and provide an in-depth look at the current US Army retrograde process from origin within the CENTCOM AOR to the CONUS depots. This section is designed to provide the reader with a frame of reference for defining and

understanding the customer in the Army retrograde process and the movement of parts from the mechanic to the depot.

Finally, the third section of the chapter will describe the creation of the AMC Pure Pallet program and the role that radio frequency identification (RFID) technology has played within the retrograde process.

Reverse Supply Chain Management

RSCM and reverse logistics are terms that in many cases are used interchangeably. However, many commercial companies and most academicians specify the range of RSCM as encompassing an enterprise point of view of product recovery management across all activities from the point of consumption to the point of origin. According to their article, “Empirical Research Opportunities in Reverse Supply Chains,” Prahinski and Kocabasoglu (2006: 520) outline five sequential steps to the RSC process: “product acquisition, reverse logistics, inspection and disposition, and distribution and sales.” Acquisition is simply how the product is retrieved from the customer, and occurs through three primary sources: the forward supply chain by product returns resulting from damage or defect, the reverse supply chain by “market-driven systems using incentive policies such as deposits, cash for product return, leasing and credit towards a replacement purchase,” or from the “waste stream” such as landfills (Prahinski and Kocabasoglu, 2006:520).

Reverse logistics is defined as “the process of retrieving the product from the end consumer for the purposes of capturing value or proper disposal. Activities include transportation, warehousing, distribution and inventory management. Transportation is usually the largest component of reverse logistics costs” (Prahinski and Kocabasoglu,

2006:521). Inspection and disposition are measures to determine the appropriate value of the product and strategy for recovery using four disposition alternatives: “reuse, product upgrade, material recovery and waste management” (Prahinski and Kocabasoglu, 2006:522). Reconditioning can be best described as the “repair, refurbishing, remanufacturing and recycling of a product (Prahinski and Kocabasoglu, 2006:522). The last step in the RSC process, distribution and sales, describes “a number of channels that can be utilized for the sale of refurbished or used products” such as the same channel as used for new products or through a broker who “specializes in close-out, job-out, surplus or defective items within a particular industry”(Prahinski and Kocabasoglu, 2006:522). Figure 1 provides a conceptual model of the disposition alternatives described in the inspection and disposition in the RSC process.

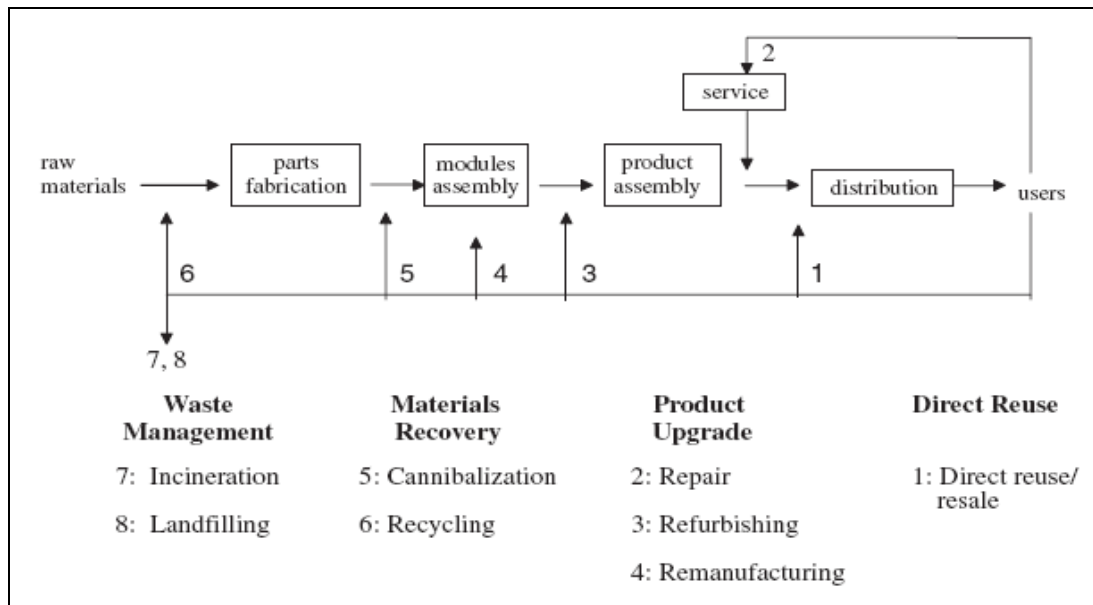


Figure 2: Disposition Alternatives on the Reverse Supply Chain (Prahinski and Kocabasoglu, 522)

Through the RSC process, “a product life cycle can be extended” resulting in additional revenue for businesses (Prahinski and Kocabasoglu, 2006:522). However, some of the biggest opportunities for reducing costs and increasing revenue are from product returns.

Product Returns

Within the last several years, many businesses have had increasing pressures from the loss of revenue due to product returns (Monahan, et al., 2004:17). According to the Reverse Logistics Executive Council, “the cost of handling, transporting, and determining the disposition of returned products is \$35 billion annually for US firms” (Prahinski and Kocabasoglu, 2006:519). These annual product return costs alone do not provide the reader with an accurate picture of the opportunities to reduce costs in the reverse supply chain.

In their article in the *MIT Sloan Management Review*, Stock, Speh, & Spear (2006:59-60) describe five stages of the product returns process: “Receive, Sort and Stage, Process, Analyze, and Support.” Each one will be briefly discussed because, as the authors indicate, they are “common to almost all companies irrespective of industry or product type” (Stock, Speh, & Spear, 2006:59) to include correlation with the retrograde process. In stage one, the product returns are processed at centralized locations, which in many cases are automated to meet cost and service goals (Stock, Speh, & Spear, 2006:59). “The way that items are returned and received greatly influences how products are sorted and staged in the next step of the returned process” (Stock, Speh, & Spear, 2006:59). The concept of postponement, where value-added services are provided at the latest possible moment in the supply chain, is mentioned in the article as a cost effective option in handling product returns (Stock, Speh, & Spear,

2006:59). “Conversely, in reverse distribution, processing returned items nearer the point-of-sale, that is, early in the returns process, saves both time and money. The thought behind this approach is that returns are evaluated as soon as possible when they are received to assess their recoverable value” (Stock, Speh, & Spear, 2006:59). The advantage of such an approach is only dedicating processing expenses to those items that have significant recoverable value—hence extending the product cycle—and not ones that are worthless with no redeemable value (Stock, Speh, & Spear, 2006:59). In stage two, Sort and Stage, product returns can be sorted by packaging composition such as pallets, cartons, or packets; the labeling or size /number of items received; or any combination of these options (Stock, Speh, & Spear, 2006: 60). Process is the third stage where “returned items are subsorted into items, based on their stock-keeping unit number, which can be returned to stock/inventory; while vendor returns (if applicable) are sorted according to the specific vendor name” (Stock, Speh, & Spear, 2006:60). This is the stage where documentation is separated from a product return and is compared with the electronic records to eliminate any discrepancies. In stage four, Analyze, highly-trained employees make decisions on product return disposition. These employees must have in-depth knowledge of the products, repair or refurbish options, and associated financial benefits as repackaged items are more lucrative than ones that are refurbished or remanufactured (Stock, Speh, & Spear, 2006:60). Finally, companies must actively pursue marketing strategies that maximize profit from the broad range of repacked, repaired, refurbished and remanufactured product returns (Stock, Speh, & Spear, 2006:60). Support is the last stage in the process where final disposition of product returns is determined. “Back-to-stock or back-to-store items are returned to inventory. If

repair, refurbishment or repackaging are required, appropriate diagnostics, repairs and assembly and disassembly operations are performed in order to get the items into a salable condition” (Stock, Speh, & Spear, 2006:60). The amount of repair or refurbishment of a product return should be directly correlated with the potential market value. Items that are quickly converted into a salable condition should result in increased customer service levels and decreased carrying costs (Stock, Speh, & Spear, 2006:60). The idea behind this concept is for companies to transition product returns to a profitable efficient operation by minimizing management and administration costs. The authors also warned that efficiency is not always the best strategy. “Speed is the critical variable in many cases, and managers need to remember that cost-efficient supply chains are not necessarily fast supply chains. The longer it takes to retrieve and process a returned product, the lower the likelihood of economically viable reuse options” (Stock, Speh, & Spear, 2006:61). The length of the product life cycle will play a large part in the decision of type of supply chain required to recover the maximum value from the returned items.

Product return centers provide opportunities for improving customer service and knowledge by tapping into “buying exceptions and habits of customers” (Stock, Speh, & Spear, 2006:61). The ability of a company to capitalize on these opportunities will hinge upon good communications processes to transmit information quickly, both internally and externally. Lastly, product return centers usually operate the best when they have dedicated, full-time managers who are responsible for their success. However, this decision must be balanced with the possibility of using a third-party logistics (3PL) company if the level of expertise doesn’t exist within the company to successfully manage product returns (Stock, Speh, & Spear, 2006:62). In many cases, companies may

be able to minimize the number of product returns. This may be as simple as improving the quality of the product or changing customer return policies, each of which requires a thorough examination as to the causes of product returns.

In their article in AT Kearney entitled, “Shifting Your Supply Chain Into Reverse,” Monahan, Bossche, & Harthan (2004:19) attribute the cause of products returns to “liberal return policies” as a result of the internet explosion during the late 1990s, with returns ranging from 50 to 100 percent depending on the item and industry, as well as the competition of traditional brick and mortar companies adopting policies of “satisfaction guaranteed” with book returns reaching as high as 30 percent, consumer electronics ranging from 4 to 5 percent, and mass merchandise reaching as high as 15 percent (2004:19). Furthermore, Monahan, Bossche, & Harthan (2004:20) state that “poorly defined return policies between vendors and customers can create excessively lenient or overly complex returns that prolong and consume valuable resources. Also, a lack of accountability and cost management between reverse logistics and other departments, such as corporate accounting, can prevent proper and timely credits, negatively affecting cash flow and customer satisfaction.” To contrast some of the major differences between the directions of the supply chain, Monahan, Bossche, & Harthan describe the complexities and numerous challenges [Figure 3] that businesses face in the reverse supply chain.

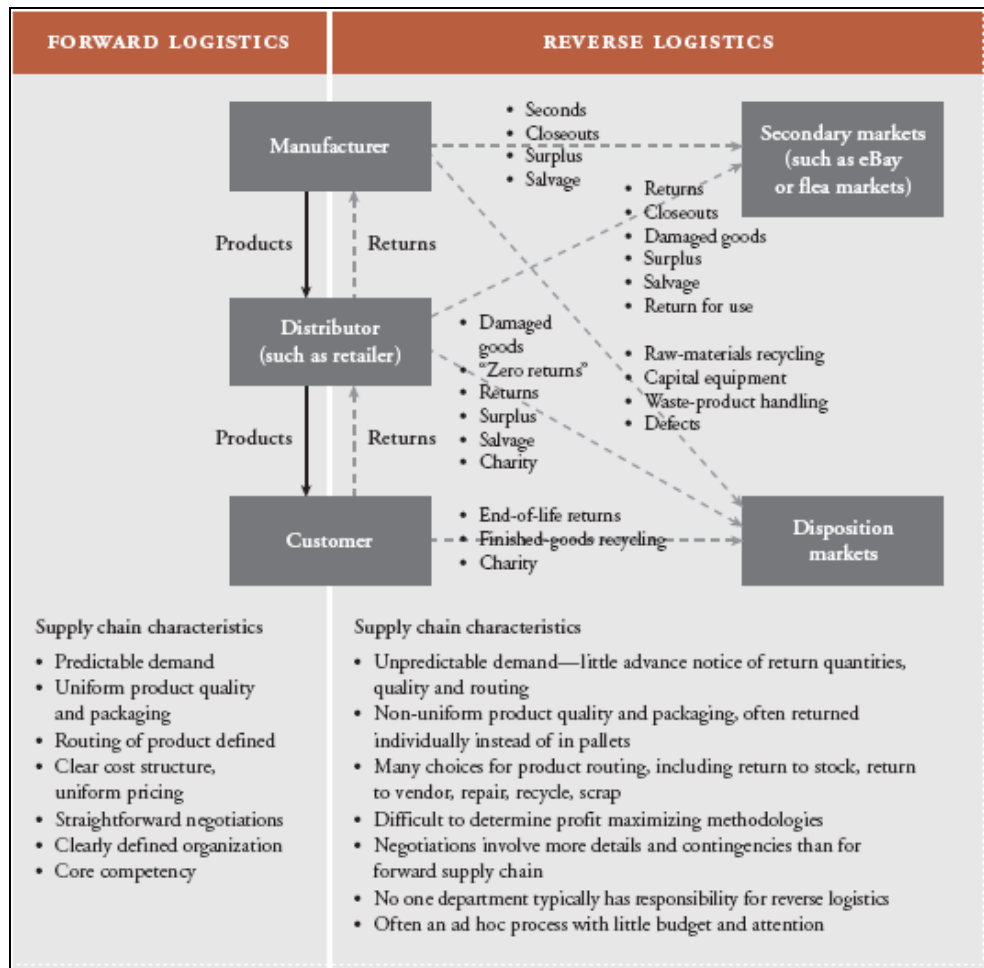


Figure 3: Forward and Reverse Supply Chain Characteristics (Monahan, Bossche, & Harthan, 2004:7)

Monahan, Bossche, & Harthan (2004:21) offer a two-step approach to “tightening the reverse supply-chain” by reducing the number of returns and streamlining and redesigning the RSC process. Companies can reduce the impact of returns at the source by enforcing requirements for consumers to provide the original carton and all product manuals, similar to the Best Buy® “no receipt, no return” policy; establishing help lines and retailer return centers for consumers; and making considerations for reverse logistics in the product development stage to account for “manufacturing costs, marketability, and sale margin” (Monahan, Bossche, & Harthan, 2004:22). Other measures for reducing the

number of returns include simplifying the process by having the customer provide preliminary information on the product being returned and the customer's personal information. The process serves two purposes: to provide advance information to the company of the product returns and to retain the customer's information in a database for any future patterns of abuse (de Brito, 2003:17).

Streamlining the process is what the authors described as "implementing a more effective triage program at the point of return" (Monahan, Bossche, & Harthan, 2004:22). Rogers and Tibben-Lembke and Gooley provide a clearer explanation of the same concept in the form of centralized returns centers (CRC). CRCs are "independent facilities where the returns are managed in a central location" (Prahinski and Kocabasoglu, 2006:521). CRCs increase efficiency in product sorting and repacking, allow firms to acquire specialized assets, provide opportunities for managers and employees to focus exclusively on product returns, tie "incentives, goal and results" directly to centralization, and allow "managers [to] gain increased experience with different disposition strategies" (Prahinski and Kocabasoglu, 2006:521).

After a company has applied policies to reduce the number of returns, management must review the reverse supply chain using seven design decisions (Monahan, Bossche, & Harthan, 2004: 24). On a strategic level, the company has to determine if reverse logistics is a niche market that it can capitalize on with some measure of success and "generate value to the enterprise" (Monahan, Bossche, & Harthan, 2004:24). "For instance, an efficient and effective reverse logistics program represents more of a competitive edge to a company selling high-volume, high value products with a short lifecycle, such as consumer electronics than to discount retailer

selling a large assortment of low-value products” (Monahan, Bossche, & Harthan, 2004:24). Products with high value and short life-cycles, the right balance of outsourcing coupled with supply-market capabilities, and pricing strategies are key determinants in whether a company can successfully use a niche market strategy for reverse logistics (Monahan, Bossche, & Harthan, 2004:24). On an operational level, the company “must answer key questions surrounding flexibility of the reverse supply chain to respond to changing market conditions. As with a forward supply chain, the ability to grow and shrink the labor force when demand fluctuates—such as when seasons change—helps control operating costs” (Monahan, Bossche, & Harthan, 2004:25). Figure 4 outlines the seven key design parameters that companies must face based on their current situation and their overall strategic and operational objectives. Monahan, Bossche, & Harthan (2004:27) concluded by emphasizing the importance of communication integration with all current and future partners within the reverse supply chain and the need to “establish robust internal processes—such as returns tracking and inventory management.”

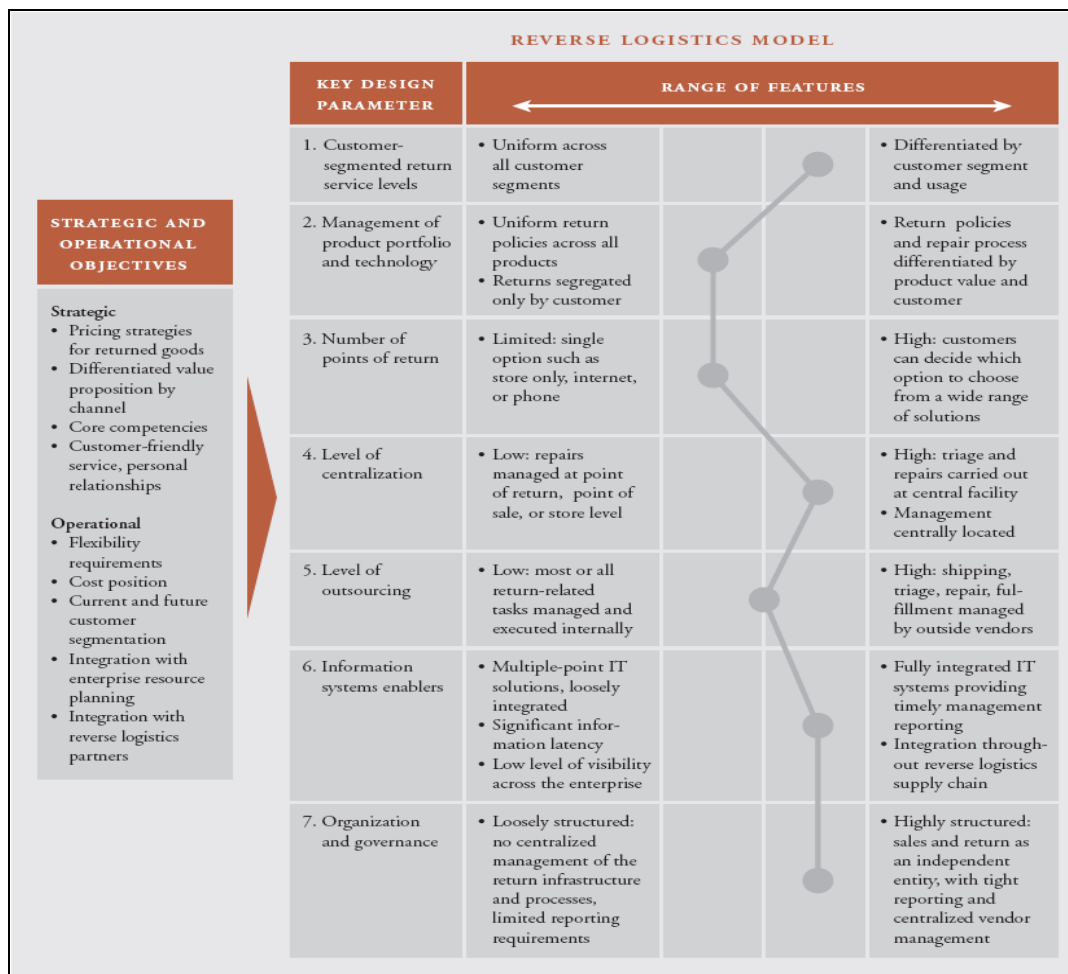


Figure 4: Design Parameters for Reverse Logistics (Monahan, Bossche, & Harthan 2004:25)

Reverse Logistics Network Design

In the *2006 Capability Gaps and Process Opportunities Listing*, CINC Requirement 63, which is linked to retrograde and scheduling capability gaps, states the need to “receive and integrate the complete (i.e., intra-continental United States, inter-theater, intra-theater) movement requirements and generate the optimum strategic transportation network for a military deployment and redeployment including an integrated deployment plan for the retrograde of materiel” (USTRANSCOM, 2006:47). This generates a critical requirement for retrograde movement because the primary

emphasis over the past two decades has been on improving or optimizing the distribution system. The integration of distribution and retrograde movement has been a neglected priority, as demonstrated by the numerous problems cited in Chapter One. The European academic community offers some of the most current research and model solutions on logistics network design. In their book, *Reverse Logistics: Quantitative Models for Closed-Loop Supply Chains*, Dekker et al (2004:36) puts together comprehensive chapters by various academicians on the most current reverse logistics research, primarily from businesses in Europe but also including some US companies. The focus of the book is to cover the major issues facing companies in reverse logistics activities and capture the issues in quantitative models to support decision-making in finding business solutions (Dekker, et al, 2004:36). In Chapter 3, Reverse Logistics Network Design, the authors listed the following three characteristics that describe a reverse logistics network: “supply uncertainty, degree of centralization of testing and sorting, and interrelation between forward and reverse flows” (Fleishman et al, 2004:70). Fleischmann et al (2004:70) state that:

In traditional supply chains (distribution), demand is typically perceived as the main unknown. In a reverse logistics setting, however, it is the supply side that accounts for significant additional uncertainty....The need for testing and sorting operations in reverse logistics is a direct consequence of the above supply uncertainty. The degree of centralization of this stage has a fundamental impact on the transportation needs in a reverse logistics network and is subject to the following tradeoff: testing collected products early in the channel may minimize that total transportation distance since inspected products can be sent directly to the corresponding recovery operation....On the other hand, investment costs, for example for advanced test equipment or specially trained labor, may call for centralizing the testing and sorting operations.

These are some similar challenges and tradeoffs as faced with product returns, and conclude with centralization as a recurring recommendation from businesses to capitalize

on reduction in transportation costs and increased efficiency. Some of the main strategies implemented to improve supply chain performance are the “location of production, storage, and cross-dock facilities, and the selection of transportation links between them” (Dekker, et al., 2004:65). Cross-docking is a fairly recent technique used by retail and distribution companies and is extensively incorporated within the Less-Than-Truckload (LTL) industry (Bartholdi, 2004:236). The use of cross-docking is one of the strategies that contributed to the success of Wal-Mart in surpassing its rival, Kmart, during the 1980s (Bartholdi, 2004:235). Bartholdi and Gue (2004) define cross-docking as:

A logistics technique that eliminates the storage and order picking functions of a warehouse while still allowing it to serve its receiving and shipping functions. The idea is to transfer shipments directly from inbound to outbound trailers without storage in between. Shipments typically spend less than 24 hours in a cross-dock, sometimes less than an hour (p. 235).

As a result of this technique, companies are able to consolidate shipments and lower transportation costs (Bartholdi, 2004:235). Fleischmann et al outline several options for extending the reverse logistics network design. Integrating forward and reverse logistics channel facilities through the co-location of assets such as a warehouses and test centers allows transportation flow integration through backhauls, utilizing partial and mixed truckloads, distinguishing demand for new and recovered products, and exercising multiple recovery options (Dekker, et al., 2004:76). For example, Richey (2005:237) uses the Home Shopping Network as illustration of improving responsiveness to customers by changing its network design.

Home Shopping Network (HSN) replaced their old warehouse management system which handled available-for-stock inventory, and [a] separate legacy mainframe system that was used for returns. The two systems were replaced with one system intended to fully integrate reverse and forward logistics. Advantages associated with the new system and supplemental customized supply chain

solutions, include: complete visibility of each return from its receipt to final disposition, near real-time visibility of all fulfillment center inventories, and near real-time customer credit information on returns. The system has allowed HSN to become more responsive to customers, i.e. facilitate and improve handling of returns that has improved customer satisfaction.

HSN ships more than 32 million packages annually "of which approximately 6.4 million are returned" (Richey, 2005:237). The need for responsiveness by HSN to its customers is what Dekker et al refer to in Fisher's (1997) *Harvard Business Review* article as "the fundamental trade-off between cost and service" (Dekker et al., 2004:30). In his article, "What is the Right Supply Chain for Your Product?: A Simple Framework Can Help You Figure Out the Answer," Fisher (1997:106) classifies products into two categories: functional or innovative. Functional products would be those items that are widely available, satisfy basic necessities, and have "stable demand and long life cycles" (Fisher, 1997:106). Innovative products are relatively unique or newer items with short life cycles, normally higher profit margins, and greater demand uncertainty (Fisher, 1997:106). Fisher contrasts the Ford Fairmont as an example of a functional product and the BMW Z3 as an innovative one. Figure 5 below emphasizes the distinctions between functional and innovative, links key characteristics of a company's product line, and draws distinctions as they relate to demand.

Functional Versus Innovative Products: Differences in Demand		
	Functional (Predictable Demand)	Innovative (Unpredictable Demand)
Aspects of Demand		
Product life cycle	more than 2 years	3 months to 1 year
Contribution margin*	5% to 20%	20% to 60%
Product variety	low (10 to 20 variants per category)	high (often millions of variants per category)
Average margin of error in the forecast at the time production is committed	10%	40% to 100%
Average stockout rate	1% to 2%	10% to 40%
Average forced end-of- season markdown as percentage of full price	0%	10% to 25%
Lead time required for made-to-order products	6 months to 1 year	1 day to 2 weeks
* The contribution margin equals price minus variable cost divided by price and is expressed as a percentage.		

Figure 5: Functional Versus Innovative Products—Differences in Demand (Fisher, 1997:107)

Fisher (1997:106) asserts that “the root cause of the problems with many supply chains is a mismatch between the type of product and the type of supply chain.” Stable, low-margin products require a completely different type of supply chain than innovative products. Within the distribution process, the supply chain accomplishes two functions: physical and market mediation (Fisher, 1997:107). The physical function refers to “converting of raw materials into parts, components, and eventually finished goods, and transporting all of them from one point of the supply chain to the next” (Fisher,

1997:107). Market mediation is making sure the right mix of products is in the marketplace to meet consumer demand (Fisher, 1997:107). A functional product “makes market mediation easy because a nearly perfect match between supply and demand can be achieved” (Fisher, 1997: 107). Market mediation exerts control over innovative products due to unknown market demand, the pressure for early sales, and high profit margins. As a result, these products run the risk of stock-outs or excess inventory (Fisher, 1997:107). Information flow is cited by Fisher as critical in this environment, not only within the supply chain but also “from the marketplace to the chain” (1997:107-108). Fisher recommends the following steps in devising a strategy that better aligns the company’s types of products with its supply chain. First, the company must determine whether their products are more functional or innovative, then “whether their supply chain is physically efficient or responsive to the market” (Fisher, 1997:109). Fisher (1997:109) also iterates that:

By using the matrix [Figure 6] to plot the nature of the demand for each of their product families and its supply chain priorities, managers can discover whether the process the company uses for supplying products is well matched to the product type: an efficient process for functional products and responsive process for innovative products. Companies that have either an innovative product with an efficient supply chain (upper right-hand cell) or functional product with a responsive supply chain (lower left-hand cell) tend to be the ones with problems.

If innovative products are positioned in the upper right-hand corner of the matrix [Figure 6], the company simply does not understand that increasing responsiveness will far outweigh any rewards from supply chain efficiency (Fisher, 1997:109-110). The only solution for moving out of the right-hand corner is through improving supply chain responsiveness or increasing the amount of functional products (Fisher, 1997:111).

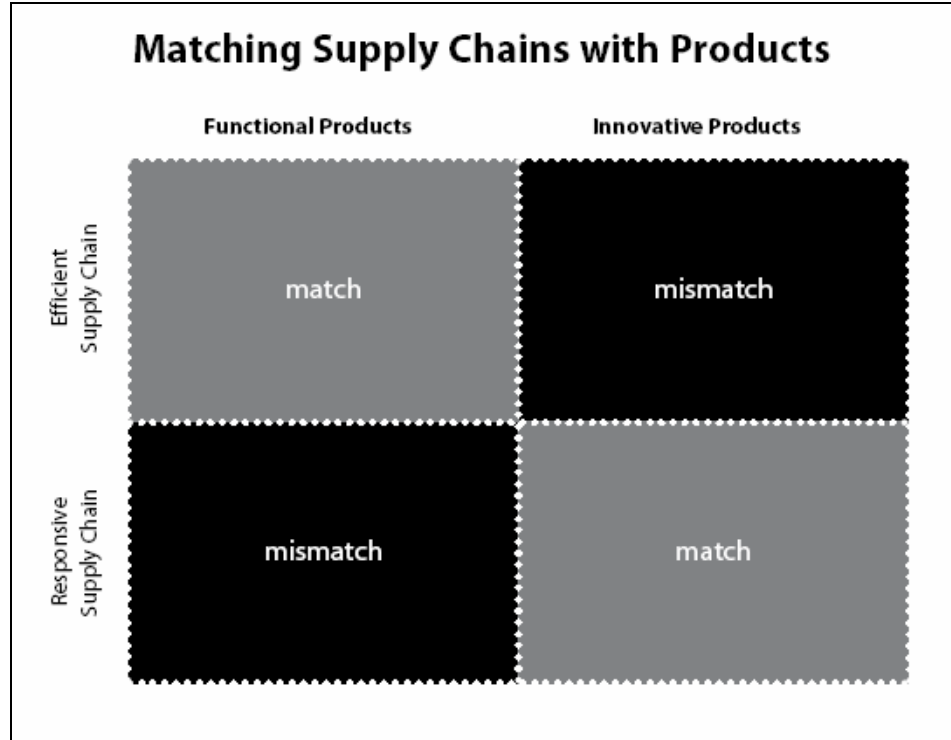


Figure 6: Matching Supply Chains with Products (Fisher, 1997:109)

Although Fisher's article is focused on the distribution aspect of the supply-chain, his arguments are directly relevant to the reverse supply chain for two reasons. First, all recovered products are not processed from the point of consumption the same way. More specifically, products in the reverse supply chain are separated based on value or remaining product life cycle before determining how they are routed through the supply chain. Different levels of responsiveness are placed on unserviceable products versus serviceable ones based on potential profit margins. This corresponds to the premise about different products for different supply chains. Second, Fisher makes an excellent case about innovative products in the market and their demand uncertainty which shares characteristics with recovered products which have high supply uncertainty and longer life cycles. Innovative products imply that more research and development,

manufacturing, preventative maintenance, and pre- and post-service costs are calculated into their availability on the consumer market. One could argue that Dekker's reference to Fisher's article was to raise awareness of the fact that each organization must examine its products and their respective life cycles and determine whether the value from a recovered product outweighs the cost of a responsive supply chain. Fisher's characterization of functional products, which seems to imply their status as commodities, makes sense with the alignment of an efficient supply chain. So, recovered products, with low redeemable value, appear to be a logical candidate for an efficient supply chain. It is for these reasons that Fisher's article has direct relation to finding the right balance or tradeoff in recovered products within the reverse supply chain.

Lee (2002) builds on Fisher's framework of the right supply chain strategy with product demand uncertainty. In his article, "Aligning Supply Chain Strategies with Product Uncertainties," Lee outlines three factors that successful companies know are essential to the right supply chain strategy (105). Those factors are: a tailored strategy to a customer's specific needs, "a product with a stable demand and a reliable source of supply should not be managed in the same way as one with a high unpredictable demand and an unreliable source of supply" (Lee, 2002: 105), and the power of the Internet for "supporting or enabling supply chain strategies for products with different demand and supply uncertainties" (Lee, 2002:106). Lee (2002) uses a similar argument as Fisher in describing functional products as "ones that have long product life cycles and therefore stable demand , while innovative products are products that have short life cycles with high innovation and fashion contents—and which as a result, have highly unpredictable demand" (106). Lee identifies collaboration, information sharing, and "synchronized

planning across the supply chain” as demand reduction strategies and the “free exchange of information” from product development through maturation and the end of the life cycle as a supply reduction strategy. Lee also mentions early design collaboration as a way to reduce supply uncertainties downstream (111). In Figure 7, Lee depicts how these reduction strategies can improve supply chain performance.

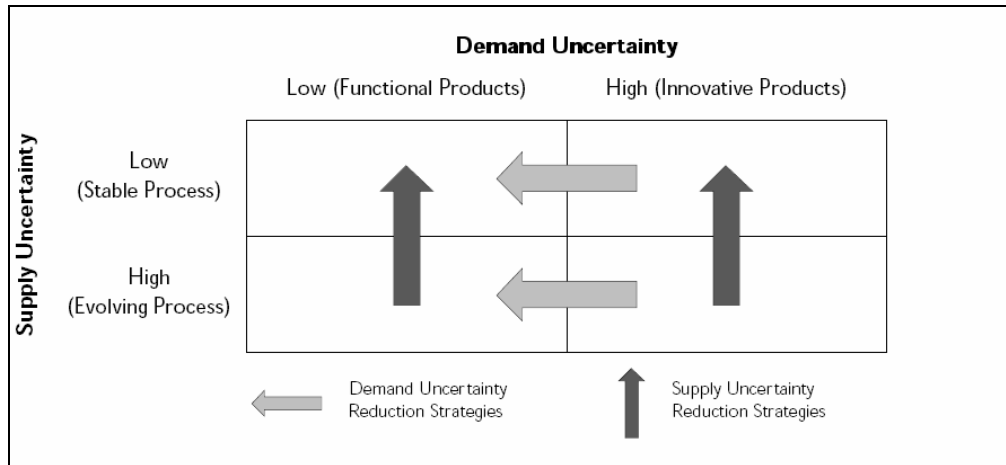


Figure 7: The Uncertainty Reduction Strategies (Lee, 2002:109)

What is most fascinating about Lee’s article are the four types of supply chain strategies through the use of information technology by matching the degree of demand or supply uncertainty [Figure 8]. The four strategies are classified by four types

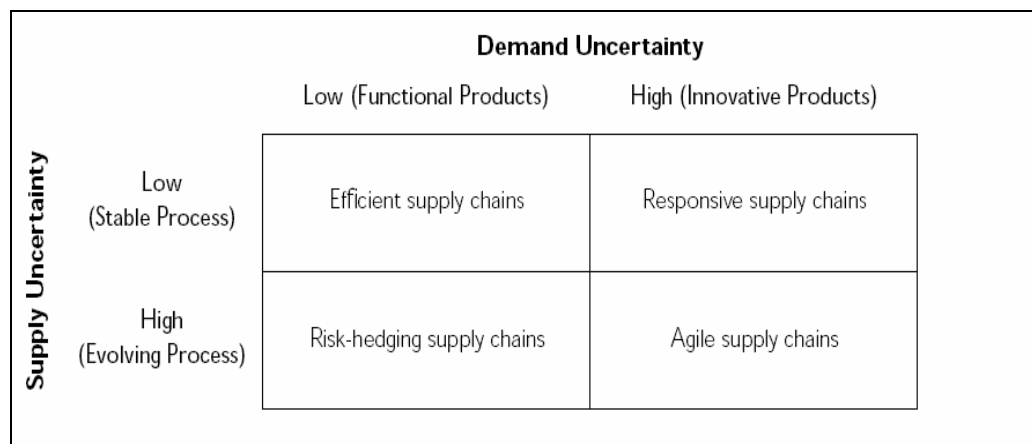


Figure 8: Matched Strategies (Lee, 2002:114)

of supply chains: efficient, risk-hedging, responsive and agile. Efficient supply chains, as it implies, is designed to reduce waste and minimize cost through optimization techniques aimed at maximizing production, distribution, and information flow across the chain.

“The role of the Internet in this case is that it enables the supply chain to have tight and effortless information integration, as well as enabling production and distribution schedules to be optimized once the demand, inventory, and capacity information throughout the supply chain are made transparent” (Lee, 2002:113). A risk-hedging supply chain consists of “pooling and sharing resources” to minimize supply disruption across the chain. Some common examples are increases to safety stock and the use of pooling inventories where you would have several different retailers having access to the same inventory. The Internet’s role in this supply chain would be to act as an enabler for “information transparency” in sharing inventory with other stakeholders across the chain (Lee, 2002:113). Flexibility in responding to changing and diverse requirements of customers best describes responsive supply chains (Lee, 2002:114). The Internet’s role in this supply chain is one of accuracy and timeliness in meeting a variety of tailored customer needs. An ideal strategy for this supply chain would be mass customization. The final type is an agile supply chain, which is a hybrid of both responsive and risk-hedging supply chains. The design is aimed at capitalizing on the responsiveness and/or flexibility on the front end and exercising risk-hedging options on the back end of the supply chain (Lee, 2002:114). What can be gained from Lee’s work is the incorporation of both demand and supply uncertainty and matching the right strategies can reduce their impact on supply chain performance. Recall in Chapter One that the Army retrograde process is subject to both demand uncertainty due to the inability of knowing the

reliability of major systems in a desert environment. The level of inventory in theater or in the national supply inventory required to hedge that risk is subject to supply uncertainty because of the unknown availability of unserviceables or the right amount of new spare parts to maintain depot level repair production lines to prevent and mitigate supply backorders. The key may lie in a balance between responsiveness and efficiency.

Munnich argues that responsiveness and efficiency are interrelated (Munnich, 2006:3). In his working paper, entitled Balancing Supply Chain Responsiveness and Efficiency—A System-Dynamics-Based Investigation, Munnich (2006:3-4) states that:

Responsiveness and efficiency are directly and indirectly linked and even involve feedback. In supply chains, the interrelationships between key parts of the system are complex. There are various players in the supply chain, and each of them addresses aspects of demand, production, and supply management, distribution, planning, etc... These interrelationships form feedback loops [Figure 9] that either amplify or cancel out management initiatives in unintuitive ways. This is the case both when such initiatives are carried out by individual supply chain players in an un-coordinated fashion as well as when supply chain members coordinate their initiatives and attempt to align policies in the supply chain. These feedback loops make problem solving and decision making difficult because it is not at all obvious which combination of strategic or operational levers will have the desired effect in the short or long term.

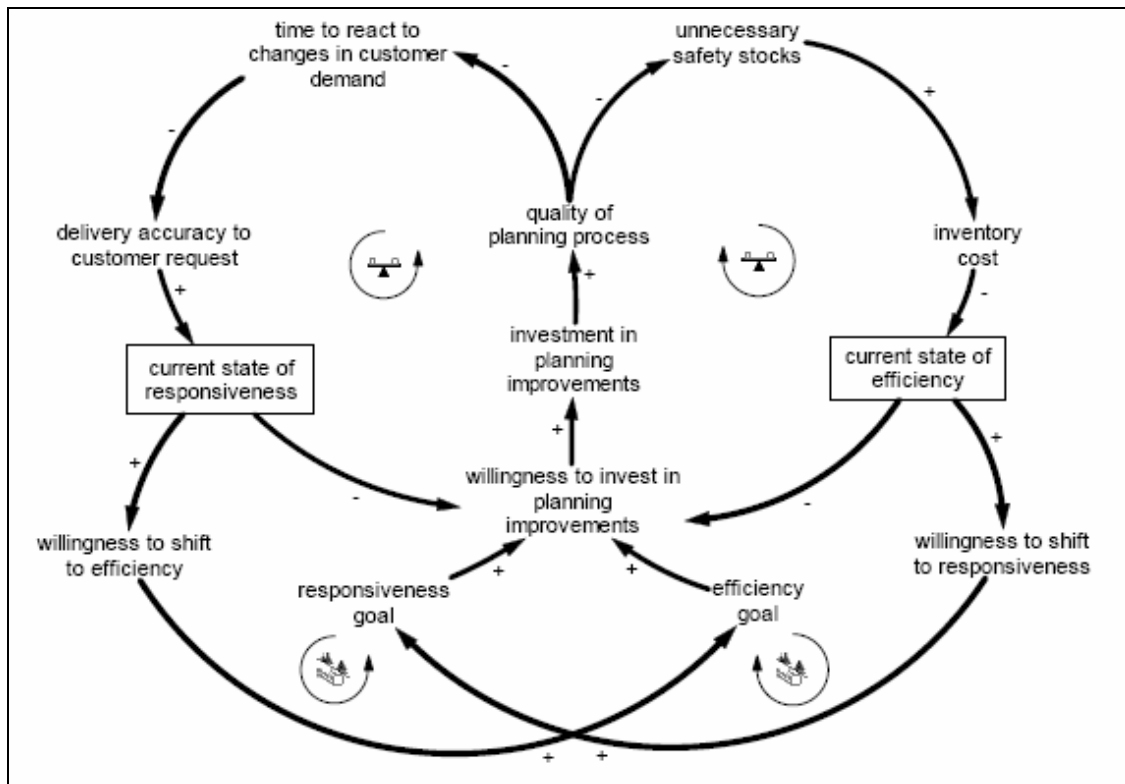


Figure 9: Planning Loops—Improvements for Growth (Munnich, 2006:5)

The key to improving supply chain performance is in planning and design/redesign of the planning system (Munnich, 2006:4). Forecasting and product characteristics are a few factors that must be taken into consideration but “suboptimal supply chain planning is one of the key reasons for the bullwhip effects in supply chains” (Minnich, 2006:4). One of the most important points to draw from Figure 9 is that organizations, regardless of their current state, must have a “willingness to invest in planning improvements” to reach their desired goal, whether that goal is improved responsiveness or efficiency.

Current Applications and Methods

When it comes to the commercial sector, product returns are a large portion of reverse logistics and return supply chain due to sheer volume. However, an estimated \$50 billion in remanufacturing costs in the US alone indicated that this process is also a

significant portion of the reverse supply chain (Prahinski and Kocabasoglu, 2006:519).

Remanufacturing provides the closest commercial comparison activity to the Army retrograde process for reparable components. In their article, *Remanufacturing: The Next Great Opportunity for Boosting US Productivity*, Giuntini and Gaudette (2003:41) state that:

Remanufacturing...is the ultimate form of recycling. It conserves not only the raw materials content but also much of the value added during the processes required to manufacture new products. And it may represent the largest untapped opportunity for improving productivity in American industry.

Remanufacturing starts with the process of retracting value from durable products or cores by disassembling, cleaning, inspecting and testing parts that can be resold into the open market (Giuntini and Gaudette, 2003:42). According to Giuntini and Gaudette, remanufactured products consist of two categories: capital goods, which “can be anything from complex military weapons systems to manufacturing, mining, and agricultural equipment to vending machines,” and consumer durable goods such as “automotive parts, computers, laser toner cartridges, and single-use cameras” (Giuntini and Gaudette, 2003:42). Companies such as General Electric, Boeing, Caterpillar, John Deere, Xerox and Pitney Bowes have collectively recovered an estimated \$130 billion in value from remanufacturing capital goods through leasing and remarketing efforts (Giuntini and Gaudette, 2003:43). Figure 10 below provides a breakdown of expenditures by industry based on current replacement value.

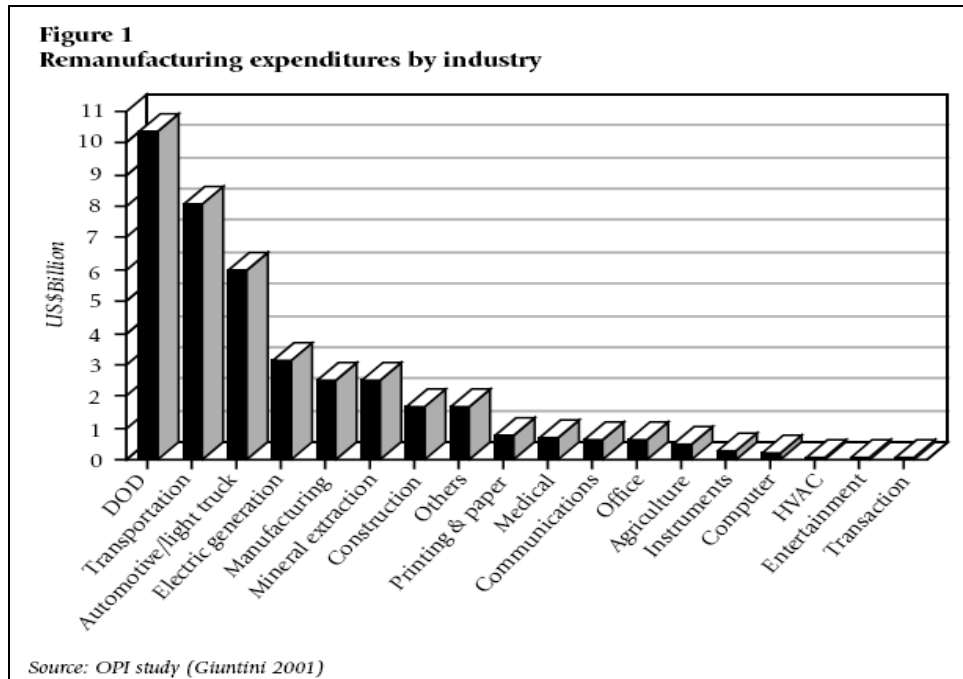


Figure 10: Remanufacturing Expenditures by Industry (Giuntini and Gaudette, 2003:43)

As indicated by this 2001 study, DOD is easily the industry with the highest level of expenditures in remanufacturing, totaling slightly over \$10 billion. In addition to corporations, the workforce, American consumers, and society at large can benefit from remanufacturing. With some additional training and skills, many retired or laid-off manufacturing workers could provide the needed expertise for disassembly and reassembly of durable products and parts. According to the Bureau of Labor Statistics, “there were around 18.3 million manufacturing jobs in the U.S. at the end of 1995, which dwindled to around 14.2 million by June 2006” (Malhotra, 2006:1) resulting in a net loss of 4.1 million jobs. In the consumer market, remanufactured products command a 30 to 40 percent lower price than new products. Another key benefit of remanufacturing products is the capability to provide a wide range of discontinued products in like-new condition (Giuntini and Gaudette, 2003:43-44). Society could gain huge benefits in the reduction of energy and natural resources consumed in producing new products.

Remanufacturing products are “typically 40 to 65 percent less” of the natural resources and energy required for the delivery of new products (Giuntini and Gaudette, 2003:44). Additionally, a 15 percent reduction in energy consumption compared to making a new product is estimated to result in a savings of 400 trillion BTUs annually. Giuntini and Gaudette (2003:44) state that “to put that figure [400 trillion BTUs] into perspective, it is the equivalent of about 16 million barrels of crude oil (350 tankers), or enough gasoline to run 6 million cars for a year.”

With so many opportunities for savings, some of the reasons stated for the lack of interest in remanufacturing products include deficiencies in the following support capabilities: ability to disassemble/reassemble product design, sales incentives, marketing or strategic plans for selling the products, skilled labor force, business tax credits, advertising, and competent managerial accounting (Giuntini and Gaudette, 2003:45-46). Overcoming these obstacles will require strategic level planning, better design engineering, comprehensive efforts in marketing and advertising, “experimentation with new organizational structures; reengineering or creation of new business processes; reconfiguration of reward and compensation systems to align with desired business outcomes; implementation of support infrastructure; and training and hiring of qualified people” (Giuntini and Gaudette, 2003:46-48). Increasingly, many manufacturers have turned to third-party logistics (3PL) companies as the solution to many of the aforementioned obstacles. Typically, these companies have the expertise, IT infrastructure, and transportation network required to accomplish their needs.

In his article, *What Can Logistics Do for You*, Bob Violino (2006:1) states that:

Global logistics service providers such as UPS, DHL, and others are leveraging their vast, worldwide IT and delivery infrastructures to create services that involve a combination of warehousing, transportation, feet-on-the-street and customer service...

By turning to these companies for a range of new services, enterprises can potentially cut time and costs, create efficiencies and improve services to their customers.

In March 2006, a survey accomplished by the Aberdeen Group discovered that around 61 percent of companies said they either planned or intended to utilize 3PLs for parts management, reverse logistics, and depot management due to demand for “wider geographic coverage, service profitability mandates from executive management, escalating field-service labor costs, and increasing areas of low-density product installations” (Violino, 2006:2). Manufacturers are really feeling the pressure to lower cost and increase efficiency as a result of global competition (Violino, 2006:3). Many companies are performing assessments of services provided to determine which are actually core functions and, of those that are not, assessing the potential for outsourcing to a 3PL (Violino, 2006: 4).

Companies like UPS offer a wide variety of services to those looking to outsource. Out of its Atlanta location, UPS provides solutions such as asset recovery, “recycling management for obsolete and excess inventory of high-technology products and components; field-tech support to perform on-site repairs, installations, preventative maintenance and other applications; parts planning, and returns and repair management” throughout its distribution network (Violino, 2006: 3). UPS also offers a computer repair service at its two million square-foot facility in Louisville, Kentucky. Conveniently located next to its Worldport global air hub, this UPS site can receive, repair, and ship computer laptops within the same day for delivery the following day (Violino, 2006:3).

DHL also offers outsourcing services such as “service parts logistics, order fulfillment, warehousing, product-returns management, parts repair, and repair management” (Violino, 2006:4). Sun Microsystems is taking advantage of some of these services for their after-market service parts and Unisys is outsourcing its “warehousing, distribution, freight, and component repair services” (Violino, 2006:4).

Violino (2006:5) offers some essential “next steps” for companies in managing outsourcing relationships. These companies must first determine the right balance of in-sourcing versus outsourcing, and then ensure they select a 3PL “based on their expertise, geographic scope of coverage, digitization of business processes, and knowledge of the industry.” Lastly, companies need to tie incentives and metrics such as “time-to-repair” to the services offered, utilize senior level personnel with the background to manage the partnership, and monitor customer satisfaction for “services such as call center, operations, product repair, and delivery” (Violino, 2006:5).

Reverse Logistics Incentives

The use of incentives in reverse logistics is intended to stimulate or encourage product recovery among supply chain partners and stakeholders (de Brito, 2003:6). In their article, *Reverse Logistics: A Review of Case Studies*, de Brito, Flapper, and Dekker (2003:6) make a distinction between two categories of incentives: “incentives that may be used to get a hold of goods a company would like to recover [economic], and incentives that may be used to influence others to accept the goods a company wants to get rid of [non-economic].” Economic incentives consist of deposit fees, buy-back options, “new” price reduction, condition fees, and supplier take-back. Deposit fees are utilized by rental car agencies and with recyclable bottles in certain states. Buy-back options under which

a “buyer is offered the possibility to sell the product to the seller for a preset price when the product meets some preset requirements at the moment of return which is either based on the use of the product or based on expected possibilities for selling the returned product” (de Brito, Flapper, and Dekker, 2003:6-7). “New” price reductions are a standard practice with car dealerships on used car trade-ins. Some companies may charge a fee “depending on the condition and configuration of the product delivered” (de Brito, Flapper, and Dekker, 2003: 6-7). Finally, take-back, with or without cost for the supplier, may be offered so that “a person who wants to dispose of a product [recoverable/recyclable item] can do this for free or for a lower price than he would have to pay elsewhere [return of a product to the original equipment manufacturer versus to another source]” (de Brito, Flapper, and Dekker, 2003:6-7). de Brito, Flapper, and Dekker also offer eight non-economic incentives. “New for old” is a something Daimler-Benz is offering its customers who own passenger cars and vans by replacing their older engine with a reconditioned one. Lease or rent contracts are exemplified in products such as automobile dealer leases. Easy and simple method of supply applies to two types of systems: “pickup systems where (parts of) products to be recovered are collected at the location where they are disposed, and bring systems where the disposer has to bring the goods to dispose at a certain location” (de Brito, Flapper, and Dekker, 2003:7). A good example of easy and simple method of supply would be soft drink companies and their interest in returning recyclable bottles but not the caps (de Brito, Flapper, and Dekker, 2003:8). “Timely and clear information, legislation, power, appeal to the environmental consciousness of people, and appeal to the charity’s consciousness of people” round out the remaining non-economic incentives (de Brito, Flapper, and Dekker, 2003:8).

The Establishment of the DOD Supply Chain Integration Office

The development of the Office of the Undersecretary of Defense, Supply Chain Integration emphasizes the importance how much the Department of Defense places on optimization of material management and distribution to support the warfighter from across the services. The DOD office was established as a result of the outcomes of two studies by the RAND Corporation, the Army's Velocity Management and the Marine Corps' Precision Logistics (Fricker and Robbins, 2000; Devore, 2004:18). To understand the significance of both studies, a brief summary of Precision Logistics and a more detail review of the Velocity Management, due to its contribution to the current Army retrograde process, are necessary to understand the rationale for the establishment of the DOD office.

The results of the USMC's Precision Logistics baseline study, performed by the RAND Corporation, were briefed in late 1996 to a meeting of Marine logistics generals. The focus of the study was to analyze all Marine Corps logistics process and to measure order and ship times (OST), repair cycle times (RCT) and examine outsourcing options with deliverables to measure logistics response times (LRT) and continuous improvement (Robbins et al., 1998:v). To measure LRT, analysts drew data from three processes: "on-repair, order and ship from retail supplies, and order and ship from wholesale supplies" (Robbins et al., 1998:v). What they found was the unavailability of parts contributed to slow RCT performance, the retail order and ship process is cumbersome with multiple players, and unknown causes for delays in order fulfillment without any issuance of backorders and the performance of the wholesale OST was slow and variable based on

the ship-to-receive times and requisition processing time on base (Robbins et al., 1998: vii-xiii). Robbins (1998:xiii-xiv) et al cites that:

...slow repair will reduce the number of serviceable items at the RIP [Reparable Issue Point], slowing up other repairs depending on those items and impacting the stockage allocation for these often expensive components. Poor parts identification and bad requisitioning procedures will fill the pipelines with requisitions for unneeded parts, both at the retail and wholesale level, and will absorb space and resources better used by more critical items.

The recommendations from the baseline study were the incorporation of performance measurement for continuous process improvement, use of diagnostic information for “detecting core problems and directing improvement efforts,” an internal examination of their own managed processes to reduce delays and redundancy, and solicit outside assistance from DLA, GSA and the Military Traffic Management Command (MTMC) [now known the Surface Deployment and Distribution Command] for the logistics system (Robbins et al., 1998:xiv-xv). As a result of the recommendations, the Marine Corps launched the Precision Logistics Initiative to “improve logistics processes and supply support to Fleet Marine Force (FMF),” using the Define-Measure-Improve methodology (Fricker and Robbins, 2000: iii). The goal of the initiative was to improve customer support in “requisition submission and processing, distribution, repair processes, and inventory management” (Fricker and Robbins, 2000:iii).

In 1995, the Army launched the Velocity Management (VM) Initiative which transformed the way the Army executes logistics. VM improved the “speed and accuracy with which materials and information flow providers to users” (Dumond et al., 2001: ix). The VM initiative is credited with improving performance along three key dimensions: time, cost, and quality (Dumond et al., 2001:ix). VM was implemented by the Army

through a continuous improvement three-step method called the D-M-I cycle. Each step is accomplished through the process sequentially, beginning with “Define—identifies the customers of a process and specifies what they need from the process in terms of outputs,” “Measure—aims to improve knowledge about how well it is done,” and “Improve—capitalizes on the increased expertise developed during the first two steps” (Dumond et al., 2001:ix-x). As the implementation of VM unfolded, the Army developed a new metric called customer wait time (CWT) that is designed to “capture the time from when a customer orders an item until the order is filled” (Dumond et al., 2001:xi). “CWT is a high-level metric that can be used to drive improvements in the processes through the logistics system” (Dumond et al., 2001:xi). Some of the successes of the VM initiative include: improving the order fulfillment process by a combination of developing metrics to track performance, streamlining the process and incorporated automated systems for sorting and receipting, improving the inventory management process through the development of “new algorithms for determining stockage levels” (Dumond, 2001:xi-xv) improving the repair times by “procedural changes to reduce administrative workload and the elimination of repetitive inspections,” and improving the quality of financial information by “reducing uncertainties in prices, reducing the time required to provide information...and improving access to information” (Dumond et al., 2001:xii-xvi).

US Army Retrograde Process

The Army Retrograde process is the centerpiece of the study and will begin with a broad overall definition, then proceed through the order fulfillment process, the internal activities of the supply support activity (SSA), the planning and execution of the Army

depots, and wrapping up with lessons learned/after action report recommendations. The retrograde process or what is referred in a recent RAND study as the “reparable-management process” starts when a mechanic identifies a malfunctioning component and is not complete until either a requisitioned or repaired part is issued and received back to the mechanic (Folkeson and Brauner, 2005:xii). The view of the retrograde process in the RAND Study is the mechanic does not care about the origin of the required component part but typically does not release the bad part until the new part is received. Thus the retrograde process as defined earlier has not changed with a serviceable part processed from the SSA to the depot. This process will become more apparent further along in this section.

A technically proficient mechanic should follow a three-step procedure when trying to determine the type of repair. First, pinpoint the problem with the weapon system and figure what actions are required to restore to fully mission capable status. Second, execute all the repair tasks which at this point will probably involve changing out parts or components. The last step involves inspecting and making sure the system is fully mission capable. It is during the second step where the mechanic must determine if a part is required and place an order for the reparable. If the parts are not available locally in the deployed location or at the national inventory level, the mechanic must rely on either the requisition process for a new part or reparable at the depot level (Folkeson and Brauner, 2005:19). Figure 9 provides a graphical depiction of the three-step procedure for identifying potential reparable components.

The order-fulfillment process [Figure 11] starts when the mechanic pinpoints the equipment failure, orders the part through either at the local level supply activity or from

the national inventory. If the part can't be requisitioned at the local level, the request is forward to the national inventory. In the absence of the part at the national inventory level, a backorder is generated and is routed to the SSA servicing the deployed location of the mechanic (Folkesson and Brauner, 2005: 7).

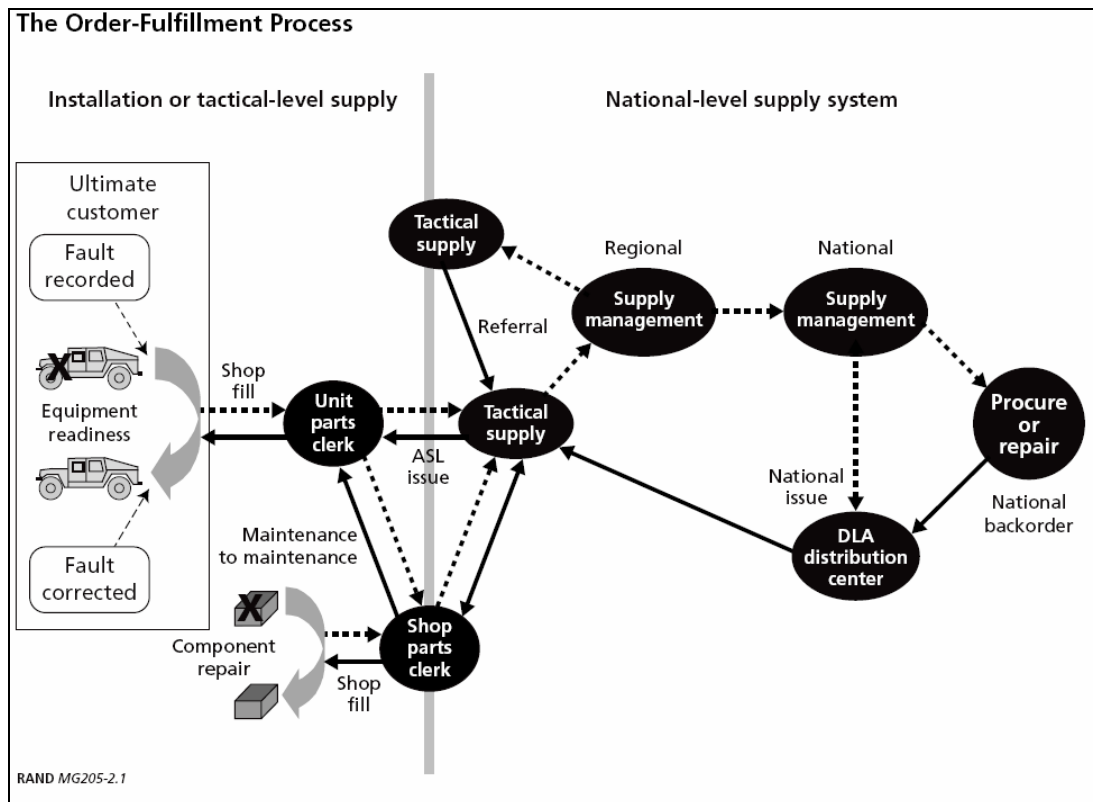


Figure 11: The Order-Fulfillment Process (Folkesson and Brauner, 2005:8)

Once a part has been deemed unserviceable, the mechanic will normally turn the part into the local SSA. The mechanic will enter the information on the unserviceable part into either the Unit Level Logistics System (ULLS) or in the Standard Army Maintenance Systems (SAMS) where it is assigned an "F" code (Diener et al., 2005:20). The mechanic will take the unserviceable part over to the SSA with the document from either ULLS or SAMS. Once the SSA receives the unserviceable reparable, they will process the unserviceable part and create a document in the Standard Army Retail Supply

System (SARSS) (Diener et al., 2005:20). When the unserviceable part is entered into SARSS, the system will provide where the part is to be routed for repair based on look-up tables. Any time the information within the tables is outdated or inaccurate the result is delays or excessive handling (Diener et al., 2005:23). At this point, the reparable has three possible dispositions. First, the reparable is coded “H” with the system and disposed of due its lacks any redeemable value. Second, when a reparable is returned to a serviceable condition, it is coded “A” as a like new or new asset and returned to the depot replenishment stock or local stock depending on where in the retrograde process. The last disposition for a reparable is coded “F” and is beyond repair at the local level. The reparable is sent to the depot where it is used in the repair processes through its disassembly into small components or for disposal. The disposition process through the SSA is captured in Figure 12 (Diener et al., 2005:16-17). All required documentation to include technical inspection, drain and damage statements (if applicable) and steam cleaning is accomplished at the unit level before an unserviceable reparable is accepted by the SSA (Diener et al., 2005:22). Diener et al (2004) noted in their analysis that:

Examinations of paperwork for in-process unserviceable retrograde items commonly indicate that it had taken several days to move an item a very short geographical distance... Delays also result from the practice of ‘batching’; unserviceables are sometimes accumulated until a certain amount is on hand before moving them on... Observations of outbound shipments from posts/installations suggest that some improvements are needed. A major issue is packaging and crating. For many reparable items this requires special materials as well as special training on how to properly protect items (p. 24).

Possible recommendations cited in the study were to route high-value retrograde through DLA’s Strategic Distribution Platforms (SDP) because it aligns with their core

competency or centralize the capability either CONUS or OCONUS (Diener et al., 2005: 24).

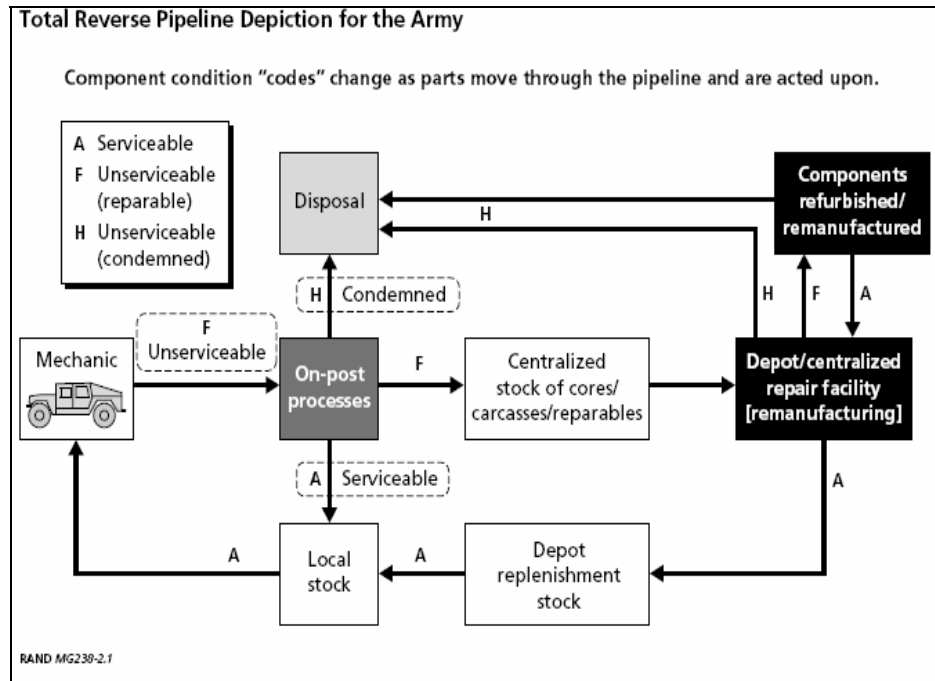


Figure 12: Total Reverse Pipeline Depiction of the Army (Diener et al., 2004:17)

Within the CENTCOM AOR, once the SSA processes high priority components from armored weapons systems, the part is sent to the retrograde facility in Camp Arifjan, Kuwait. The determination of where the components are routed is based on depot workload projections during weekly meetings between HQ Army Material Command and all applicable depots. The individual depots that can handle the flow of retrograde components, sometimes categorized by national stock numbers, are routed to either the CONUS or in some instances to Europe (Beckmann, 2006).

The goal of the reparable-management process is to meet customer demand by “repairing unserviceable returns to keep serviceable national inventory at required levels”

(Folkesson and Brauner, 2005:19). Once a demand is triggered from the deployed location by the mechanic, the ability to repair an asset largely depends on the availability of a reparable component. Therefore, it is critical to maintain an adequate level of serviceable parts based on the planning and execution at the depot level (Folkesson and Brauner, 2005:20).

Depot-level reparable workload management consists of two main functions: planning and execution. Planning is focusing on the “long-term needs, such as budgeting and capacity issues” (Folkesson and Brauner, 2005:21). Execution addresses the responsiveness to the “uncertainty of actual customer demands and non-forecast mission needs” (Folkesson and Brauner, 2005:21). “Repair activities at the source of repair” are also included in the execution function.

The planning function “produces recommendations for inventory levels and repair and/or vendor buy quantities, and it also provides input to the Army working-capital fund (AWCF) budget process and to program-objective memorandum (POM) budget planning, which has a rolling six-year horizon” (Folkesson and Brauner, 2005:21). The funding mechanism for any repair program within the planning function is a decision package called the procurement-request order number (PRON). The PRON initiates the repair process and can only be scheduled for execution 18 months from approval every fiscal year within the planning function (Folkesson and Brauner, 2005:22). The item manager at DLA is the one who “initiates workload planning for Army-managed items” (Folkesson and Brauner, 2005:22). The item managers start planning activities utilizing a software system called the Commodity Command Standard to “collect data on supply transactions and executes multiple batches of transactions through each workday” (Folkesson and

Brauner, 2005:23). The Requirement Determination and Execution System (RD&ES), a database system is used, on occasion, to “access NSNs on a monthly basis” (Folkeson and Brauner, 2005:23). As complex as this process may be to follow, it is critical to understanding how the movement of retrograde cargo from the CENTCOM AOR affects this process. The PRON is what is used to start any repair actions, typically to acquire any resources to fix assets or procure new parts. The month of April is the start of the long-range planning process for reparable components (Folkeson and Brauner, 2005:24). Conflict usually arises at the end of the fiscal year on the current PRON due to its ties to the congressional appropriations process which runs in conflict with the AWCF. The AWCF can be used for Army Material Command activities carried over past the fiscal year for labor and materials while awaiting a new PRON for approval. However, the delays in production and workload carried over into the next fiscal are some of the main reasons for backorders (Folkeson and Brauner, 2005:xvii).

Lessons Learned

The lessons learned subsection of the literature review will primarily consist of the findings and recommendations from an April 2006 joint study by the Lexington Institute and the Center for American Progress and a 2005 RAND Study on Management of Army Reparable Parts. So far, the intent was to familiarize the reader with a basic foundation of the retrograde process at the origin to the SSA and repair activities at the depot. The transportation portion of the process will be covered in the last section of literature review. The purpose of this subsection is to provide a broad view from various independent sources on their perspective of the Army equipment/retrograde process and the recommendations. It is unclear and beyond the scope of this research whether any of

the recommendations made from these studies were actually implemented by the US Army.

In their study, *Army Equipment After Iraq*, Thompson, Korb, & Wadham (2006:3) examines the status of Army equipment as a result of the Iraq war, lessons learned about the Army's active-duty and Reserve component equipment deficiencies, some short-term steps necessary to repair and modify equipment for continued support in Iraq and Afghanistan, and long term recommendations to restore the aging Army equipment fleet.

High utilization rates, the severity of combat losses, lack of desperately needed depot level repair, and the readiness levels at non-deployable units are the four areas cited by the study on Army equipment as a direct result of the War in Iraq. Thompson, Korb, & Wadham discussed the stress on equipment with examples of the Abrams tank and the Bradley fighting vehicle. They state that:

The Army's preferred measure of equipment usage is operational tempo, or 'opstempo.' Opstempo [Figure 13] is calculated as a multiple of the rate prevailing in peacetime. For example, the M1A2 Abrams tank drives 800 miles in a normal year, but those deployed in Iraq are covering about 5,000 miles per year, giving the Abrams an optempo six times the usual rate. The M2 Bradley tracked fighting vehicle that often accompanies Abrams in battle is experiencing a similar rate of use, as is the High Mobility Multi-purpose Wheeled Vehicle, a light truck popularly known as the HUMVEE. Medium and heavy trucks are experiencing optempos as high as 10 times the typical peacetime rate. Helicopter optempo's in Iraq range from two to five times the normal rate, depending on the type of helicopter. At these elevated rates of utilization, combat systems quickly become unusable without frequent maintenance and repair (Thompson, Korb, & Wadham, 2006:4).

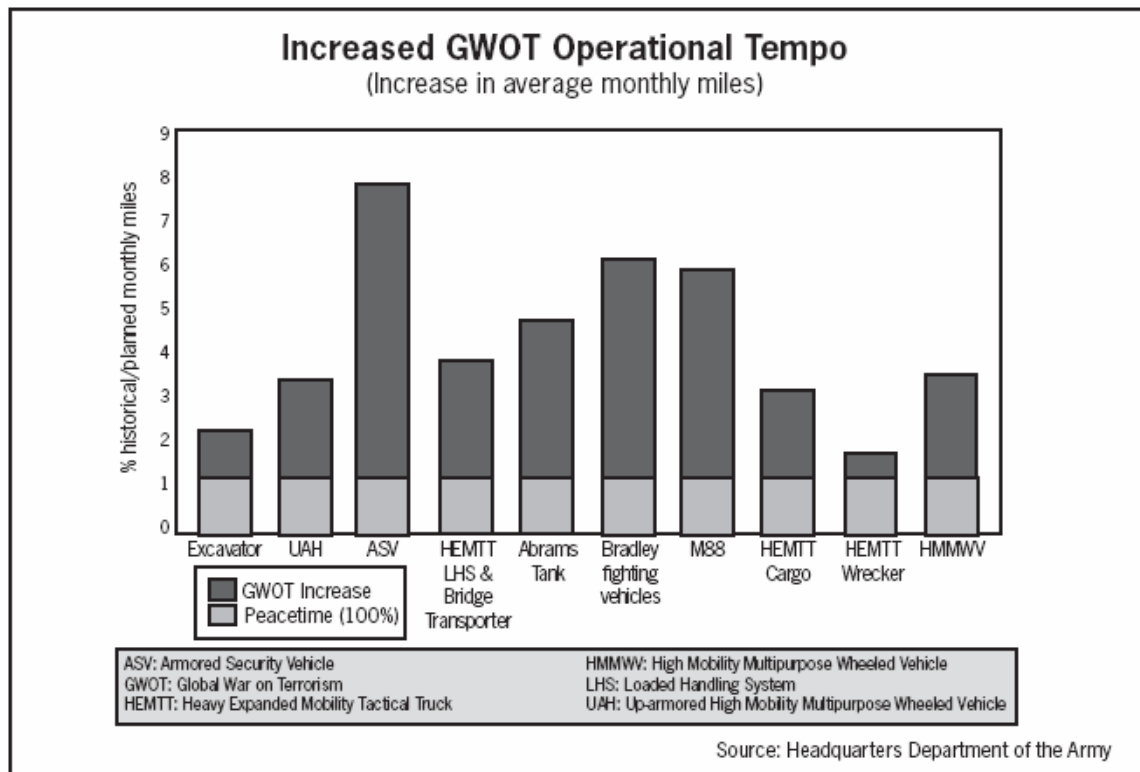


Figure 13: Increased GWOT Operational Tempo (Thompson, Korb, & Wadham, 2006:5)

The Army has had significant combat damage since the beginning of operations in Iraq and in FY2005 requested an emergency supplemental of \$553 million to acquisition 800 pieces of equipment and 350 wheeled vehicles (Thompson, Korb, & Wadham, 2006:5). In January this year, the Army indicated they intended to request \$1.3 billion over 100 helicopters due to hostile action or accidents in Iraq (Thompson, Korb, & Wadham, 2006:5).

During the redeployment of the Army National Guard, they “transferred more than 100,000 major equipment items to deploying forces, while deploying forces in turn have left behind more than 64,000 major items” for future rotations (Thompson, Korb, & Wadham, 2005:6). The net result is equipment worn out under brutal environmental conditions and extreme difficulty in maintaining the large amount of equipment items

(Thompson, Korb, & Wadham, 2006:5). The study short term recommendations are advocating Congress to approve current and future reset funding, set aside funding for equipment procurement and depot maintenance, drop further “recapitalization of aging equipment” (Thompson, Korb, & Wadham, 2006:13), for Congress to order the DOD to perform a review of the Army Reserve Component equipment requirements to meet its future commitments and that the Army should cease use of the supplemental process (Thompson, Korb, & Wadham, 2006:13). Their long term recommendations were for the Army to: “reorganize its war-fighting capabilities around modular, networked brigade combat teams”, field new communications systems for an “overarching Future Combat System,” begin efforts to replace the HUMVEE, and fight to keep its “aviation modernization program on track” (Thompson, Korb, & Wadham, 2006:17).

Last year, the RAND Corporation Arroyo Center performed a comprehensive analysis of the US Army Repairable Management process. The study will provide the baseline for this section with additional analysis and recommendations from other RAND studies, General Accounting Office (GAO) reports, and Army publications and lessons learned after-action reports.

During the Army's efforts in implementing the Velocity Management (VM) initiative, they discovered a historical pattern of backorders for reparable. RAND Arroyo Center conducted a case study analysis of the M88A1 armored recovery vehicle engine as a typical example of systemic backorder problems at Anniston Army Depot (ANAD), Alabama sponsored by the US Army DCS of Logistics and the CG of Army Material Command. Based on their analysis, they concluded the Repairable-Management Process had three critical issues that needed to be addressed: the impact of uncertainty

and variability in customer demands on long-term planning forecasts, the need for increased emphasis on near-term re-planning for execution, and inability of repair responsiveness to meet changing requirements (Folkeson and Brauner, 2005:xii). Each issue will be briefly covered along with the study's recommendations.

The planning forecasts used to estimate the reparable workload are 18 to 30 months out and do not allow for any adjustments or updates in mission requirements that inevitably lead to uncertainty and variability. In their analysis of the M88A1 engine, Folkeson and Brauner (2005) discovered that the long horizons of the planning forecasts led to underproduction, but as they also noted can also result in overproduction because of a decrease in demand. With the emphasis on using a long-term budget planning, the reparable-management process isn't responsive to customer's needs. The last critical issue centers on whether the depot is responsive to the changing requirements of the Item Manager, and if the depot had any procedures for adjustments to the repair program. The feedback from the RAND study concludes that there was little evidence at ANAD to substantiate an ability to "identify repair-part problems before they became critical in the production process" (Folkeson and Brauner, 2005:xiii). Folkeson and Brauner suggest some strategies for Army Material Command to use to address each critical issue.

For dealing with uncertain demand, use frequent update forecasts, increase safety stock, improve the replenishment lead times, and improve communication about customer needs and requirements (Folkeson and Brauner, 2005: xiv). Folkeson and Brauner recommend that depots can improve repair responsiveness by "reduce lead time" between repair and total repair flow time, "synchronize repairs with demand," and "assure the availability of unserviceable assets" (Folkeson and Brauner, 2005:xiv).

Better management of depot repair parts can be achieved by “greater flexibility in setting inventory levels for different items” versus a standard 60 days supply (Folkeson and Brauner, 2005:xvi). Lastly, the depots need to adopt policies that are “responsive to customer demands and “financial policies that encourage the proper use of repair capacity” (Folkeson and Brauner, 2005:xvii).

Establishment of the AMC Pure Pallet Program

The significant events leading up to the creation of the pure pallet program can be traced back to the summer of 2003 when problems begin to surface surrounding the movement of consolidated mixed pallets transiting the recently developed Theater Distribution Center (TDC) near Camp Arifjan, Kuwait. During a visit to Kuwait, a representative from the Defense Distribution Center (DDC) wanted to look at ways of improving the distribution of pallets and provide recommendations on how to improve the process only to discover that the methods used to consolidated pallets from the CONUS Consolidated and Containerization Points (CCP) were creating a buildup of pallets due to the manpower and resources required for break-bulk handling for onward movement to the final destinations (Mongold, 2005:22). The pallets shipped from the CCP represented mostly general cargo (not hazardous, outsized or oversized) where material is consolidated, palletized and trucked to the port of embarkation for onward movement in the defense transportation system (Dye, 2006:23). Known as MILALOC (military air lines of communication), these pallets from the CCP would, in many cases, have advanced visibility within the air transportation system so the aerial ports could plan for the arrival and provide expedited handling of onward movement to the AOR. However, with different consignees (DODAAC/unit address) on the same pallets, the

shipments would arrive within theater, then be trucked to the Theater Distribution Center where pallets are broken down by destination and re-palletized, and placed in trucking lanes for line-haul or break-bulked due to mixed destinations and shipped on intra-theater airlift to their final destinations (Dye, 2006:23-24). As a result, the shipments were in many cases damaged, pilfered, lost or had extensive delays in customer wait times for the warfighter. In most cases, the customer had no visibility of their shipments as pallets through the series of processes from the CONUS to the final destination in the AOR. As the volume of shipments from the CONUS intensified, customer wait time to destinations in Iraq rapidly deteriorated until November 2003 (Dye, 2006:23).

As previously mentioned in Chapter One, the Secretary of Defense designated the USTRANSCOM Commander as the Distribution Process Owner (DPO) in September 2003, which placed the ‘span of influence’ across all segments of the DOD distribution supply chain under a single component authority in contrast to multiple stakeholders only optimizing their individual segment of the distribution process [Figure 14].

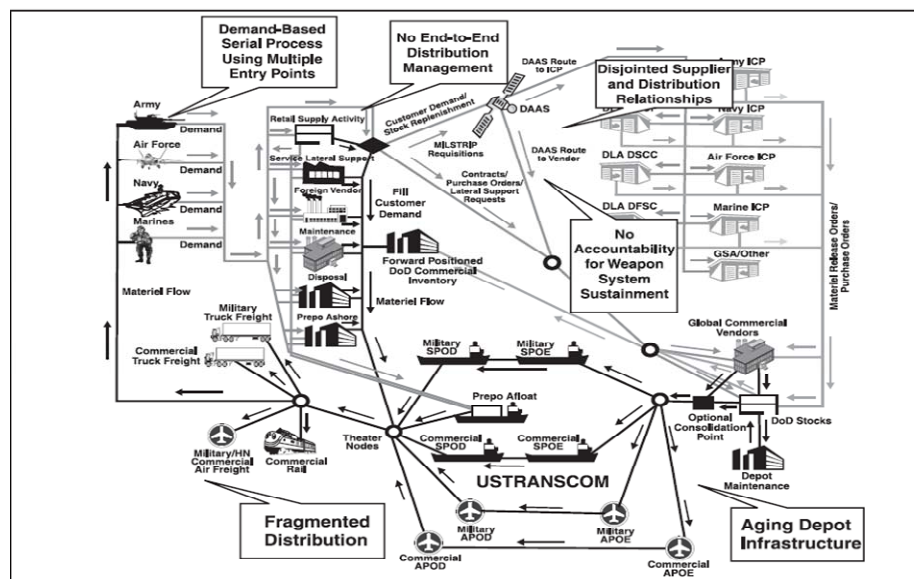


Figure 14: Current DOD Distribution (Crimiel and Currie, 2005:20)

Major General William Johnson, USTRANSCOM Chief of Staff, remarked that “it’s the first time we have a single entity that’s responsible for synchronizing and integrating the distribution pipeline” (DTJ, 2006:9). In the role of DPO, TRANSCOM is in a unique position to increase ITV for the warfighter, better responsiveness, and improve collaboration with key stakeholders (acquisition and storage—DLA, storage and inter-theater strategic movement—TRANSCOM, and intra-theater movement and tactical distribution—Combatant Commands) across the distribution process [Figure 15].

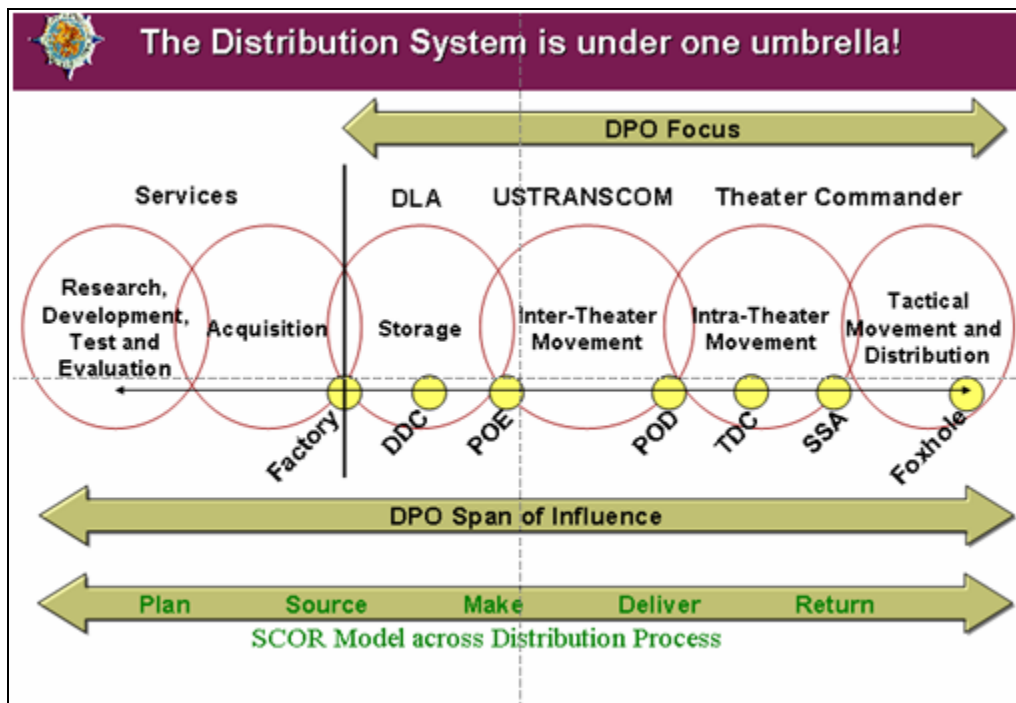


Figure 15: DPO Span of Influence (DUSD SCI Website, 2004)

In October 2003, representatives from DLA, Army Central Command (ARCENT), US Army Combined Arms Support Command (CASCOM), Combined Forces Land Component Command (CFLCC), TRANSCOM and Air Mobility Command meet to discuss ways to improve the AOR distribution system (Mongold, 2005:22). The representatives agreed that requisitioned material would be “held as far back in the

supply chain as possible where infrastructure was in place to efficiently hold and consolidate it” (Mongold, 2005:22). They also decided the ideal CCP locations were Defense Distribution Susquehanna (DDSP), Defense Distribution Depot Red River (DDRT) and Defense Distribution Depot San Joaquin (DDJC). Material consolidated at the CCPs would be considered “pure” pallet as they would be built to the end-user specifications where they would not require any break-bulk or immediate handling enroute or sorting for onward movement the final destination (Mongold, 2005:23). So, in essence, the pure pallet would be defined cargo built for a single DODAACs or SSAs. CFLCC, as the lead agency, would develop the routing plan and provide any necessary coordination within the scope of CENTCOM. The route plan is set-up by strategic airlift channel, final destination, and DODAACs or SSAs requiring consolidation. Stipulations were agreed upon by the participants that certain routes may not generate an adequate volume of cargo and could be combined with other DODAACs thus forming a “mixed” pallet (Mongold, 2005:23). However, these precautions were to be accounted for in the route plan.

During the same month, USTRANSCOM, as the DPO, proposed an plan for a Deployment Distribution Operations Center (DDOC) within the CENTCOM AOR for the purpose of tackling some the challenges that “include the uncoordinated Service component oriented control of distribution into theater and onward, retrograde operations, command and control of reception and staging, land transportation of arriving/departing forces, and multiple Service component and agency points of coordination” (DTJ, 2006: 11). In December 2003, CENTCOM accepted the plan (DTJ, 2006:11) and the DDOC was established in January 2004 (Kress, 2004). The DDOC deployed with “63 subject

matter experts from DLA, TRANSCOM, SDDC, Army Materiel Command and the individual member services” (Kress, 2004) to Kuwait with a first ever partnership working for CENTCOM. The CDDOC was charged to focus on six main areas: improve total asset visibility of personnel and materiel, “refine theater distribution architecture” (DUSD SCI Website, 2004), synchronize strategic and theater distribution, develop strategic distribution performance metrics, execute better 463L asset, container and RFID management, and lastly most notably establish visibility of retrograde cargo (DUSD SCI Website, 2004). Over the past three years, the CDDOC has had numerous successes, to include maximizing use of commercial freight liners for return, repair spares and return management of helicopter components to CONUS vendors, and “consolidating individual aircraft pallet for direct shipments to a single customer in the field” (Supply Brain Website, 2005). “CDDOC publicized with reach back to the National Partners, the CJTFs [Combined Joint Task Forces] willingness to wait a couple of extra days so the pallets were built ‘pure’ at the depot or APOE rather than have to break down pallets when they arrive in theater for repackaging and delivery to the customer. It was better to build the pallets in ‘clean warehouses’ than to break down and repackage them ‘in the mud’” (DUSD SCI Website, 2004).

Today, the successes of the pure pallet include reduction of cargo delivery by 4 days, less truck convoys over the roads which mean lower exposure to hostile fire, and fewer resources required for break-bulk handling. The number of pure pallets built from June 2004 to August 2006 was 40,181 which were 99.3% compliant with the CENTCOM Route plan (Scharven, 2006).

The Role of RFID within the DOD

Before covering the role of RFID within the Army retrograde process, a very brief history of the RFID technology, the components of the RFID and how RFID fits into total asset visibility will be covered familiarize the reader with its functionality. The history of RFID technology dates back to World War II under the Identification Friend Foe (IFF) system where it was used by “Allied fighters and anti-aircraft systems to distinguish their own returning bombers from aircraft sent by the enemy” (Garfinkel, 2005:15). During the 1970s, RFID technology evolves into the application commonly used in the military and commercial sector. Kriofsky and Kaplan (1975) patented an application for “inductively coupled transmitter-responder arrangement” (Garfinkel, 2005:16) that was capable of transmitting a signal and receiving power from a system of separate coils (Garfinkel, 2005: 16). Another patent application was filed in 1979 as “an ‘identification device’ that combined the two antennas” and is considered the precursor of the RFID devices widely used today (Garfinkel, 2005:16).

RFID consists of four distinct components: the tags, the readers, the antennas and the radio characteristics and the network utilized by the readers (Garfinkel, 2005:16). “Each tag consists of antenna and a small silicon chip that contains a radio receiver, a radio modulator for sending a response back to the reader, control logic, some amount of memory, and a power system” (Garfinkel, 2005:17). These tags may be passive (without a battery power source) that uses an incoming RF signal for power or active (with a battery power source) (Garfinkel, 2005:17). The readers send RF signals to the tag and stands by for a response from the tag. The tag, in turn, detects the RF signal and sends back the “tag’s serial number and possibly other information as well” (Garfinkel, 2005:

20). The antenna on the tags and reader vary in size. Large antennas on the readers or tags usually imply a better RFID system because of the ability to receive and transmit more RF power (Garfinkel, 2005:22). Typically, the reader sends RFID code information to the network. How this information is used by the network largely “depends on the application” (Garfinkel, 2005:22).

The first widespread application of active RFID technology within the DOD was due in large part from the lessons learned in the first Gulf War in 1991. During the Gulf War, the distribution system was flooded with duplicate or triplicate supply requisitions in a push supply chain with no way of identifying the contents of containers being shipped into the theater of operations. Known as the “iron mountain,” over 40,000 containers accumulated during Desert Storm without any idea of the exact contents (Garfinkel, 2005:192). As many as 20,000 containers were re-opened, inventoried and placed back into the defense transportation system and over 8,000 containers remained un-opened at the end of the Gulf War (JTAV, 1999:1-1).

Joint Total Asset Visibility

In 1992, the DOD established the Joint Asset Visibility in an effort to capture visibility of “in-storage, in-progress and in-transit assets” (JTAV, 1999:2-1). The Joint Total Asset Visibility Office defines JTAV as “the capability to provide users with timely and accurate information on the location; movement; status; and identity of units, personnel, equipment, and supplies. JTAV also facilitates the ability to use that information to improve the overall performance of DOD’s logistics practices. The ability to identify materiel and personnel assets and know their exact locations has long been recognized as a critical DOD need” (p.1.1). Some of the projected benefits of JTAV

were better use of maintenance assets and repair activities, reduced “backlogs at ports and depots,” supply responsiveness, lower inventory levels, and increased operational assessment accuracy (JTAV, 1999:1-4).

JTAV has two primary enablers that consist of Automated Information Technology (AIT) and Automated Information System (AIS). AIT provides the capability to bridge “data collection, aggregation, and transmission to AISs” (JTAV, 1999:D-1). AIT is able to capture data quickly with better quality and little manual effort, thus minimizing input errors (JTAV, 1999:D-1). The AIT technology suite consists of RFID tags, bar codes, optimal memory cards (OMC), and satellite tracking systems as a means of capturing and integrating logistics data. AIS are “designed to interface with commercial transportation information systems to receive and pass required personnel, unit, and cargo movement data and other transportation information to appropriate commands and agencies throughout the DTS” (FM 55-80, 1997:3-1).

The Deputy Under Secretary of Defense for Logistics designated the US Army as the Executive Agent for JTAV and stood up the JTAV Office in 1995. During Operation Joint Endeavor, the JTAV Office started initiatives for using “RFID devices and satellite technology under the DTRACS [Defense Transportation Reporting and Control System]” for the redistribution of reparable assets and the tracking the movement of convoys in Bosnia (JTAV, 1999:2-2). The Army transferred the JTAV Office to the Defense Logistics Agency and designated DLA as Executive Agent in 1998 along with oversight of the other services (GPO, 1999:27).

DOD RFID Policy

On October 2, 2003, Acting Under Secretary of Defense (Acquisition, Technology and Logistics), Michael W. Wynne passed the first of three policies on the implementation of RFID within the DOD supply chain. In the October 2003 memo, the Undersecretary Wynne established an official policy for the use of active RFID tags within the AIT suite and enforces the use of business rules on all DOD components to “ensure continued support for on-going Combatant commander in-transit requirements and operations” (Wynne, 2003:1). The memorandum mandates RFID (both active and passive) within the DOD to “provide near-real-time in-transit visibility for all classes of supplies and material, provide ‘in the box’ content level detail for all classes of supplies and material, provide quality non-intrusive identification and data collection that enables enhanced inventory management, and provided enhanced item level visibility” (Wynne, 2003:4).

On February 20, 2004 RFID Policy Memorandum, Undersecretary Wynne updated the business rules, the use of Electronic Product Code (EPC) compliant tags and set a implementation deadline of 1 January 2005 for DOD suppliers to use RFID passive tags on “all cases and pallets of material shipped to the DOD as well as on all packaging of all items requiring a Unique Identification (UID)” (Wynne, 2004:1). All DOD Components must also establish the ability to read passive RFID tags and extract data by the deadline date as well. The memo goes on to state that the Defense depots at Susquehanna, PA and San Joaquin, CA will operate as strategic distribution platforms with the ability to read and apply passive RFID tags on shipments to DOD locations and activities (Wynne, 2004:1). With the RFID mandate on DOD suppliers, the memo directs

the Deputy Undersecretary of Defense (Logistics and Material Readiness) to work on a proposed rule for insertion into the Defense Federal Acquisition Registrar by May 2004. Other efforts included how RFID data will be integrated into the “DOD data environment,” current and proposed logistics systems, “middleware translation requirements, architecture and enterprise infrastructure requirements, and data security issues” (Wynne, 2004:2). Lastly, the memo sets the final policy and overall implementation strategy by July 2004 (Wynne, 2004:2).

In the final RFID policy memorandum, Undersecretary Wynne mandates use of a RFID CONOPS for the DOD Components, the incorporation of RFID policy in DOD 4140.1-R, DOD Supply Chain Materiel Management Regulation, and the implementation of RFID transactions with logistics automated information systems starting in FY07. The memo updated business rules to include the DOD Logistics Automated Identification Technology (LOG-AIT) as “the DOD focal point for coordinating overarching guidance for the use of AIT” (Wynne, 2004: 1-1).

CENTCOM RFID Policy

In late December 2003, USCENTCOM Director of Logistics released a message, entitled, “New In-transit Visibility (ITV) Requirements for the USCENTCOM AOR” (USCENTCOM/CCJ4, 2003). Essentially, the message follows the same guidelines as the original October 2003 RFID memo but mandates immediate compliance for all cargo, seavan containers, and unit equipment for deployment or redeployment to have active RFID tag write capability. The message directs all aerial ports, seaports and distribution centers to requisition and install RF interrogators at their facilities and that all USCENTCOM components and subordinate combined task forces are to utilize the DOD

PM-AIT Office for all procurement actions (USCENTCOM/CCJ4, 2003). Although retrograde isn't addressed in the CENTCOM message, the guidelines are stated in the February and July 2004 RFID memo. The active RFID business rules for retrograde are:

All consolidated shipments or retrograde shipment (RFID Layer 4 freight containers (e.g., 20 or 40 foot sea vans, large engine containers and 463L air pallets) of DOD cargo being shipped OCONUS must have active, data-rich RFID tags written at the point of origin for all activities (including vendors) stuffing containers or building air pallets. Content level detail [Figure 16] will be provided in accordance with current DOD RFID tag data specifications. Containers and pallets reconfigured during transit must have RFID tag data updated by the organization making the change to accurately reflect current conditions (Wynne, 2004:1-1 and 1-2).

CONTENT LEVEL DETAIL	
Content level detail comprises two components: (1) Asset Level Detail (i.e. data elements that describe the asset) and (2) Content Level Detail - data elements that minimally identify each level of a complete shipment entity (a single shipment unit or a consolidated shipment).	
1. Asset Level Detail. The minimum data elements required to describe the physical characteristics of a single asset, and the characteristics that identify that asset.	
✓ National Stock Number (NSN) ✓ Nomenclature/Description Model Number ✓ Unit Price (U/P) ✓ Condition Code ✓ Serial Number / Bumper Number ✓ Serial Number Enterprise Identifier (if UID eligible) ✓ Part Number (if UID eligible, as applicable)	✓ Item Weight ✓ Item Cube ✓ Line Item Number (LIN)/Package Identification (PKGID) ✓ Ammunition Lot Number ✓ Department of Defense Identification Code (DODIC) ✓ Hazardous Cargo Descriptor Codes (to include ammo/ hazardous materiel).
2. Content Level Detail Visibility for Each Shipment Unit. The most basic transportation entity is a single box or unpacked item governed by a shipment unit identifier. The data elements are contained in the requisition document, Transportation Control and Movement Document (TCMD), commercial carrier transaction, and the Consolidated Shipment Information transaction that describes the shipment and shipment movement characteristics. Minimum data elements necessary to provide content level visibility for each shipment unit are:	
✓ Requisition Document Number ✓ Required Delivery Date (RDD) or expedited shipment and handling codes ✓ Project Code ✓ Asset (item) Quantity ✓ Unit of Issue (U/I) ✓ 'From' Routing Indicator Code (RIC) (for DOD shipments) ✓ Inventory Control Point (ICP) ✓ RIC (for contractor/vendor shipments) ✓ Shipment Transportation Control Number (TCN) – for single shipment unit ✓ Intermediate TCN – for a multi-level consolidated shipment ✓ Conveyance (lead) TCN – for a consolidated shipment ✓ Commercial Carrier Shipment Tracking Identifier ✓ Transportation Priority ✓ Sender (Consignor) DODAAC/CAGE Code	✓ Ship Date ✓ Port of Embarkation (POE) Code ✓ Port of Debarkation (POD) Code ✓ Shipment Total Pieces ✓ Shipment Total Weight ✓ Shipment Total Cube ✓ Oversize Length/Width/Height ✓ Receiver (Consignee) DODAAC ✓ Commodity Class ✓ Commodity Code (air/water) ✓ Special Handling Code (air/water) ✓ Water Type Cargo Code ✓ Net Explosive Weight (NEW) ✓ Unit Identification Code (UIC) ✓ Unit Line Number (ULN) ✓ Operation/Exercise Name ✓ Hazardous Material (HAZMAT) Shipping Characteristics: United Nations Identification Number (UNID), Class or Division Number, Package Group, Compatibility Group.

Figure 16: Content Level Detail (Wynne, 2004:1-2)

Effective, 1 January 2005, the guidelines for passive RFID tags on all Class IX Weapons System Repair Parts and Components retrograde are that all UID items will be affixed with a “2D data matrix technology symbology marking” using the “EPC data tag construct” (Wynne, 2004:2-1). In other words, all retrograde shipments will have a passive RFID tag for each items that qualify as a UID and an active RFID tag for each palletized or container shipment as depicted in Figure 17. The content level detail plays a significant role in the retrograde process as visibility of shipments from the AOR to the depot is crucial for particularly high value components such as Bradley fighting vehicle parts in short supply.

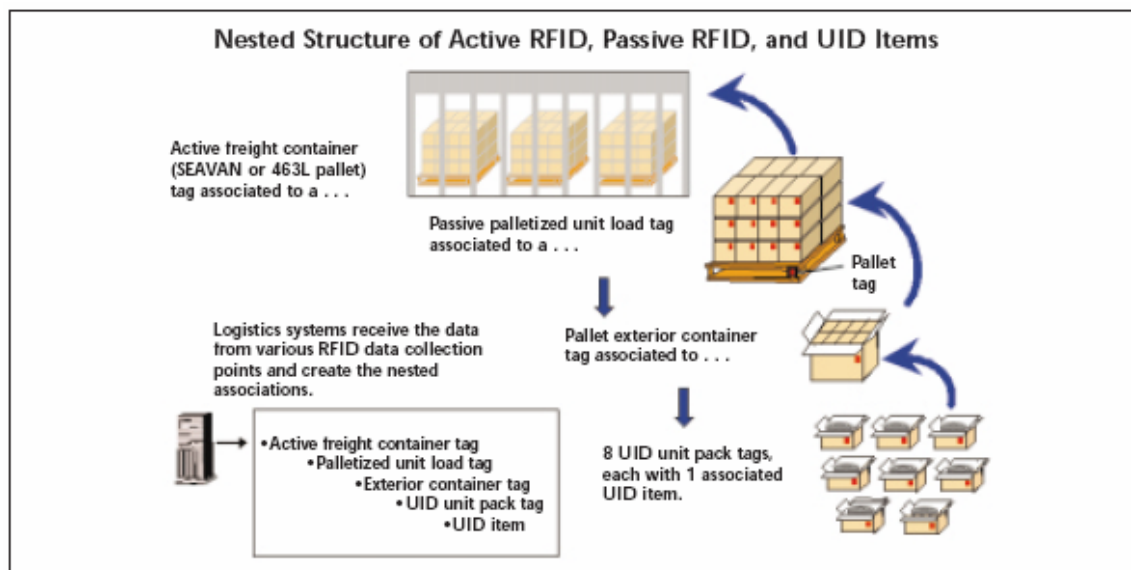


Figure 17: Nested Structure of Active RFID, Passive RFID and UID Items (Estevez, 2005:8)

The Role of RFID in the Retrograde Process

The role of RFID on the retrograde process is essentially the same as in the distribution channel as it relates to transportation processes (Estevez, 2005:6). The Assistant Deputy Undersecretary of Defense for Supply Chain Integration, Mr. Alan

Estevez believes that “with passive RFID, DOD will capture more granular [detailed] data automatically, injecting advanced technology at the transactional level. This will streamline the movement of material through warehouses and depots, increase inventory accuracy, and generate productivity improvements [Figure 18]” (6). The deployed units are using RFID write-capability with the Standard Army Retail Supply System (SARSS) to provide near real-time visibility of retrograde shipments in the Army supply chain (US Army G4, 2005:6).

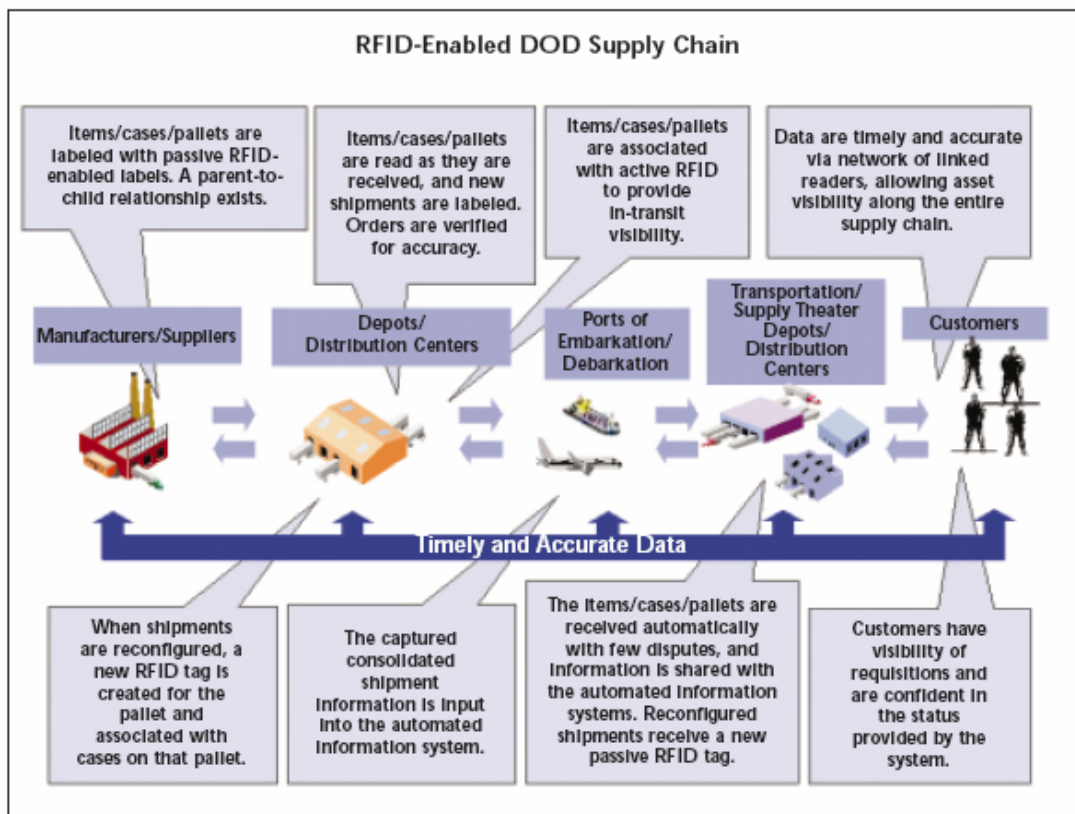


Figure 18: RFID-Enabled DOD Supply Chain (Estevez, 2005:6)

More importantly, “integration of RFID data into our supply systems, automatically queuing receipts for processing and delivery to customer, and encoding tags for retrograde shipments will speed delivery over ‘the last tactical mile’” (US Army G4, 2005:12). It is the lack of ITV that initiated the joint CENTCOM/TRANSCOM

Tiger team because RFID tags were being mistakenly removed from shipments by the aerial ports in the process of retaining the 463L assets. The Army Material Command relies heavily on the ITV server for pinging RFID tags on inbound retrograde shipments from the CENTCOM AOR. So, the role of RFID tags is one that is critical for predictability, reliability and visibility (Banks, 2002:1).

Summary

The chapter was divided into sections to guide the reader from how the commercial industry handles the complexity of the reverse supply chain, to envision the importance of product characteristics and customer defined value inputs into the reverse logistics network design, give recent and relevant commercial applications of reparable management, how and why the DOD established policy for supply chain integration, and finally closing with an brief understanding of the Army retrograde process and the creation of the pure pallet program. The chapter established a solid foundation for understanding what the reverse supply chain is as seen from the commercial industry. The literature presented a view of the relationship between the product life cycle and the individual components of the reverse supply chain with an emphasis on reducing costs and increases revenues. The reverse logistics network design takes careful thought and planning with the ultimate goal of integration based on the needs of the customer for a responsive and/or efficient supply chain. The US Army retrograde process is extremely complex and very diverse. The literature briefly touched the surface with only a limited scope on armored major weapons systems components and how to effectively and/or efficiency ship them back to the depots. Collaborative efforts from CDDOC, TRANSCOM, CENTCOM, DLA and Army Material Command are steady making

improvements to decrease lead times and increased visibility of retrograde shipments. The AMC Pure Pallet program has proven to be very successful in its origin intent specified by the customer and is a testament to joint efforts by all stakeholders involved in the process. The question still remains whether the same success can be duplicated for retrograde. RFID's role in ITV cannot be overstated both in distribution and retrograde operations. Lack of visibility was one of the leading problems to the ten of thousands of containers piling up and multiple requisitions of supply throughout the system during Desert Storm. RFID does indeed play a crucial role in retrograde as ITV systems are used more extensively by the depots for production planning and scheduling. Lastly, this chapter addressed first, third and fourth investigative questions. The next chapter will focus on the methodology and address the remaining investigative questions.

III. Methodology

Chapter Overview

This chapter will discuss the rationale for the research methodology and design, the data collection methods employed, the validity and reliability of the research design and the data analysis model selected for this research question.

Mixed-Methods Methodology

The type of research question posed for this thesis study required qualitative participatory viewpoints as well as supplemental quantitative data to confirm the results. As previously mentioned, the AMC Pure Pallet program is structured from customer inputs so the efficiency and effectiveness from the program for retrograde movement defined their vantage point. At the same time, cost is a very prevalent concern within the DOD and transportation is still one of the highest expenses within the supply chain. When it comes to the decision on whether the pure pallet program is a viable option, a cost comparison can provide one of the best indicators on the feasibility and overall value for the end customer. Volume is another key indicator on whether the pure pallet program is viable for moving retrograde cargo. In this research study, the determination of volume is based on historical patterns in archival transportation data. So, the qualitative and quantitative approaches alone would not adequately answer this research question. Based on the type of research question, the mixed methods methodology was used as the basic framework. This particular methodology seemed to fit the intent of answering the research question and the subsequent investigative questions. The option of a survey as a research method could be used in both quantitative and qualitative

approaches. However, the qualitative approach provides greater flexibility for the researcher in more open-end questions and the ability to follow-up on their responses, especially with an initiative such as the pure pallet that has never been applied for retrograde movement. As noted in the literature review, the Army retrograde process is extremely complex and has had several transformation initiatives over the past ten years. The insight from the interview process is crucial to capture this data from the experiences of the interviewees in a looser, conversational manner. Selection of one particular approach may have properly addressed the heart of the research question. Comparatively speaking, the use of a web survey for depot personnel presents challenges with pinpointing the right target audience, especially when lower level who simply may not have enough exposure to other aspects of the entire retrograde process as it relates to depot component level repair and Class IX items. The interviewees can recommend other potential participants or resources that simply is a limitation with web surveys. Therefore, a structured interview approach provides greater flexibility for the researcher and use of historical transportation data selected to address the heart of this research question.

Creswell (2003:5) states that:

Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases in the research process. As a method, it focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone.

Mixed Methods Design

Mixed methods methodology incorporates four major types of designs with multiple variants: triangulation, embedded, explanatory, and exploratory. Each design will be briefly covered to familiarize the reader with the various designs and their intent. The triangulation design is the most common and serve the purpose of gathering “different but complementary data on the same topic” to gain better insight into the research problem (Creswell, 2003:62). The design’s intent is to build on the strengths and “nonoverlapping weaknesses of quantitative methods (large size, trends, generalization) with those of qualitative methods (small N, details, in depth)” (Creswell, 2003:62). The embedded design is where “one data set provides a supportive, secondary role in a study based on primarily on the other data type” (Creswell, 2003:67). The intent is that one data set is insufficient and different types of data are needed to answer different types of questions (Creswell, 2003:67). The explanatory design consists of two phases by which “qualitative data helps explain or build upon initial quantitative results” (Creswell, 2003: 71). A situation where a researcher needs to qualitative data to expound on outliers or unusual results would be an example of how this design may be useful. Lastly, the exploratory design is when the “results of the first method (qualitative) can help develop or inform the second method” (Creswell, 2003:75). In table 1, each of the major mixed methods are described along with the variants, timing, weighing, and mixing rationalities. What should be noted from the table is that any researcher that decides to utilize mixed methods must understand how the characteristics of each design have significant influence of their allotted time and resources necessary to complete a study.

The model within the mixed methods used for this thesis study is the triangulation design with a convergence variant. This model fits the intent of the research problem because both qualitative and quantitative data will be collected separately about the same phenomenon and the results from each approach will be compared and contracted with the other (Creswell, 2003:64). “Researchers use this model when they want to compare results or to validate, confirm, or corroborate quantitative results with qualitative findings” (Creswell, 2003:65). The strengths of the design are data collection efficiency because of simultaneous efforts and both traditional techniques are used “separately and independently” (Creswell, 2003:66).

Table 4.2 The Major Mixed Methods Design Types					
<i>Design Type</i>	<i>Variants</i>	<i>Timing</i>	<i>Weighting</i>	<i>Mixing</i>	<i>Notation</i>
Triangulation	• Convergence • Data transformation • Validating quantitative data • Multilevel	Concurrent: quantitative and qualitative at same time	Usually equal	Merge the data during the interpretation or analysis	QUAN + QUAL
Embedded	• Embedded experimental • Embedded correlational	Concurrent or sequential	Unequal	Embed one type of data within a larger design using the other type of data	QUAN(qual) or QUAL(quant)
Explanatory	• Follow-up explanations • Participant selection	Sequential: Quantitative followed by qualitative	Usually quantitative	Connect the data between the two phases	QUAN → qual
Exploratory	• Instrument development • Taxonomy development	Sequential: Qualitative followed by quantitative	Usually qualitative	Connect the data between the two phases	QUAL → quan

Table 1: The Major Mixed Methods Design Types (Creswell, 2003:85)

The triangulation design also poses some challenges such as the level of effort and expertise required, how to address differences between qualitative and quantitative results, and how to weight “different samples and different sample sizes when converging two data sets” (Creswell, 2003:66). In order to deal with these challenges, the researcher should draw on the experience of the expertise of the thesis committee, collect additional data or reexamine existing data, and build comparison matrices as data sets are merged within the study (Creswell, 2003:66-67).

Validity and Reliability

The validity and reliability is a direct reflection of the measurements applied in a research design. Validity is the (Leedy and Ormrod, 2005:28) “extent to which the instrument measures what is suppose to measure” and reliability is the (Leedy and Ormrod, 2005:29) “consistency with which a measuring instrument yields a certain result when the entity being measured hasn’t changed.” Validity and reliability have different forms and their application varies depending on the methodology and the type of research question (Leedy and Ormrod, 2005:29). Within the mixed methodology, Creswell (1994, 2003) provide limited information on addressing both validity and reliability using the triangulation design in any sufficient detail. However, Yin (2003:33) cites that “four tests are used to establish the quality of any empirical social research.” The four tests used to test social science methods are: “construct validity, internal validity, external validity, and reliability” (Yin, 2003:34). Yin’s four tests will be used addressed the different forms of both validity and reliability of this research design. The credibility of the interview process as it relates to reliability and validity will be discussed separately.

Construct validity is the “extent to which an instrument measures a characteristic that cannot be directly observed but must be instead be inferred from patterns in people’s behavior” (Leedy and Ormrod, 2005: 92). Yin (2003:35) states that one of the three tactics for increasing construct validity is “the use of multiple sources of evidence, in a manner encouraging convergent lines of inquiry and this tactic is relevant during data collection.” Triangulation is cited as an approach for using multiple sources of evidence. There are four types of triangulation cited by Yin based on Patton’s (1987) work. Patton (1987) outlines four types of triangulation, “Triangulation of data sources (data triangulation), among different evaluators (investigators triangulation), of perspectives to the same data set (theory triangulation), and of methods (methodological triangulation)” (Yin, 2003:98-99). This study will explore two of the four types of triangulation: data and methods. Data triangulation will consist of responses from the interview participants pinpointing the type of reverse supply chain that meets the customer overall values and needs and cross-referencing with the archival air transportation data from Air Mobility Command’s Global Air Transportation Execution System of retrograde shipments over a three year period into a single study. The Global Air Transportation Execution System (GATES) is the primary aerial port management system for the movement of cargo and passengers on AMC aircraft and is a major ITV for input into USTRANSCOM’s Global Transportation Network (GTN). GTN is the main DOD ITV system for linking mission information and manifest data to provide a comprehensive picture of passenger and cargo movement throughout the DTS. Therefore, access and analysis of GATES transportation data of retrograde shipments is a critical component for insight into cost and generation of volume in the application of the pure pallet program.

Internal validity is defined as the “extent to which its design and the data it yields allow the researcher to draw accurate conclusions about the cause-and-effect and other relationships within the data” (Leedy and Ormrod, 2005:97). One strategy for increasing internal validity is the collection of multiple data sources with the intent to “converge to support a particular hypothesis or theory” (Leedy and Ormrod, 2005:99). As previously discussed in the research design, the triangular design convergent variant model addresses this form of validity with the interpretation of the results by contrast and compare from subject matter expert interviews and cost comparison based on the historical transportation movement data from the AOR to the defense depots. “The extent to which its results apply to situations beyond the study itself—in other words, the extent to which conclusions drawn can be generalized to other contexts” (Leedy and Ormrod, 2005:99) is defined as external validity. The selection of subject matter experts which under a reasonable assumption are customers in the retrograde process for in-depth interviews would qualify under the ‘representative sample’ strategy for enhancing external validity (Leedy and Ormrod, 2005:99). The purposeful representative sample for this thesis was drawn from personnel from DLA, Army TACOM Lifecycle Management Command, Army Communications and Electronic Management Command, and Aviation and Missile Management Command as subject matter experts selected through combination of chain and opportunistic sampling technique. The combination of purposeful sampling was necessary because the level of strategic transportation experience or knowledge of the entire US Army retrograde process needed for the interviews was too specialized and other sampling techniques proved to infeasible due to time constraints. Given these limitations, it simply was not possible to poll the entire

population to pare down the subject pool to only those individuals with direct experience with retrograde from the CENTCOM AOR, then randomly select individuals for conducting focused interviews.

External validity for quantitative portion of this study will be enhanced by the use of a representative sample of the historical retrograde data from the CENTCOM AOR to Red River Army Depot. “Whenever we conduct research to learn more about a particular category of objects or creatures...we will often study a sample from that category and then draw conclusions about the category as a whole” (Leedy and Ormrod, 2005:99. A sample of retrograde shipments during 2006 from the AOR through Dover to Red River Army Depot constitutes a representative sample of high priority retrograde movement for a cost comparison utilizing the current transportation billing process as a base with a comparison of the costs of aggregated pure pallet guidelines originating at the aerial port and TL rates on the CONUS portion versus a flat rate from deployed aerial port to the depot. The idea is this representative sample of retrograde shipments will provide insight into the variance in transportation costs for convergence with the qualitative data on what the customer actually values from the transportation port of the DOD reverse supply chain.

Yin (2003:34) states that reliability is “demonstrating that the operations of a study—such as the data collection procedures—can be repeated, with the same results.” Basically, the researcher needs to “minimize the errors and biases in a study” (Yin, 2003: 37). Reliability can be enhanced by consistently administering the research measurements—for example in the interview process for every person. (Leedy and Ormrod, 2005:93). The researcher should thoroughly and accurately document every step

of the research process as if “someone were always looking over your shoulder” (Yin, 2003:38). In this particular study, the protocol procedures cited by Rubin and Rubin (1995) for the interview process will be utilized and is discussed in greater detail in the next section.

Qualitative Interview Procedures

Validity and reliability for a research design is more closely aligned with a quantitative approach than a qualitative approach (Rubin and Rubin, 1995:85). The credibility of qualitative research is judged by “transparency, consistency-coherence, and communicability” (Rubin and Rubin, 1995:85). Transparency is defined as the ability to see the “basic processes of data collection” (Rubin and Rubin, 1995:85). The reader should be able to clearly understand the interviewer’s strengths, weaknesses and biases as well as their conscientiousness (Rubin and Rubin, 1995:85). The interview procedures in this research study will be based on the recommendations of Rubin and Rubin by documenting detail records of the interviews and the use of a separate notebook on what was learned as a part of the process. “In qualitative research the goal is not to eliminate inconsistencies, but to make sure you understand why they occur” (Rubin and Rubin, 1995:87). Many different people may offer different versions of the same events and the researcher will have to provide evidence why one version was accepted over another or to explain the circumstances surrounding the disparities between the versions (Rubin and Rubin, 1995:87). The simplest solution to resolve a contradiction is to ask for clarification by the interviewee (Rubin and Rubin, 1995:89). Lastly, communicability is the “portrait of the research arena that you [interviewer] present should feel real to the participants and to readers...” (Rubin and Rubin, 1995:91). This is accomplished by

plenty of detail, evidence, and vividness in the description of the material (Rubin and Rubin, 1995:91).

Purpose Statement

The research question is whether the AMC Pure Pallet program is a viable option for high priority Army retrograde. The viability and efficiency of the program is based on the amount of cargo generated from supply requisitions routed through one of DLA's strategic distribution platforms (Defense Depot-Susquehanna, PA) and the specified customer requirements to the warfighter in the AOR. The underlying goal of customer requirements in the pure pallet program are to hold the amount of cargo for a particular SSA(s) to consolidate individual shipments on 463L pallets thereby eliminating the risk of loss, pilferage or damage, increase ITV, and reduce intermediate break-bulk handling of the shipments upon arrival in theater. So, the success of the program centered on amount of requisitioned cargo generated in a given timeframe and customer-based requirements. Therefore, the quantitative portion of this study examined the volume of retrograde generated within the airlift system to the depot and the qualitative portion measured customer input or value of the transportation system through select in-depth interviews with the item managers and retrograde subject matter experts throughout Army Materiel Command and DLA. A sample of retrograde shipments from Kuwait to Red River Army Depot during 2006 will serve as a representative example in developing a cost comparison, based on the GATES historical transportation data. Red River Army Depot was selected as a part of this research study because the lack of visibility of its component transmissions from the CENTCOM AOR triggered the interest to establishing a joint Tiger Team to investigate ITV within the Defense Transportation System from the

deployed aerial port locations to the CONUS aerial ports and by truck to the depots. Recall that ITV is a fundamental customer requirement throughout the retrograde process. The results from the qualitative portion of the study were compared with historical transportation retrograde shipments from Kuwait, Iraq and Qatar to Red River Army Depot. The purpose is to contrast with what the subject matter experts or the item managers value overall (speed/velocity, reliability, dependability) as customers to the transportation system to what is reflected from historical records. In addition, the results may reveal whether there is a more underlying problem with the linkage between supply and transportation policy. In addition, the qualitative portion served as the basis of whether the depot and the item managers value a responsive supply chain or an efficiency supply chain. The quantitative portion of this study consisted of a cost comparison contrasting the accumulation principles of the AMC pure pallet program to take advantage of full truckload rates, a straight flat rate for all air and surface movement or the current process based on historical retrograde data to determine any supply chain optimization into the production cycle for equipment repairs. Ultimately, the goal of this research was to determine the viability of the Pure Pallet program and whether inputs from the depot provided the feedback needed for maturation of the DOD reverse supply chain by better meeting the needs and requirements of the customer.

Review of the Investigative Questions

Investigation Question 1:

How is the commercial industry managing the reverse movement of products and reparable assets and are these viable options for the DOD?

The first portion of the investigation question was answered by the review of the related literature and the second portion is included in the recommendations section of Chapter 5.

Investigation Question 2:

Who is the customer in the retrograde process? What does the customer value in the movement of reparable parts from the CENTCOM AOR? This question was answered by a combination of the literature review and an administered questionnaire by the researcher through telephone interviews with item managers at the Defense Logistics Agency and subject matter experts from Army Materiel Command directly involved with the retrograde component level repair of shipments arriving from the CENTCOM AOR.

Investigation Question 3:

What is the current retrograde process for US Army Class IX reparable shipments from the CENTCOM AOR to the defense depots? This question will be answered by an exhaustive review of related literature.

Investigation Question 4:

What contributing factors led to the successful implementation of the AMC Pure Pallet program? This question will be answered by an exhaustive review of related literature.

Investigation Question 5:

Does the intent and business rules of the AMC Pure Pallet Program meet the value expectations and requirements of the customer for movement of high priority US Army retrograde from the CENTCOM AOR?

This question will be answered by the available literature of the historical significant events leading to the implementation of the AMC Pure Pallet program and case study

analysis using recent transportation data from an USTRANSCOM field study analysis of a sample of retrograde shipments from Kuwait to Red River Army Depot during 2006 and historical data of US Army retrograde shipments over the past three years for determining volume in the applicability of the pure pallet program.

Investigation Question 6:

What are the costs of using the AMC Pure Pallet program, a flat rate using the 9GN project code for expedited handling through the aerial ports or the current transportation rate process?

This question will be answered using a cost comparison comparing the flat rate calculations for both air and surface transportation applying the 9GN project to the CONUS depots with retrograde shipment consolidation in theater and utilizing the full TL rate to the depot. Ideally, the reverse supply chain has tradeoffs with each option: responsive expedite handling and shipping out retrograde free-flow into the defense air transportation system and with a flat rate to the depot or shipment efficiency with shipment consolidation and a cheaper trucking rate.

Data Collection Procedures

As previously mentioned in this chapter, the type of data collected in this study is qualitative and quantitative. Leedy and Ormrod (2005:95) define qualitative researchers as those who “seek a better understanding of complex situations” and quantitative researchers as individuals that “seek explanations and predictions that will generalize to other person or places.” Quantitative researchers typically select one or more variables they intent to collect data on and study as it directly relate to those variables. (Leedy and Ormrod, 2005:96). Qualitative researchers “tend to select a few participants who can

best shed light on the phenomenon under investigation” (Leedy and Ormrod, 2005:96).

The data collection procedures are typically be driven by the type of mixed methods design. For the convergence variant model of the triangulation design, the data is collected concurrently and independently (Creswell, 2003:116).

The qualitative data was collected through in-depth open-ended interviews from subject matter experts from Army Materiel Command and DLA. The quantitative data was collected from USTRANSCOM through a query of the transportation systems used for the movement of air, GATES. The data was sent via email in an MS Excel document categorized by transportation control number or shipment/container ID, consignor, consignee, transportation priority, required delivery date, pieces, weight and cube of all retrograde cargo departing Iraq, Kuwait and Qatar from fiscal year 2004 through 2006. The surface billing data was obtained from a commercial carrier internet website that is under the commercial tender contract at Dover Air Force Base to calculate each of the selected retrograde shipments from GATES during fiscal year 2006 to form the baseline for the cost comparison. The non-9GN data sets were selected every other month during FY2006. Due to the limited use of the 9GN project code, the data set consisted of all shipments during FY2006.

Justification of Questionnaire

The purpose of the questionnaire is to measure the level of satisfaction with the defense transportation system and to determine whether the customer values an efficient reverse supply chain or a responsive reverse supply chain. The researcher is making a reasonable logical assumption that both the depot and the DLA item managers are the customers in the Army component repair retrograde process. Once a part has been

released from the deployed location and processed at the SSA, it does not change status or value until the depot has received the part, performed a technical inspection, repaired or refurbished the part. The item managers are monitoring the components throughout the entire process and will direct the movement of the component to fulfill a due out, into the “centralized distribution depot for future use” or to remain in storage at the distribution center (Folkeson and Brauner, 2005:xii). In essence, the depot and the item managers have an interdependent relationship as to direction and movement of retrograde from the deployed locations. It is for these reasons that both Army Material Command subject matter experts and the item managers were interviewed for this thesis study.

Survey Questionnaire

The questionnaire serves as an instrument to introduce the respondents to the survey, “the items and scales to measure the survey topics in a logical and necessary sequence” (Alreck and Settle, 2004:146), and the actual survey questions for respondents that can be individually “grouped and compared” (Alreck and Settle, 2004: 146). Typically, the questionnaire consists of three parts: (1) the introduction or interviewer greeting which sets the tone for the questions to follow, (2) the body or middle portion that consists of the questions relating to your survey topics, and (3) the concluding portion reserved for either “demographic or biographic questions” (Alreck and Settle, 2004:155) as these questions are the most sensitive from the respondents (Alreck and Settle, 2004: 147,148,155). Alreck and Settle (2004:155) cite two reasons these types of questions are placed in the last portion of the questionnaire. First, at the point in the questionnaire, the interviewer should have established a rapport with the interviewee and is very familiar with the line of questions. Second, the interviewee may not feel

comfortable answering these types of questions and feel it is necessary to terminate the remaining portion of the questionnaire. However, the format allows the interviewer to use the responses provided in the earlier portion of the questionnaire.

The questionnaire serves as the instrument during a telephone interview process to collect data from the personnel from Army Material Command and the Defense Logistics Agency to determine customer satisfaction and value with respect to the defense transportation system. The questionnaire consists of 15 open ended and short answer questions (Appendix 1) using a combination of the multiple-choice single response and forced rankings. Each set of questions were grouped together by the type of scale and the demographic questions were placed at the end of the questionnaire. Although the questionnaire will be used as a part of an interview with subject matter experts, the approval process remains the same as any other survey. A cover letter explaining the purpose of the questionnaire and how it was accomplished as a part of the thesis study is listed in Attachment One.

Telephone Interview Process

Telephone interviews should be accomplished at a central location where the costs are not prohibitively expensive for the interviewer (Alreck and Settle, 2004:238). All interviews for this study were accomplished in AFIT facilities and during normal duty hours. Potential interviewees were advised over the phone that participation is strictly voluntary and the interviewer will schedule a specific time for the interview to be conducted after confirmed written content via email. The format used in this process is referred to as the ‘focused interview,’ where the “respondent is interviewed for a short period of time—an hour” (Yin, 2003:90). The interviews consisted of short answer or

open-ended questions in a conversational manner based on case study research.

The interview process began with a brief introductory greeting explaining the purpose of the data collection, the name and institution of the researcher, and that the identifying information of the interviewee will not be retained in the final thesis study. The telephone interviews were recorded through the use of a digital voice recorder only for accuracy of the comments or responses made during the process, then transcribed verbatim by the researcher. This method minimizes bias and memory recall of how interviewees responded to the questions (Martin, 2006:63). Yin (2003:86) cites other weaknesses such as “bias due to poorly constructed questions” which will be addressed by subject matter expert review of the questionnaire and “reflexivity...interviewee gives what interviewer wants to hear,” that is compensated for by maintaining neutrality from the responses during the interview process. Once the content level questions were completed, the interviewer asked limited demographic information (Time of service in the DOD and the amount of time servicing in their current duty position) and thanked for their time in participating in the interview.

Mixed Methods Data Analysis

Although several models (Johnson and Onwuegbuzie, 2004 and Johnson and Christensen, 2004, Creswell, 1998, 2003 and Tashakkori and Teddlie, 2003) exist for mixed methods methodology, Onwuegbuzie and Teddlie (2003) was selected as it presents a detailed framework for data analysis in mixed methods research (Tashakkori and Teddlie, 2003:363). Before any researcher can begin utilizing this model, 12 decisions must be addressed. Each decision will be briefly discussed along with how each one corresponds with this research study (Tashakkori and Teddlie, 2003:363).

Purpose is the first decision made by a researcher in using a mixed methods methodology, which in this case is for triangulation of both qualitative and quantitative data and has been previously discussed at length. The second decision is variable-oriented versus case-oriented analysis where the former is “more consistent with quantitative methodologies or with qualitative methodologies with large samples” and the latter is more focused on a the case as a whole with an emphasis on “looking at configurations, associations, causes, and effects with the case—and only then turns to comparative analysis of a (usually limited) number of cases” (Tashakkori and Teddle, 2003:363). The qualitative portion of this study with the comparison of interviews from subject matter experts is the dominant approach of this study and seems to align with the case-oriented analysis. The third decision is exploratory versus confirmatory data-analytical techniques. Based on the research question and the dominant approach of this study, the exploratory data analysis techniques was the best choice and consisting of a cost comparison and descriptive statistics for the quantitative portion and cross-case analysis for the qualitative portion. The selection of which data types used is the fourth decision (Tashakkori and Teddle, 2003:363). Both types were used where the quantitative data was interpreted into qualitative form in the transformation process, which is discussed later in this chapter. The fifth decision is relationships between quantitative and qualitative data types (Tashakkori and Teddle, 2003:365). In this two-step process, the analyst must first decide between the two types of data whether they will be weighted equally or whether one will be dominant over the other. The second step is the extent to “which the quantitative and qualitative data analysis inform each other during the data analysis process” (Tashakkori and Teddle, 2003:365). The first step has

already been addressed and the second falls in line with what is referred to as “parallel mixed analysis” (Tashakkori and Teddle, 2003:365). “In parallel mixed analysis, once both sets of analyses have been conducted and verified, the researcher has the option of interpreting and writing up the two sets of findings separately or in some integrated manner” (Tashakkori and Teddle, 2003:365). In this research study, both sets of findings were integrated together for the interpretation and final conclusion. Data assumptions are the sixth decision and will be discussed at length in Chapter Four. The seventh decision is the source of typology development which means the analysis of one data type can produce a “set of substantive categories or themes...” over another data type (Tashakkori and Teddle, 2003:370). Typology can originate from five sources: “investigative (constructed directly by the researcher), participants (participants themselves identify categories), literature (derived from findings and conclusions documented in the extant literature), interpretative (constructed from a preexisting set of analytical concepts) and programs (constructed from a set of goals or objectives stated in a program manifesto)” (Tashakkori and Teddle, 2003:370). The program typology aligns with the direction of this research question in determining the applicability of the pure pallet program for retrograde movement. The eighth decision is the nomination source for typology development which is derived from the program objectives (Tashakkori and Teddle, 2003:370). The verification source for the typology development is the ninth decision and consists of six sources of justification: rational, empirical, technical, participative, referential, and external. The referential source “using research findings or theoretical frameworks to justify, through corroboration, a particular typology” will be used as the justification for this study. The temporal designation for data analytical procedures is the

basis for decision ten where the analyst decides the development of the typology “will occur a posteriori, a priori, and iteratively” (Tashakkori and Teddle, 2003:371). The categories for data analysis were created before data collection or priori. In decision eleven, the analyst must decide on the tools required for the mixed methods analysis. A computer was used to transfer the digital voice recordings of the interviews into a MS Windows® Media file for data transcription to text. For the quantitative portion, Mini-tab 14 SP® and MS Excel were used for analyzing the historical transportation data. The last decision is the process of legitimation where the analyst “verifies any inferences that evolve before making any final conclusions” (Tashakkori and Teddle, 2003:372). Triangulation is mentioned as one of the ways that is accomplished which has been previously covered in great detail. Tashakkori and Teddle also recommend addressing any threats to internal and external validity which has also been discussed at length during the beginning of this chapter. After each of the decisions has been presented, the data analysis can begin.

Data Analysis Model

Onwuegbuzie and Teddlie (2003:373) data analysis model [Figure 19] consists of seven stages: “Data reduction (Stage One), Data Display (Stage Two), Data Transformation (Stage Three), Data Correlation (Stage Four), Data Consolidation (Stage 5), Data Comparison (Stage Six), and Data Integration (Stage Seven).” Each stage will be discussed and serve as a guide for the framework for the preceding chapter. The reader should note that the stages may be sequential but not necessarily linear. Some of the stages will not apply due to the purpose of the mixed methods research and/or variant applied in the design. For example, in Figure 20, linking the type of quantitative or

qualitative research question on the left side of the diagram was a direct relationship with the research design and the corresponding stage of the mixed methods data analysis process. In this particular study, the research question is primarily qualitative in nature with a quantitative component for a descriptive research design using concurrent mixed methods collection and analysis.

Stage One: Data Reduction

In the first stage, the analyst will reduce the data collected to organize and focus it in a way that where “final conclusions can be drawn and verified” (Tashakkori and Teddle, 2003:373).

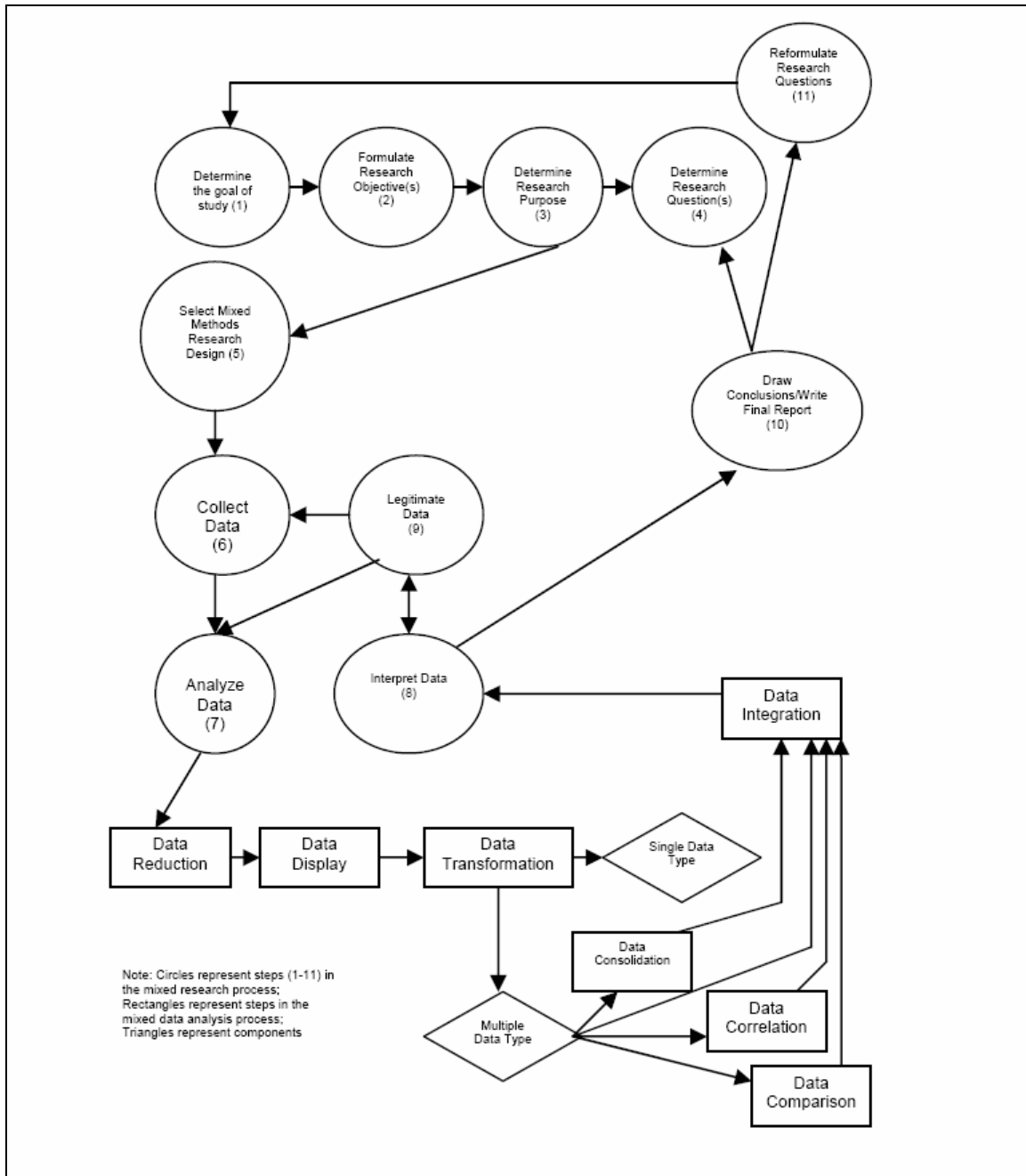


Figure 19: Mixed Methods Data Analysis Process (Onweugbuzie and Leech, 2006:492)

In the quantitative portion, the GATES transportation data extracted into an MS Excel spreadsheet was translated from various manifest codes such as consignee and consignor into their proper shipping names and the transportation control number was used to construct the day, month and year of each shipment over a three year period.

The airlift shipping costs were calculated based on the FY06 DOD cargo airlift rates. The surface shipping costs were calculated using LTL carriers used in the commercial tender contract at Dover Air Base and combined with the airlift shipping costs for the cost comparison. The qualitative data was reduced through manual transcribing the interviews from MS Window Media files via a digital voice recorder, writing summaries, and coding the data for general themes across all of the interviewees.

Stage Two: Data Display

In stage two, cross-sectional matrixes were developed to display each of the interviewees' responses for contrast and comparison. The responses to the questions from the interviews were organized in a word table matrix form for analysis and interpretation of customer value and satisfaction of the transportation system and their suggestions on developing better responsiveness of processing retrograde through the reverse supply chain. The participant's remaining comments were coded by subject groupings and analyzed for any distinctive patterns across all of the interview participants. The quantitative data was displayed in trend graphs and pie charts. The transportation costs from sample sets of quantitative data served as the basis for a cost comparison comparing a flat rate for all air and surface transportation modes, the current cargo billing process, and a cargo accumulation concept as it is applied in the distribution channel for entry into the military airlift system from the deployed location. Selected months of shipments during FY06 will serve as the data set for this analysis due to the changes in rates every fiscal year. Typically, customer wait time (CWT) would be used as a cost/benefit tradeoff within the transportation system. However, in this particular research, it is very difficult to calculate any benefits of CWT without the data to

substantiate any changes in the total length of time within the defense transportation system. Therefore, total cost savings between the pure pallet and flat rate will serve as the overall benefit to the customer. In addition, the pure pallet option will serve as an efficiency model by capitalizing on TL rates during CONUS portion to the depots and the flat rate option will serve as the effectiveness model to take advantage of expedited movement through the aerial ports and LTL movement to the depots. The idea behind using the accumulation parameters are to determine if enough retrograde is being generated for one destination based on historical data to offset the delay with any potential cost savings for truckload rates to the depot.

Stage Three: Data Transformation

In the third stage, data transformation, “data types are qualitized and/or quantitized” (Tashakkori and Teddle, 2003:375). The interview responses in stage two are coded and form an inter-respondent table for a hierarchical structure of central themes from the qualitative data. The results of the cost comparison and the trend analysis of retrograde shipments were briefly interpreted into qualitative form for the last stage, data comparison.

Stage Four: Data Correlation

At this stage, an examination is made on whether any correlation exists between the quantitative data and the “quantitized (qualitative) data” or vice versa (Tashakkori and Teddle, 2003:376). In this study, this stage and the following stage were omitted based on the type of research question and available data for analysis.

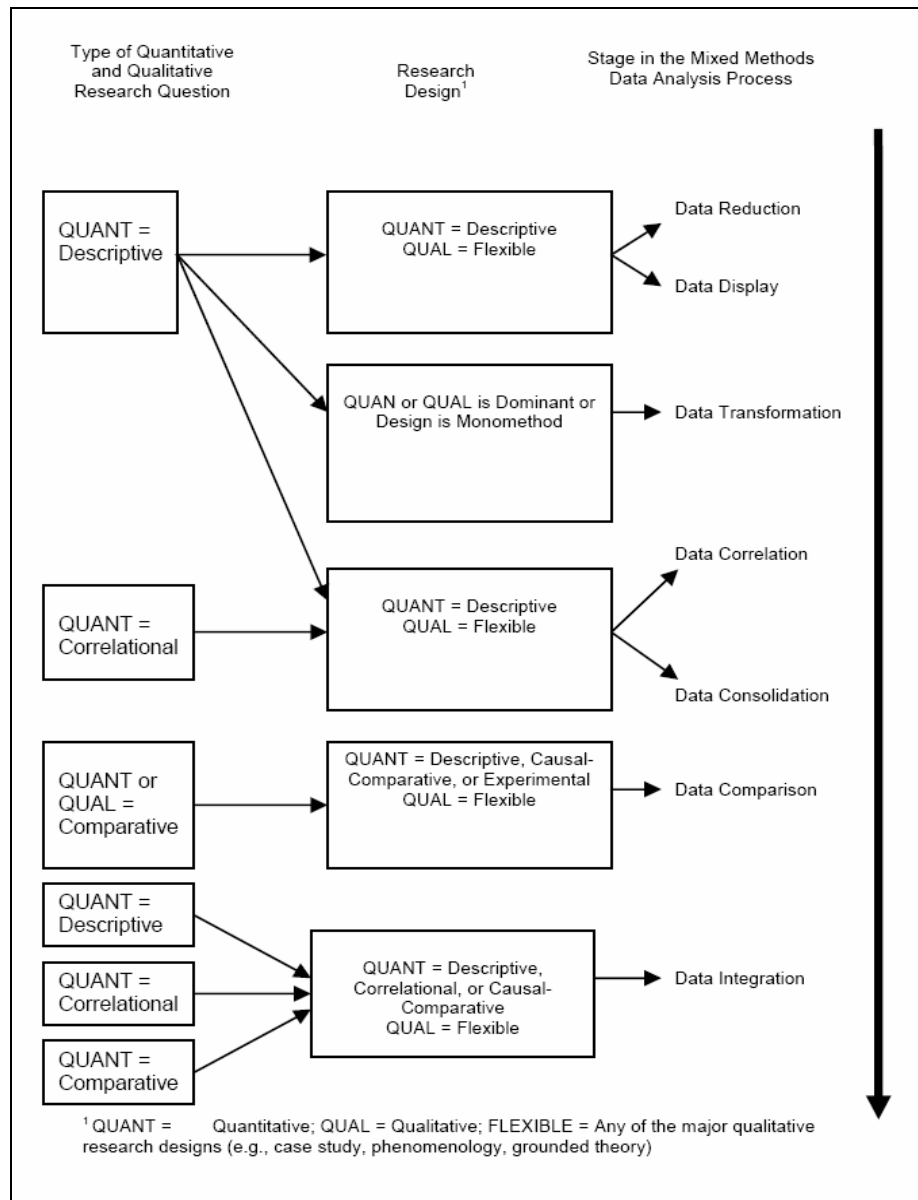


Figure 20: Relationships Among Research Questions, Research Design and Mixed Methods Data Analysis (Onweugbuzie and Leech, 2006:493)

Stage Five: Data Consolidation

As the name of the stage implies, both quantitative and qualitative data forms are combined “to create new or consolidated variables or data sets” (Tashakkori and Teddle, 2003:376). As stated in the aforementioned stage, this stage is omitted from the data analysis of the research study.

Stage Six: Data Comparison

In this stage, the two types of data are compared from different data sources (Tashakkori and Teddle, 2003:377). The response matrix to the interview questions in stage two and inter-respondent matrix in stage three was compared with the cost comparison and trend analysis of retrograde generating from Kuwait through Red River Army depot. The focus at this point is for data triangulation; clarify conflicts between both data types, and to lead the reader to an interpretation of the data in the last stage of the data analysis process.

Stage Seven: Data Integration

In this stage, all data is integrated as a whole or separate whole sets to lead to an initial interpretation (Tashakkori and Teddle, 2003:377). “The data interpretation stage is then subjected to legitimation, which might necessitate the collection of more data and subsequent analyses that lead to a modified data interpretation (either directly or indirectly) through a combination of the data reduction, display, transformation, correlation, consolidation, comparison, and integration stages” (Tashakkori and Teddle, 2003:378). If the analyst believes the interpretation is plausible, then conclusions are generated into a final report (Tashakkori and Teddle, 2003:378). It is in this stage of the analysis where it became clear whether the pure pallet program can be used as a mechanism for movement of retrograde from the deployed location and improves optimization. The last portion of the data analysis pertains to measuring customer value and examining what the customer values in the movement of retrograde through a qualitative analysis of the data collected from personal interviews. The intent of the interview questions for the AMC Pure Pallet program is discussed as well. Finally, the

intent of each of the interview questions will be discussed to lay the foundation for the analysis in Chapter 4.

Customer Value

The analysis of the interview participant responses is centered on the ability to measure customer value. However, value can be difficult to measure and is subject to a constant change of flux as technology and processes evolve. Simchi-Levi et al (2004:212) do provide some insight in assessing customer value from three primary indicators: service level, customer satisfaction, and supply chain performances. Each one will be briefly covered to provide insight into the analysis of measuring customer value of the retrograde process. Service level is usually an indication of whether a company's delivery date can be met or the "decision support systems" to accurately access that information from the supply chain (Simchi-Levi, 2004:212). Customer loyalty is sometimes an indicator of customer satisfaction; however, another option in tapping to the level of satisfaction is through customer defections—whether that's through shifts in their spending or "partial defection (Simchi-Levi, 2004:213). Finally, customers need an "independent criteria to measure supply chain performance" (Simchi-Levi, 2004:214). Simchi-Levi cites the Supply Chain Operations Reference Model (SCOR) as a "process reference model that includes analyzing the current state of a company's processes and its goals, quantifying operational performance and comparing it with benchmark data" (2004:215). The point of this indicator is to ensure the company's goals and strategy match that of the supply chain using the right set of metrics and operational performance benchmarks. Although the questionnaire listed in Appendix One is grouped based on general questions on the retrograde process, customer satisfaction, USTRANSCOM

initiatives and demographic questions, the instrument was designed to assess value using similar guidelines of service level, customer satisfaction and supply chain performance. The order of questions and subcategories briefed during the interview for measuring value was changed to eliminate any potential interviewer bias or “leading” and to ensure honest and candid feedback on that particular question. The interview questions were rearranged into the three indicator categories for analysis in measuring customer value as depicted below.

Service Level

1. What percentage of retrograde cargo arrives from the CENTCOM AOR that has radio frequency identification tags affixed to the shipment? The rationale for this question is simple. The inability to track inbound retrograde shipments through RFID tags or similar technology adds frustration, costs and inefficient use of resources from a customer perspective.
2. What is the primary system used by your organization for tracking the movement of inbound Class IX retrograde cargo shipments? The question serves a two-fold purpose: to discover if there are commonalities among the major subordinate commands on the type of ITV systems used and their reasons for selecting that system or systems over the dozens of others within the DOD.
3. Which is most important to you as a customer for inbound retrograde shipments as it relates to transportation services...Speed and Velocity, Reliability, or Predictability and why? The genesis of the question is to determine, in general terms, the type of supply chain that best serves their needs and requirements as a customer.

Customer Satisfaction

1. What percentage of retrograde cargo arrives from the CENTCOM AOR by commercial cargo express carrier? Measuring the depth of commercial express air carrier use within the Army Materiel Command for movement of retrograde was the intent of the question. As Simchi-Levi et al (2004) cites, “there is a direct relationship between the ability to achieve a certain level of service and supply chain cost and performance” (213). Clearly, the customer has an expectation equal to or greater than what is been provided in the commercial sector. When that expectation cannot be met, this can ultimately lead to a breakdown of the process and serve as a catalyst for high levels of defections from military air to commercial air.
2. How would you rate your level of satisfaction of the transportation system, as a whole, from the deployed location to the depot (on a scale of 1 to 10 with 10 being the best)? The intent of the question was to gain their general perception of transportation system within the DOD reverse supply and to pinpoint the specific areas of concerns as to the reason for their ranking.
3. What recommendation(s), if any, do you have to improving the Army Retrograde process from the CENTCOM AOR? The question was designed to draw a distinction from the last question about the transportation system because the intent was to identify areas of concern both within the DTS and from the deployed to the SSA to the aerial port and from the DLA warehouses to the depot. In this way, the responses serve not only an indicator of customer satisfaction but as a

- starting point for TRANSCOM or HQ Army Materiel Command in taking steps towards better development of the DOD reverse supply chain infrastructure.
4. Are you familiar with the 9GN project code which charges a flat rate for the movement of retrograde cargo from the CENTCOM AOR to the CONUS depots? USTRANSCOM released the message, Retrograde Distribution of High Priority Depot Level Reparable (DLR) in support of Operation Iraqi Freedom, in May 2003 for select Class IX DLRs and Class VII end items at the request of all of the services in the synchronizing and scheduling retrograde movement that provides a port-to-door flat rate charge from the CENTCOM AOR. The intent behind the message was to identify high priority DLR cargo with a project code in the transportation movement document of 9GN will receive expedite handling through the theater and CONUS aerial ports to the depots. The project code would also allow for “more effective performance measurement and cost tracking of retrograde distribution” (USTRANSCOM, 2003).

Supply Chain Performance

1. What information about the transportation system is not being provided to you as a customer of the retrograde process that would help you do your job more efficiency? The underline intent of the question was to gauge what metric or elements to form a metric that would best serve the needs and requirements of the customer that they are not getting with the ITV systems or processes within retrograde process.
2. What criterion is used to determine high priority retrograde shipped by air versus retrograde shipped by sealift? Is the depot involved in the determination process?

The question was aimed at identifying the specific drivers of retrograde modal decisions, whether any written procedures or common processes exist within or across major subordinate commands and if there is any collaboration that occurs with various stakeholders for improving supply chain optimization through adjustments to the transportation system.

Based on the responses, each of the interview responses grouped in the three categories of questions were used to make a determination of customer value. The analysis of the qualitative portion concludes with an interpretation on the viability of the pure pallet program for retrograde.

AMC Pure Pallet Program

The remaining interview questions centered on the understanding of the pure pallet program and potential cost savings in utilizing a backhaul option at the depots.

1. What impact will the consolidation of Class IX retrograde airlift shipments from the AOR affect the depot internal production processes? The question about the impact of consolidation was asked to understand the concept on the depot process. The question was originally intended for the depots but no participants working directly in the depot were available to take part in this study. However, many of the subject matter experts took part in this study did have some experience with working with, interaction or co-location with a depot.
2. Do you understand the purpose and goals of the Air Mobility Command Pure Pallet Program? If so, do you feel that the depots can benefit from this program? This question was focused on the tapping into respondents' direct knowledge or

experience of the pure pallet program and whether, in their professional opinion, the program would benefit the retrograde process.

3. Can your depot support backhaul shipments from inbound Class IX retrograde cargo with outbound shipments destined to the CENTCOM AOR? The last question was also designed for the depot. Some of the participants do have knowledge or experience with depot operations and the intent was to understand if any cost savings could be captured through a backhaul concept.

Summary

The goals of this chapter was to familiarize the reader with solid framework of the methodology and why the mixed-methods design was selected as the best fit to fully address this particular thesis study. The chapter recapped the research question along with the supporting investigative questions and provided a data analysis model on how the remaining ones would analyze and interpreted based on the data from the quantitative and qualitative vantage point. The next chapter will the analysis and results of the data collected and Chapter Five will closed with conclusions and future areas of research in Army retrograde movement.

IV. Analysis and Results

Chapter Overview

The chapter consists of qualitative and quantitative portions within each of the applicable data analysis stages. The qualitative portion consisted of comparisons of each of the responses into word table matrixes based on the particular interview question. In later stages of the data analysis process, an inter-respondent matrix was developed by extracting common themes during the interview process and their respective comments. The quantitative portion consists of a descriptive statistical analysis of the historical retrograde shipment data and a cost comparison through an independent assessment of air and surface shipping costs from the Global Transportation Execution System (GATES) based on fiscal year 2006 Class 100 truckload and less-than-truckload rates to compare and contrast total transportation retrograde shipment costs to the customer. Each of the applicable stages of the mixed methods data analysis model will serve as the framework for this chapter. The first two stages have qualitative and quantitative portions with the last stages forming the basis for the results from both data portions of this analysis to determine whether the intent and business rules of the AMC Pure Pallet program indeed meets the value expectations and requirements of the customer. Although this particular chapter is focused on the research findings and analysis of the data collected, Chapter V discusses the viability of the pure pallet program for retrograde based the research results.

Stage One: Data Reduction

1. Qualitative

Each of the interviews was initially recorded on the digital voice recorder with a backup analog voice recorder in the event of problems or glitches with the hardware. The digital recordings were transferred via a USB connection to a computer and copied from the recorder in a .wma format with the ability to be played on MS Windows Media Player. The media player provided the ability to slow down the playback of the interviews to properly transcribe the data into written format in MS Word. The questions were underlined and interviewee responses were bolded for easier identification. The responses were extracted and placed in a matrix table format for comparing and contrasting their comments. During a second phase of reviewing the transcriptions, the responses to the questions and general comments about the retrograde process were grouped into major categories based on recurring themes from the interview participants. This group of comments were extracted and summarized in an inter-respondent matrix table. Some of the comments were paraphrased to minimize any potential threats to the anonymity of the participants.

2. Quantitative

The original data set of GATES cargo retrograde shipments [Appendix 3] was provided by USTRANSCOM J5 at the request of this researcher for the aforementioned purposes. The request included all air transportation retrograde cargo shipments segregated by transportation control number (TCN), aerial port of embarkation (APOE), aerial port of debarkation (APOD), country, consignee, consignor, transportation priority (TP), pieces, weight, cube, and required delivery date (RDD) originating from Kuwait,

Iraq and Qatar through Dover Air Force Base with final destinations of Red River Army Depot (DOD Activity Address Code: W45G19 and SW3227) in Texarkana, Texas and Anniston Army Depot (DOD Activity Address Code: W31G1Z and/or SW3120), in Anniston, Alabama.

First, within MS Excel, the seventh through tenth digit of the TCN were extracted into a separate column using the MID (text, start_num, num_char) function. The seventh, represents the calendar year and the eighth, ninth, and tenth digit represents the Julian date of the TCN. These digits from the TCN were manually matched with the corresponding Julian date calendars for each shipment over a three year period. Next, the Single Mobility System Air Cargo/Passenger Cost Calculator¹ was utilized to convert the APOE and APOE information into clear text locations. The consignor and consignee codes were translated to clear text in order to properly identify origin and final destination (Oelgoetz and Ray, 2006:7). As a point of clarification, the consignor is a six character alphanumeric code that identifies the shipper (Oelgoetz and Ray, 2006:6). The consignee is a set of alphanumeric codes that identifies the final destination of the shipment (Oelgoetz and Ray, 2006:6). The consignor code locations were identified using the Defense Automatic Addressing System Center² website through the query function by their six-character DODAAC. After most of the codes from the original data

¹ Single Mobility Air Cargo/Passenger Cost Calculator is a website operated by USTRANSCOM which gives air cargo and passenger shipping costs estimates between APOE to APOD. The website is <https://sms.transcom.mil/sms-perl/SMSWEBAirCostCalculator.pl>.

² The Defense Automatic Addressing System Center Inquiry (DAASINQ) “provides information on Communication Routing Identifiers (COMMRI), DOD Activity Address Codes (DODAAC), Routing Identifiers (RIC), Military Assistance Program Address Codes (MAPAC) and US Postal Zip Codes (ZIP).” The website address is <https://www.daas.dla.mil/daasinq/dodaac.asp?cu=d>

set were translated to clear text, the next step was calculating the air transportation shipping costs.

Every fiscal year, USTRANSCOM publishes the US Government Department of Defense Airlift Rates for Passenger and Cargo Channel Rates. The FY06 DOD Zone List [Appendix 4], FY06 Cargo Regional Rates [Appendix 5], and corresponding multipliers [Appendix 2] were used to compute the air transportation shipping costs for the entire data set.

To calculate the air transportation shipping costs, the zone of the origin and destination must be identified. In Appendix 4, Dover AFB DE is listed in upper left hand side and is Zone 1. If, for example, Doha International was the destination, just follow across to the fourth column from the left hand side to locate Zone 9. The next step was to find where the two zones connect on the FY06 Channel Cargo Regional Rates Chart listed in Appendix 5. In the example of Dover and Doha, the regional rate is \$2.83. In Table 2, the first TCN with an origin of Al Udeid AB, Qatar and destination of Dover AFB, Delaware weighs 779 pounds.

TCN	CY/JD	Date	APOE	APOD	Country	Project Code	CONSIGNEE	CONSIGNOR	TP	Pieces	Weight	Shipping Costs	Cube	RDD	Zone Rate	Shipment Sizes (lbs)	Multipliers
W52H091150H540XDX	1150	5/30/2001	IUD	Dover	QA		Anniston	Al Udeid QT TMO	1	1	779	\$2,076.56	47	340	\$2.240	1-439	1.24548658
W52H091150H540XEX	1150	5/30/2001	IUD	Dover	QA		Anniston	Al Udeid QT TMO	1	1	779	\$2,076.56	47	340	\$2.380	440-1099	1.12002933
W52H091150H540XFX	1150	5/30/2001	IUD	Dover	QA		Anniston	Al Udeid QT TMO	1	1	779	\$2,076.56	47	340	\$3.50	1100-2199	0.99747432
W52H091150H540XAX	1150	5/30/2001	IUD	Dover	QA		Anniston	Al Udeid QT TMO	1	1	779	\$2,076.56	47	340	2003	2200-3599	0.870546487
W52H091150H540XBX	1150	5/30/2001	IUD	Dover	QA		Anniston	Al Udeid QT TMO	1	1	779	\$2,076.56	47	340		3600-up	0.76645714
W52H091150H540XCX	1150	5/30/2001	IUD	Dover	QA		Anniston	Al Udeid QT TMO	1	1	779	\$2,076.56	47	340			
W52H091150H540XZX	1150	5/30/2001	IUD	Dover	QA		Anniston	Al Udeid QT TMO	1	1	779	\$2,076.56	47	340			
W80PUX12192106LXX	1219	8/7/2001	IUD	Dover	QA		Anniston	Al Udeid QT TMO	2	1	1264	\$3,000.72	126	363			
W81Y1C22365010XXX	2236	8/23/2002	KWI	Dover	KU	ARI	Red River	Camp Doha KU	3	1	3520	\$6,864.08	105				
W902P422584020XXX	2258	9/14/2002	IUD	Dover	QA		Anniston	Camp As Sayliyah A	2	1	15	\$44.46	1				
W902P422584003XXX	2258	9/14/2002	IUD	Dover	QA		Anniston	Al Udeid QT TMO	2	1	23	\$68.18	2	60			
W902P422584015XXX	2258	9/14/2002	IUD	Dover	QA		Red River	Camp As Sayliyah A	2	4	20	\$59.29	2				
W902P422584004XXX	2258	9/14/2002	IUD	Dover	QA		Red River	Al Udeid QT TMO	2	1	1605	\$3,810.25	51				
W52H092295H517XXX	2295	10/21/2002	IUD	Dover	QA		Anniston	Camp As Sayliyah	1	1	165	\$489.10	5				
25200123464490XXX	2346	12/11/2002	KWI	Dover	KU		Red River	Camp Arifjan KU	1	1	2885	\$5,625.82	260				
W52H093031CD02XXX	3031	1/31/2003	KWI	Dover	KU	GEN	Red River	Camp Arifjan KU Port	2	1	170	\$474.28	40				
W90U1J30481002AXX	3048	2/17/2003	KWI	Dover	KU	GEN	Anniston	Camp Arifjan KU	1	1	600	\$1,505.32	23	999			
W91QSU31400057XXX	3140	5/20/2003	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	5760	\$13,244.38	140				
W91WQQ31682801XXX	3168	6/17/2003	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	3510	\$8,070.79	110				
W91UVQ31720005XXX	3172	6/21/2003	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	4335	\$9,967.78	347				
W58H0Z317A316BXX	3178	6/27/2003	KWI	Dover	KU		Red River	Camp Arifjan KU	3	1	30	\$83.70	8				
W91YWB31820308XXX	3182	7/1/2003	KWI	Dover	KU	9GN	Anniston	Camp Arifjan KU	2	1	3150	\$8,226.66	160				
W91QSU31820336XXX	3182	7/1/2003	KWI	Dover	KU	9GN	Anniston	Camp Arifjan KU	2	1	7140	\$12,258.41	210				
W91RXD31920511XXX	3192	7/11/2003	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	5425	\$12,474.09	358				
W91RXD31960513XXX	3196	7/15/2003	KWI	Dover	KU	9GN	Anniston	Camp Arifjan KU	2	1	4580	\$10,531.12	160				
W91QSU31960393XXX	3196	7/15/2003	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	5760	\$13,244.38	140				
W91DXY31980052ZXX	3198	7/17/2003	IUD	Dover	QA	OEF	Red River	Camp As Sayliyah Q	1	1	270	\$800.35	182				
W91QSU32050089XXX	3205	7/24/2003	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	3529	\$9,216.48	110				
W91XP532081005XXX	3208	7/27/2003	KWI	Dover	KU	GEN	Red River	Camp Arifjan KU	3	1	375	\$1,046.21	35				
W91XP532081004XXX	3208	7/27/2003	KWI	Dover	KU	ARI	Red River	Camp Arifjan KU	3	1	560	\$1,404.96	36				
W91YWG32080082XXX	3208	7/27/2003	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	5640	\$12,968.45	140				
W91XP532104001XXX	3210	7/27/2003	KWI	Dover	KU	ARI	Anniston	Camp Arifjan KU	3	1	170	\$474.28	30				
W91YWG32190006XXX	3219	8/7/2003	KWI	Dover	KU		Anniston	Camp Arifjan KU	2	1	7880	\$13,528.89	250	999			
W909WJ32310018XXX	3231	8/19/2003	KWI	Dover	KU	9FW	Anniston	Camp Arifjan KU	1	1	390	\$1,088.06	28				
W910Z732340006XXX	3234	8/22/2003	KWI	Dover	KU		Anniston	Camp Arifjan KU	2	1	7950	\$13,649.07	250	999			
W91CLX32376047XXX	3237	8/25/2003	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	3540	\$9,245.20	110				
W91YWG32380100XXX	3238	8/26/2003	KWI	Dover	KU	9GN	Anniston	Camp Arifjan KU	2	1	7950	\$21,326.67	250				
W902P4323840000CXX	3238	8/26/2003	IUD	Dover	QA		Red River	Al Udeid QT TMO	1	1	3155	\$6,536.85	99	777			
W902P4323840000ZXX	3238	8/26/2003	IUD	Dover	QA		Red River	Al Udeid QT TMO	1	1	3155	\$6,536.85	99	777			
W902P4323840000AX	3238	8/26/2003	IUD	Dover	QA		Red River	Al Udeid QT TMO	1	1	3155	\$6,536.85	99	777			
W902P4323840000BX	3238	8/26/2003	IUD	Dover	QA		Red River	Al Udeid QT TMO	1	1	3155	\$6,536.85	99	777			
W91TVY32390002XXX	3239	8/27/2003	KWI	Dover	KU		Red River	Camp Arifjan KU	2	1	5710	\$9,803.29	248				
W91TUX32400803XXX	3240	8/28/2003	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5410	\$12,439.60	140				

Table 2: GATES Retrograde Cargo Data (Revised with Estimated Airlift Shipping Costs)

Since the zone-to-zone for the first TCN is the same as the example, shipping costs can be calculated by multiplying the zone rate of \$2.83 times the multiplier of 1.1200 (depending on the weight range in the right hand corner of Table 5 and in Appendix 2) times the actual weight which is total cost of \$2,076.00. The shipping costs for each of the shipments in the original data set were calculated in MS Excel using the same guidelines. After the shipping costs were completed, a representative sample of all 9GN projects code shipments and all shipments from Kuwait to Dover to Red River Army Depot from January to September 2006. Since the number of 9GN shipments was extremely low and the flat rate from the original message of \$3.00 in 2003 until FY2006 was not available, the entire set of 9GN shipments from Kuwait to Red River was used as a cost comparison set between current billing for shipping costs and the flat rate. The MS

Excel sort function was used to select the sample from October 2005 to September 2006 since the FY2006 was published at \$3.50 per pound. The last sample from the revised data set is for testing the aggregation concept by selecting four months of transportation shipments between October 2005 through September 2006 for maintaining the same rates and multipliers in calculating air cargo costs. Every other month was selected as samples for applying similar business rules of the pure pallet program with the emphasis of monitoring cargo generation and total transportation costs to the depot.

Finally, the Class 100 Rates were calculated using ABF LTL Trucking Carriers rates due to the unavailability of precise rates from SDDC Freight Operations Office or the Dover Traffic Management Office. This is another limitation of research study. Historically, the SDDC Baseline Charts for Freight-All-Kinds (FAK) [Appendix 7] could be used to calculate the Class 100A rates by a Rates Specialist (SDDC Freight Office, 2007). For example, if an FAK shipment weight 5,640 pounds with a distance of 1,273 miles (Dover AFB to Red River Army Depot), look at the mileage base along the left side of Appendix 7 and search across the table for the minimum weight bracket at the top to determine the baseline rate which in this case is 2196. To determine the charges, multiply 2196 times the carrier's rate (.47) times 56.40 (5,640 pounds) with a total charge of \$582.11 ($58211.11568/100$). If the calculated fell below the minimum charge, the minimum charge is applied for the cost of the shipment. The carrier's rate for independently and manually calculating the class 100 rates could not be obtained because the rates do fluctuate with variables such as fuel surcharges. Currently, the Class 100 FAK rates are calculated by computer with a list of carriers authorized to carry freight on a particular commercial tender (SDDC Freight Office, 2007). At Dover Traffic

Management Office (TMO), the priority and volume of cargo for a particular destination determines the mode (LTL, TL, or commercial air) of cargo received from the Air Freight Cargo Import section. Dover TMO has a contractor who acts as a ‘switcher’ for rotating carriers on the commercial tender contract (Dover Traffic Management Office, 2007). “For TP-2 and TP-3 and even non-Expedite TP-1 general cargo, this type of cargo is placed in a 48 foot closed trailer, once the trailer is full or 72 hrs have been reached for that cargo on hand, the trailer is closed out and all those shipments are rated as an LTL off the Class 100 rate, because the cargo is brought to that company's distribution center for onward movement throughout the states. If we have 10,000 lbs or more of cargo that is marked for the same destination, it is processed as a TL shipment” (Dover Traffic Management Office, 2007). The rationale for explaining how retrograde cargo is processed through Dover and the Class 100 FAK calculations is to indicate the complexity of computing the actual LTL rates and why a commercial carrier website was used as the baseline for figuring the surface freight costs in this research study. As stated earlier, ABF Freight [Appendix 8] website was chosen as calculate the surface cost and two other commercial carriers under the commercial tender at Dover was checked to verify the quotes provided by the website. The margin between the quotes was within 3 percent so the assumption is that the quotes are fairly consistent across carriers. The parameters used for the online quote are listed in Appendix 8.

Stage Two: Data Display

1. Qualitative

In this portion of the second stage, the interview responses are placed in table matrixes and are following by analysis of what the data should mean to the reader. As stated earlier in this chapter, each matrix is designed to measure customer value. The first will be service level.

Service Level		
Interviewee	What percentage of retrograde cargo arrives from the CENTCOM AOR has radio frequency identification tags affixed to the shipment?	Comments
1	Unsure	"Personally, I know at all times when people would asked me to try and track shipments, I would frequently find no tracking in like...ITV [RFID Server] which indicated to me that there was no RFID tag..."
2	One shipment in the last three months.	
3	Unsure	
4	Unsure	
5	"I would believe they all but I wouldn't have the specific percentage for you but I believe all are coming back with an RFID tag."	

Table 3: Service Level-RFID Tag Usage

Recall in Chapter 2 about the critical role of RFID tags play in streamline the retrograde process and through this capability of providing near-real time data of material movement in order to give customers "predictability, reliability, and visibility" (Banks, 2002:1). In Table 3, only one interview had an idea on the use of RFID tags on retrograde shipments. Although most of the interviewees were not sure about the

percentage of commercial express air, which will be discussed later, most of them did highlight the advantages of tracking their shipments from origin to destination from those carriers. It is not the position of the researcher to access blame or responsibility but to indicate a clear concern from some of the interviewees' perspective for addressing the challenges with implementing more widespread use of RFID tags to increase ITV of inbound retrograde shipments. This seems to point to the fact that because few knew the actual percentage, it may be one of many ideal metrics for accessing performance of the retrograde process. Within the distribution process, this metric is being provided to the customer but not in the retrograde process. The use of active and passive RFID tags has a direct relationship with the selection of ITV systems used in the retrograde process as noted by the participants in the interview process. This leads to the second question on service level about the primary system (s) the interview participants they use for tracking the movement of retrograde shipments.

Service Level		
Interviewee	What is the primary system used by your organization for tracking the movement of inbound Class IX retrograde cargo shipments?	Comments
1	Parts Tracker, RFID ITV Server, Global Transportation Network	Different people in the organization used various ITV systems. Use of ITV systems depended on the individual's familiarity.
2	MS Excel Spreadsheets	They receive daily spreadsheet reports with arrival data at the ports, commodities, transportation manifest data, and estimate delivery date. They don't have access to any type of ITV system for the movement of retrograde shipments.
3	Asset Tracker, Global Transportation Network	Other systems such as the Visual Logistics Information Processing System (VLIPS) are not used because it provides poor reliability and accuracy. TRANSCOM is willing to commit major funding to GTN and it shows in their level of effort to meet customer needs.
4	GATES, GTN... All products of TRANSCOM	
5	RFID Server	"It just has all of the RFID tag readings off of it and it seems to be the best as far being able to locate exactly where the items are at that point in time."

Table 4: Service Level-ITV Systems

In Table 4, each of the interviewees indicated their primary information system for tracking retrograde shipments. The results indicated that most of the interviewees were satisfied with GTN and Parts Tracker and that familiarity and previous experience was most prevalent reason for use of those systems. However, what's most interesting is the continued use of spreadsheets to pass information through the retrograde process and either the lack of use, access, or confidence in most of the interviewees in the major Army ITV and supply systems.

Service Level		
Interviewee	Which is most important to you as a customer for inbound retrograde shipments as it relates to transportation services...Speed and Velocity, Reliability, or Predictability and why?	Comments
1	Predictability	"Once you know what's coming, you can plan your production around it. I guess...that's what I would say...is the about being able to predict when you'll get a shipment."
2	Reliability	
3	Reliability	"I'll sacrifice the speed for the accuracy every time!"
4	Reliability	"I would actually choose that because if I know I can get something on a schedule then I can build around that schedule."
5	Predictability	Better predictability with airlift and less predictability with surface transportation.

Table 5: Service Level-Transportation Service

In Table 5, the interviewees are asked about what is most important to them as a level of service in the transportation system: speed and velocity, reliability, or predictability. Recall from the conceptual model in Chapter One, the question is meant to provide some insight into whether the customer values supply chain efficiency or responsiveness. Based on the responses, reliability seems most important and their comments indicated a desire of efficiency from the reverse supply chain to maximize use of available resources.

Customer Satisfaction		
Interviewee	What percentage of retrograde cargo arrives from the CENTCOM AOR by commercial cargo express carrier?	Comments
1	Don't know.	
2	None	Everything comes either military air or in containers via sealift.
3	Unsure	
4	About 20 percent on DHL or FEDEX	
5	Don't know.	

Table 6: Customer Satisfaction-Use of Express Air

The original intent of the Worldwide Express (WWX) program was for to provide greater flexibility to warfighter with time-definite delivery, “door-to-door delivery,” and near real-time ITV for national and international packages of 150 pounds or less (HQ AMC A4TD Website, 2007). The question, in Table 6, was intended to gauge the degree of use and how much of a role cost plays in its use for high priority retrograde shipments. Based on the responses, it is not clear about the criticality of the WWX program to the retrograde process and whether there is relationship between cost and its use for the movement of high priority retrograde versus the military airlift system.

Customer Satisfaction		
Interviewee	How would you rate your level of satisfaction of the transportation system, as a whole, from the deployed location to the depot (on a scale of 1 to 10 with 10 being the best)?	Comments
1	Three	"There's just not enough visibility...it's hard to track things. Things gets misguided...the method of tracking is cumbersome. You basically are tracking 'eachs' and when you have...as some managers have, you know, multiple programs and trying to track some real NSNs and if they have high volume returns, it's a very time consuming matter."
2	Five	The problem is no identification, documentation, packaging and labeling of the retrograde before it's placed into the DTS. Basically, they never know the contents of the retrograde shipments.
3	Nine	"You know, at the height of the conflict, Dover was moving 300 short tons a day, Charleston was moving 300 short tons a day, God knows what the surface terminals were moving...probably 600...a day. Is there anybody in the world that moves that much freight in 24 hours? That's a half a year for some companies."
4	Five	Lift or availability of lift is not the problem. Getting retrograde out of the theater seems to work well but transshipping through the aerial ports is the problem. During the beginning, Charleston and Dover had difficulty handing inbound retrograde with their large outbound missions. Even with the addition of LTL trucks, delivery days had high variability versus dedicated trucks. Some retrograde would take up to days before arriving at the depot because of the lack of synchronization of retrograde priorities.
5	Seven	Bottlenecks in the process...particularly in Germany with limited wash rack capacity for retrograde being sent through one particular location for meeting the agricultural requirements for both unserviceable and serviceable assets. Retrograde routing is being addressed through national maintenance.

Table 7: Customer Satisfaction-Level of Satisfaction

The interviewees had an opportunity to rate their level of satisfaction with the transportation system in Table 7. Although one interviews seemed very pleased with the

level of service from the transportation system, the remaining ones concerns were largely confined to ITV, packaging and documentation, synchronization between transportation modes, and bottlenecks in the system. Each of these common themes is discussed in more depth later in this chapter. On average, their rating of the transportation system is a six out of ten but some of the concerns identified in their comments are outside the realm of the transportation system and speaks to the reverse supply chain as a whole.

In Table 8, the interviewees were asked their opinions on how the retrograde process from the CENTCOM AOR, as whole, could be improved. Based on their responses, it seems that packaging, proper documentation, in-transit visibility, inter-modal synchronization retrograde and transportation priorities, adequate supply chain infrastructure or capacity, the identification and resolution of bottlenecks, and direction of how retrograde shipments are routed out of the AOR were the primary recommendations for improvement of the retrograde process. One area of concern is the perceived conflict with the issue of transportation priorities. This will be addressed in stage seven, the data integration portion of the analysis process with follow-up with both interview participants.

Customer Satisfaction		
Interviewee	What recommendation(s), if any, do you have to improving the Army Retrograde process from the CENTCOM AOR?	Comments
1	The need to change of how unserviceables are routed to one location based on what theater it originated versus being returned to where the repairs will actually be made. The process needs more flexibility and less manual handling.	"You need to make the programs...for national maintenance programs and depot programs interact...the programs they use to direct shipments for retrograde do not recognize depot programs unless it's a depot level reparable. A manager has to keep an eye on things and make sure enough gets into depot transfer to the depot and if those two systems could learn to talk to each other, you could have a smoother flow..."
2	Documentation	"Sometimes it seems like they're just getting rid of their junk. Cause...a lot of this stuff could be, you know, DRMO'd over there...disposed of over there. I mean why are we paying for something that we're going to send directly to DRMO?"
3	Packaging	"Pack it as close to spec[MILSTD 2073-1A through Z], if not over spec that you can. This way, we're going to feel a lot better when you open the boxes on the other side of the ocean and stuff [are] still in repairable condition instead of condemned condition."
4	Synchronizing priorities of retrograde, supply discipline, and an infrastructure to handle it.	Supply Discipline-not getting the documentation and packaging right; RFID tags with very limited information and an overall perception of a lack of training.
5	Identifying bottlenecks	"I guess working the issue that needs to be solved and not necessarily just always trying to prioritize the shipments because the prioritizing the shipments of unserviceables is really [pause] we're not getting anywhere. We need to fix the problem at hand as far as capacity goes."

Table 8: Customer Satisfaction-Retrograde Recommendations

Customer Satisfaction		
Interviewee	Are you familiar with the 9GN project code which charges a flat rate for the movement of retrograde cargo from the CENTCOM AOR to the CONUS depots?	Comments
1	No	
2	No	
3	Yes	Knowledge of 9GN Project Code is limited to only what's been read in message traffic.
4	Yes	"There were certain things that were supposed to be done in the distribution system or the reverse pipeline to the retrograde. Some of it was supposed to be high priority and different things that [were] identified in the message that was suppose to happen. But it never did....I mean, you would be a 9GN project code on something and...I mean, it got nothing! You know...I mean, it did[not] do much of anything but identified it as retrograde and that's about it."
5	No	

Table 9: Customer Satisfaction: Familiarity with Flat Rate Service

In Table 9, the question was intended to measure the customer's knowledge of the program and any reasons for its lack of use as stated in Chapter One. Only 2 of the 5 participants had ever heard of the program. Despite the small number of participants, this could simply be an issue of little marketing of the program by TRANSCOM to the other services. The comments made by the fourth interview participant are worth noting because it is very clear that the program from their perspective is not working as it was advertised in the message. During the interview, this participant made a point of wanting

to highlight their frustration with using the project code and that it did not provide any benefit for their particular command. So, the lack of use may simply be “word-of-mouth” of the program not living up to its promises or little potential savings or benefit for using the 9GN project code. As previously stated in previous tables, the areas of customer satisfaction, packaging, documentation, and published schedules were all identified as major concerns with the current retrograde process. The original 2003 message outlines key responsibilities to the services, theater commands and TRANSCOM. The services were “to identify DLR and major end items” with the 9GN project code and be prepared to develop processes for onward movement from the APODs. The theater commands were to coordinate the movement and “recommend use of the Central Receiving Shipping Point (CRSP) activities to facilitate proper documentation and packaging prior to delivery of hi-pri retrograde cargo to APOE” (USTRANSCOM J5, 2003). USTRANSCOM was to publish flight schedules and make any needed changes to the CONOPS and provide performance metrics to the services. It is not clear if any of the guidelines and responsibilities were ever executed given the limited available information on the use of the project code. On 30 January 2007, the 9GN project code expired without any additional extensions. What is not evident from the responses or available literature on the program is why the project code was only used less than 1 percent of total cargo retrograde movement and the reason the code was not extended further out given the demands of the Army RESET program. The last set of questions is focused on supply chain performance. Again, the goal is to find a “common language” for measuring or finding a common metric of how well the reverse supply chain is meeting the requirements and goals of the stakeholders (Simchi-Levi et al, 2004: 214).

Supply Chain Performance		
Interviewee	What information about the transportation system is not being provided to you as a customer of the retrograde process that would help you do your job more efficiency?	Comments
1	Better visibility of retrograde and less confusion of trying to track shipments	
2	Retrograde Shipment Documentation	
3	None.	Any information requirements are proactively gathered and disseminated.
4	Published transportation schedules for retrograde movement	“For instance, for the things we move forward, you know pretty much you can find schedules and pretty much track things that move but the reverse pipeline I think should have the same infrastructure, should report out the same way as the forward movement. If it acted the same way, then I think we would have more success of being able to keep up with the retrograde. Ah, [when] we know when the crafts [aircraft] are moving out of theater, we know when things have dedicated trucks when they’re moving out of the ports, you know we [could] actually keep up with it better [pause] on the reverse side. On the forward side, they provide all of that and you can keep up with the movement of your items.”
5	Better ITV tracking	“Sometimes, it’s quite cumbersome. I guess if maybe they could just make some sort of improvements there, it would be easier.”

Table 10: Supply Chain Performance: Measure for Cross-Firm Optimization

Most of the comments point directly or indirectly to visibility or the lack of visibility on the shipment location within the reverse supply chain or the contents of the shipments themselves. The comments from the fourth interview participant developing the same level of consistency and service as provided in the distribution system. From the

majority of comments made from the participants, the appropriate level of ITV is the persistent theme for better performance from the reverse supply chain.

Supply Chain Performance		
Interviewee	What criterion is used to determine high priority retrograde shipped by air versus retrograde shipped by sealift? Is the depot involved in the determination process?	Comments
1	The item manager makes those decisions through close coordination with the depots.	
2	No. Not at all.	
3	No.	HQ Army Materiel Command does have a retrograde list but isn't sure of its distribution.
4	The item managers make those determinations because they have visibility and the posture of their repair lines.	Within this particular major subordinate command, they communicate on a monthly basis with item managers to identify their top priority retrograde items by examining the repair lines and seeking ways to meet those requirements.
5	Based on the stock availability to repair for a repair program and the lead time for getting unserviceable assets to meet the requirements of a particular program deadline.	Some coordination with the depot but the determination is on a case-by-case basis with the item manager having the final decision on mode and priority of retrograde.

Table 11: Supply Chain Performance-Retrograde Transportation Mode Criteria

The consensus seems to be the item managers are the primary driving force behind the transportation modal selection depending on the “health” of the individual production lines. It also appears that some subordinate major commands may be having better success than others in their collective expectations of the reverse supply chain, more specifically the transportation system. But, by in large, this may not be the case.

In the opinion of the researcher, this question falls within supply chain performance because the development of the reverse supply chain can not occur until

commonly accepted guidelines and/or policies for what constitutes high priority and customer driven measurements of performance be established to gauge the success or failure of the entire process as a whole. These policies, guidelines and metrics for accessing an acceptable level of performance for the movement of retrograde may indeed exist. If this is the case, it has not filtered down the middle and lower levels of the organization.

Customer Value of the Retrograde Process

Investigative Question Two: What does the customer value in the movement of reparable parts from the CENTCOM AOR?

Simchi-Levi et al (2004:221) states that:

There is no real customer value without a close relationship with customers. Today this is possible not only through direct interaction but also through information and communication technology. By allowing customer to state their preferences and learning from them—a true two-way interaction—a firm can develop the means to achieve greater customer value and therefore loyalty.

From all of the responses across the three indicators, the customer values efficiency with varying degrees of flexibility within their supply chain. This type of flexibility is in both the availability of express air carriers while maintaining the ability to trace and trace their shipments from origin to destination. The use of RFID is a key enabler of ITV within the military air transportation system. Recall in Chapter Two about Lee (2002) descriptions' and strategies used for the four types of supply chains. It is no surprise that ITV plays a large role in a supply chain. In his article, Lee (2002:113) states that the role of the Internet in efficient chains "is that it enables the supply to have tight and effortless information integration, as well as enabling production and distribution schedules to be optimized once demand, inventory, and capacity information throughout the supply chain

are made transparent.” Lee’s comments seem to encapsulate those of the interview participants with respect to ITV. The issue of documentation and packaging are major issues as well because it has a large impact on the useable condition of unserviceable and component assets once they arrive at the depots. These concerns may be a part of a larger problem of available skill sets within the US Army to specifically address these gaps in performance in the supply chain.

AMC Pure Pallet Program

The remaining interview questions centered on the understanding of the pure pallet program and potential cost savings in utilizing a backhaul option at the depots. Each table will be presented followed by a brief analysis. The next section will begin the quantitative portion of stage two.

AMC Pure Pallet Program		
Interviewee	What impact will the consolidation of Class IX retrograde airlift shipments affect the depot internal production processes?	Comments
1	"I think the problem with doing that is the delay and it all would be like an item-by-item problem. Some programs are getting enough returns that wouldn't really impact them [long pause] on the other hand some programs have real critical requirements and gets few returns so like just-in-time repairing."	The current problem is with retrograde shipments being disassembled either from containers or pallets; you lose in-transit visibility and difficulty in tracking them.
2	The consolidation of shipments would create a large backlog and cause strain on available manpower.	The movement of retrograde needs to be a continuous flow.
3	Lauded as a good idea but manpower, time, and resources at deployed locations were cited the top reasons for why consolidation of retrograde shipments couldn't be accomplished.	Unsure if the concept can be employed in a tactical environment.
4	No impact.	
5	Don't know.	

Table 12: AMC Pure Pallet Program-Consolidation of Class IX Shipments

The responses are mixed given this limitation but overall it seems like the concept is unfavorable. Many expressed concerns on its execution in the tactical environment and the need for more enterprise level management of items and assets.

AMC Pure Pallet Program		
Interviewee	Do you understand the purpose and goals of the Air Mobility Command Pure Pallet Program? If so, do you feel that the depots can benefit from this program?	Comments
1	"I think that there's some value [pause] personally I think there would be a value because if you had everything going to Anniston [as an example] it would be easier to track...if it would palletized and they never broke the pallet..."	The challenge will be with the movement and separate of high priority shipments and the flexibility of being able to shift retrograde quickly through the pipeline to avert a production line from shutting down.
2	Yes. The program would be nice but isn't sure if it can be accomplished in an effective way.	"...if what we were receiving was material that's relative to our stock that we now have on-hand and in pure quantities, I could see large benefit to that, you know."
3	Yes...and is completely behind the program.	Everybody would benefit from such a program and it keeps pallet accountability.
4	Yes. "Ah...yes it would...yes it would. I would say because if you had a pallet and everything on that pallet belong[s] to that depot for repair, I think that's a win-win deal."	"...the system [distribution] is actually built to get volume in and not necessary taken into consideration of priorities and what our customers beat us up with all the time is that...hey, you know, we wanted this item pretty quick, well, it's on a pallet with low priorities, medium priorities and all other sorts of priorities. So, the Air Force actually built this system around being able to get volume to an SSA [Supply Support Activity] and I don't think it really takes in consideration our priorities."
5	Yes.	"...it would be a benefit as far as everything going on one pallet and not getting broken up. It seems like it be less likely to get lost."

Table 13: AMC Pure Pallet Program-Goals, Purpose and Potential Benefits to the Retrograde Process

All participants responded favorable to the concept of the pure pallet program but had many reservations about a consolidation of shipments. The reason for the divergence of responses may be the result of the researcher providing a clear definition of the intent

of the question. Regardless, most participants were very familiar with the pure pallet program and their responses are noteworthy. In particular, the fourth interviewee mentions concerns with the current way it is being implemented but does not diminish the individual's opinion of the merits on the program. The takeaway is the program can benefit the retrograde process but has numerous challenges to overcome in its execution.

AMC Pure Pallet Program		
Interviewee	Can the depot support backhaul shipments from inbound Class IX retrograde cargo with outbound shipments destined to the CENTCOM AOR?	Comments
1	Don't know...it's an item by item decision.	
2	Don't know...not involved in that portion of the process.	
3	Yes. Within this command, there's enough reset (repair or replace) production of items to generate cargo for outbound shipments	
4	It's possible...but there would have to be synchronization between the depot transportation office and the aerial ports.	
5	No.	Within their experience on a particular program, it would not work at all.

Table 14: AMC Pure Pallet Program-Application of Backhaul Shipments

During the interview process, this concept was explained to each participant to ensure they had a clear perspective of the question. Despite those efforts, many of them were not sure of its feasibility.

2. Quantitative

Investigative Question Five: What are the costs of using the AMC Pure Pallet program, a flat rate using the 9GN project code for expedited handling through the aerial ports or the current transportation rate process?

The first part of the quantitative portion consists of a cost comparison of 9GN cargo shipments with and without the flat rate and the sample data sets during FY2006 applying the pure pallet business rules of holding cargo 120 hours before shipping from origin to destination. The transportation costs from sample sets of quantitative data served as the basis for a cost comparison comparing a flat rate for all air and surface transportation modes, the current cargo billing process, and a cargo accumulation concept as it is applied in the distribution channel for entry into the military airlift system from the deployed location. The idea behind using the accumulation parameters was to determine if enough retrograde is being generated for one destination based on historical data to offset the delay with any potential cost savings for truckload rates to the depot. The second portion provides a trend analysis of the historical movement of retrograde cargo within the airlift system. What the reader should gain from both the cost comparison and the historical analysis of the data is whether the AMC pure pallet program is viable based on the volume of cargo being generated and the potential savings given the tradeoff with time of aggregation from the deployed location.

Cost Comparison

The 9GN project shipments identified in the original data set from USTRANSCOM during fiscal year 2006 were used as the sample set [Appendix 5] for comparing the current billing rates process with the application of a flat rate. The results for the comparison revealed 6.1 percent decrease in costs using the 9GN project code versus non 9GN shipping costs. The 9GN project code costs of 51 shipments were calculated at a cost of \$722, 960.24 and the non 9GN shipping costs totaled \$769, 935.06. The results are prefaced with many assumptions and limitations. First, the Class 100 rates

from the ABF Freight System website are only estimates of the baseline rate using a single shipment rate. Unless an entire shipment arrives at Dover weighting 10,000 pounds or more, the retrograde shipment will be sent to Red River Army Depot using LTL trucking and the SDDC Class 100 FAK commercial rates are based on those rates. Although the calculations may not be precise, it does provide a general indication of the cost difference to use of the project code and may explain why it has not been applied more frequently to retrograde shipments. If these assumptions are correct, this is likely another indicator of the customer may not actually see any of the advertised benefits from using the 9GN project code.

The sample set [Appendix 6] for applying pure pallet business rules consisted of the months of December, February, April, June, and August during FY2006. The assumptions were Class 100 rates were good appropriations for commercial tender costs from Dover Air Force Base to Red River Army Depot. The amount of airlift was sufficient to move the consolidated shipments every five days from Kuwait to Dover without any limitations on airlift capability from the deployed aerial port. The commercial tender rates are based on LTL costs and not TL rates. The tailored transportation contract rates for TL shipments from Red River to Dover Air Force Base are an appropriation of the costs of TL shipments on a return route using a commercial tender. The weight of the shipments were the only consideration and not the cube or bulk of the shipments in estimating costs and available space on trailers, rollerized or flat bed trucks. The consolidation shipping costs were based on five day increments from the first day of each month. For example, if shipments arrive at the deployed aerial ports, they would be held for five days, regardless of weight and shipped as a consolidated shipment

(s) to Dover for onward movement to Red River Army Depot. The airlift costs were calculated based on individual TCNs weights versus combining the weights for one airlift bill. The results were very significant in cost savings to the customer, depending on the amount and weight of retrograde cargo generated in a given month. In the month of December, the total shipping costs totaled \$122, 422.88 and the consolidated costs totaled \$79,711.96. The costs for the remaining months on current billing process versus consolidated was \$460,937.32 and \$286,430.90 in February, \$185,343.96 and \$134,009.83 in April, \$13,922.10 for both in June due to no shipments over 10,000 pounds and \$156,734.26 and \$98,886.98 in August. If any of the shipments fell below the 10,000 pound consolidated threshold during the five day period, the current billing rates were applied. If any consolidated shipments exceeded 40,000, the TL rate was double indicating use of two trailers.

TCN	Date	Weight	Air Shipping Costs			ABF Freight Costs	Total Trans Costs	Revised Consolidated Costs		TL Trailer Rate	Zone Rate	Range (lbs)	Multipliers
			Costs	Cube	RDD								
December-06										\$660.00	\$2,240	1-439	1.245487
W91PAM53390082XXX	12/5/2005	920	\$2,308.16	160		\$1,584.57	\$3,892.73	920	\$2,308.16		\$2,380	440-1099	1.120029
W91CZR53420003XXX	12/8/2005	5850	\$10,043.65	140		\$6,503.64	\$16,547.29				\$3.50	1100-2199	0.997474
W91P9H53440222XXX	12/10/2005	5820	\$9,992.15	140		\$6,471.38	\$16,463.53				\$3.00	2200-3599	0.870546
W91THB53440146XXX	12/10/2005	5940	\$10,198.17	140		\$6,600.41	\$16,798.58	17,610	\$30,893.97			3600-up	0.766457
W45G1853461109XXX	12/12/2005	258	\$719.79	9		\$686.27	\$1,406.06						
W917L353489999XXX	12/14/2005	6000	\$10,301.18	140		\$6,664.92	\$16,966.10						
W91THB53490046XXX	12/15/2005	5980	\$10,266.85	140		\$6,546.65	\$16,813.50						
W91Y3B53490088XXX	12/15/2005	6000	\$10,301.18	140		\$6,664.92	\$16,966.10	18,238	\$32,249.01				
W813WD53551001XXX	12/21/2005	5890	\$10,112.33	140		\$6,456.65	\$16,568.98						
February-06						Total	\$122,422.88	36,768	\$79,711.96				
W91CN160390013XXX	2/8/2006	2915	\$5,684.32	140		\$4,086.34	\$9,770.66						
W91CP460390001XXX	2/8/2006	2940	\$5,733.07	140		\$4,121.39	\$9,854.46						
W91VT36039004XXX	2/8/2006	2940	\$5,733.07	140		\$4,121.39	\$9,854.46						
W91AY360400002XXX	2/9/2006	2905	\$5,664.82	140		\$4,072.33	\$9,737.15						
W91N6W60400010XXX	2/9/2006	5745	\$9,863.38	140	999	\$6,390.74	\$16,254.12						
W91P9H60400135XXX	2/9/2006	5850	\$10,043.65	140		\$6,546.65	\$16,590.30						
W91P9H60400133XXX	2/9/2006	5910	\$10,146.67	140		\$6,568.16	\$16,714.83	29,205	\$53,528.99				
W91C4P60429998XXX	2/11/2006	2862	\$5,580.97	140	999	\$4,012.05	\$9,593.02						
W91PAM60440048XXX	2/13/2006	80	\$223.19	10		\$424.87	\$648.06						
W91J3T60440001XXX	2/13/2006	2862	\$5,580.97	140	999	\$4,012.05	\$9,593.02						
W8124N60459001XXX	2/14/2006	275	\$767.22	30		\$725.16	\$1,492.38						
W91MQF60460002XXX	2/15/2006	2880	\$5,616.07	140	999	\$4,037.28	\$9,653.35	8,959	\$30,979.83				
W91XVA60470054XXX	2/16/2006	2900	\$5,655.07	140	999	\$4,065.32	\$9,720.39						
W91J3T60489005XXX	2/17/2006	2920	\$5,694.07	140	999	\$4,093.35	\$9,787.42						
W91P9H60490016XXX	2/18/2006	5615	\$9,640.19	140	999	\$6,250.97	\$15,891.16						
W9189H60490012XXX	2/18/2006	5805	\$9,966.40	140	999	\$6,455.25	\$16,421.65						
W91N6W60510017XXX	2/20/2006	2880	\$5,616.07	140	999	\$4,037.28	\$9,653.35	20,120	\$37,231.80				
W91PAM60520007XXX	2/21/2006	570	\$1,430.05	200		\$1,112.42	\$2,542.47						
W91P9H60530140XXX	2/22/2006	2810	\$5,479.57	140		\$3,939.16	\$9,418.73						
W91P9H60530138XXX	2/22/2006	2810	\$5,479.57	140		\$3,939.16	\$9,418.73						
W91P9H60530136XXX	2/22/2006	2945	\$5,742.82	140		\$4,128.40	\$9,871.22						
W91P9H60530131XXX	2/22/2006	2950	\$5,752.57	140		\$4,135.42	\$9,887.99						
W91P9H60530133XXX	2/22/2006	2950	\$5,752.57	140		\$4,135.42	\$9,887.99						
W91P9H60530127XXX	2/22/2006	2975	\$5,801.32	140		\$4,170.45	\$9,971.77						
W91P9H60530129XXX	2/22/2006	2975	\$5,801.32	140		\$4,170.45	\$9,971.77						
W91MQF60540042XXX	2/23/2006	2852	\$5,561.47	140		\$3,998.02	\$9,559.49						
W91U3960540002XXX	2/23/2006	2917	\$5,688.22	140		\$4,089.15	\$9,777.37						
W91U3960540014XXX	2/23/2006	2917	\$5,688.22	140		\$4,089.15	\$9,777.37						
W91PU060550001XXX	2/24/2006	2970	\$5,791.57	259		\$4,163.45	\$9,955.02						
W91C4P60550006XXX	2/24/2006	2862	\$5,580.97	140	999	\$4,012.05	\$9,593.02						
W91C4P60550007XXX	2/24/2006	2932	\$5,717.47	140	999	\$4,110.17	\$9,827.64						
W91XC60560010XXX	2/25/2006	2920	\$5,694.07	140	999	\$4,093.35	\$9,787.42						
W91C4P60560002XXX	2/25/2006	2920	\$5,694.07	140	999	\$4,093.35	\$9,787.42						

Table 15: Pure Pallet Cost Comparison

The net percentage savings across the four month period was 11 percent. However, given the delay in shipment from the deployed aerial port, the customer will need to weigh whether the tradeoff is truly worth the savings in shipment costs.

Descriptive Statistics

McClave, Benson and Sincich (2005:5) states that “descriptive statistics utilizes numerical and graphical methods to look for patterns in a data set, to summarize the information revealed in a data set, and to present the information in a convenient form.”

What the reader can expect from this section is a trend analysis of historical transportation shipments over the last three years and any visible patterns that can give any indications of the viability of the pure pallet concept. Included in the trend analysis

are charts of the transportation priority and required delivery date to gain to some insight into the shipping patterns in the retrograde process.

A trend analysis is simply a specific timeframe of a chart is being examine to determine trending patterns (Wikipedia, 2007). Trend analysis is usually associated with forecasting and simple regression analysis. But, the intent is simply for the reader to get a real “feel” of the data. As a given, the visual data does not always tell the whole picture and issues with production or capacity issues, deadline for unserviceable assets, and cyclical issues with Congressional funding could all play a part within the data set. As such, the result should be simply be a quick snapshot over a period of what may be systemic problems or challenges in the retrograde process.

The first chart [Figure 21] is the total amount of retrograde shipments to Red River and Anniston from Kuwait, Iraq and Qatar during 2004 through 2006. Although the number of shipments has risen at the beginning of each year, the volume of shipments generated indicates a strong downward trend with a spike during June and July only to slightly rise and level out at the end of the year. The probable causes of the spikes in retrograde generation are the US Army redeployment cycles (Colacicco, 2007). In figure 22, the transportation priorities are depicted for the population of 2,044 shipments. The percentage of priority two and three retrograde shipments should not be a surprise on the chart, given previous indications of efficiency from the customer. What is a concern is the combination of the TP with the Required Delivery Date as depicted in Figure 23. Over 76 percent of retrograde shipments had no RDD data on the transportation movement document. Less than three percent of all retrograde shipments within the

population of data had a defined RDD. Without RDD data, it's very difficult to truly measure performance of the transportation system within the retrograde process.

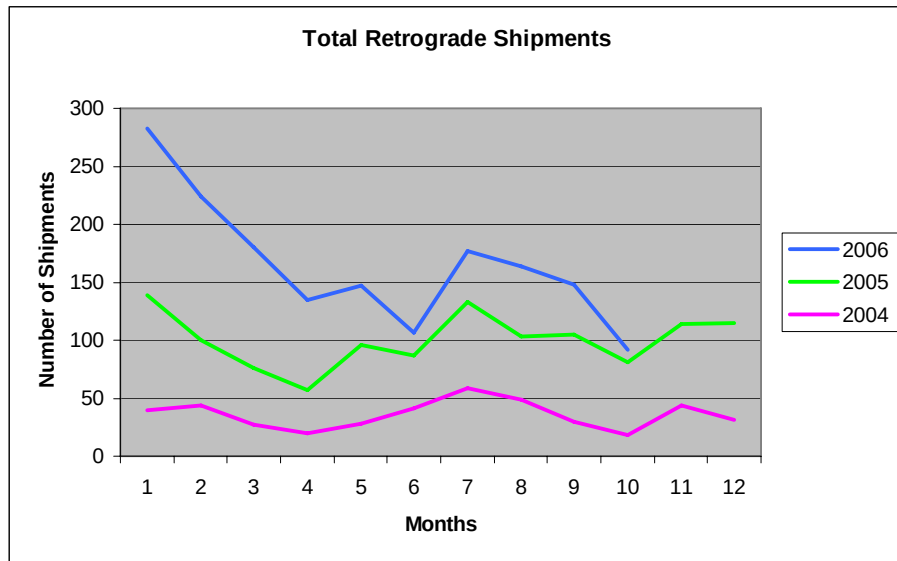


Figure 21: Total Population of Retrograde Shipments

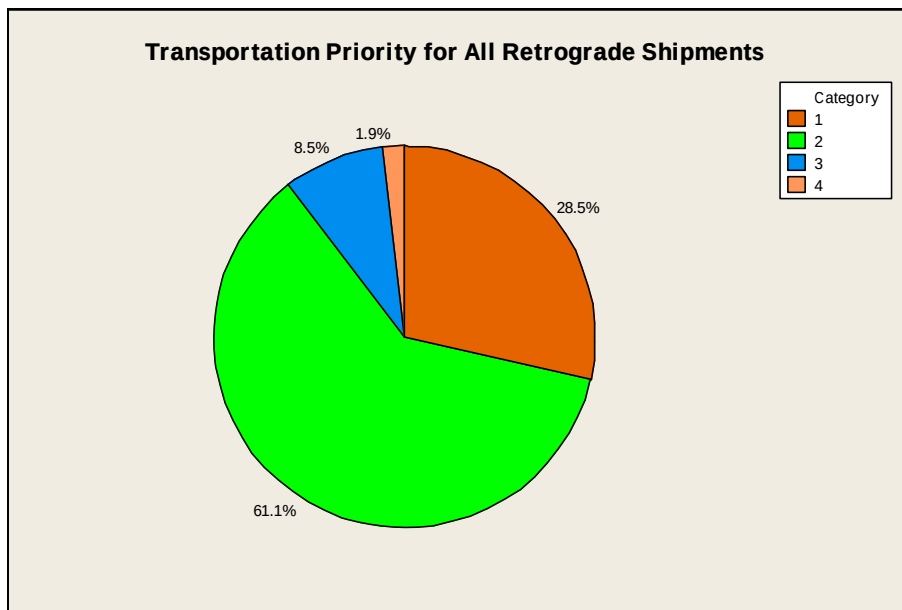


Figure 22: Transportation Priority of All Retrograde Shipments

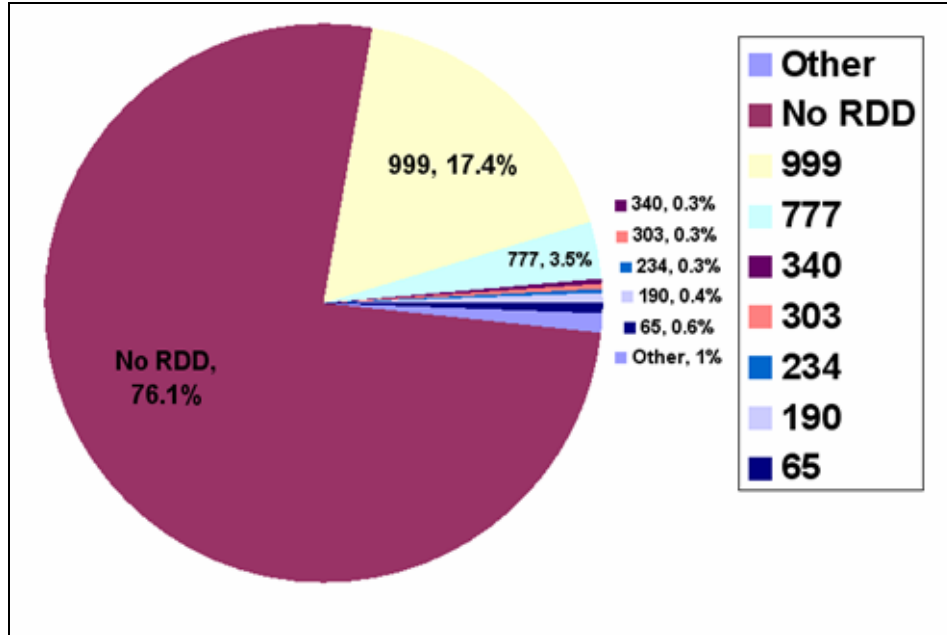


Figure 23: Retrograde Required Delivery Date Data

The last set of graphs collectively in Figure 24 represents the weights of individual retrograde shipments per month over the fiscal year 2006 and a comparative graph of the total number of shipments for the 12 month period. When viewing the graphs, make sure to take note of the scale on the left hand side as the individual weights of each of the shipments across months vary greatly and all months for the exception of December displays severe spikes with an overall downward trend. By looking at the pattern of shipments from the months selected for the aggregated data sample, the reader can easily gather that there is very little consistency in the weights of retrograde shipments. It is a concern for primarily two reasons. First, as previously cited, the AMC Pure Pallet Program is a specifically designed above all else to move high volume of cargo very quickly through the aerial ports to the theater and onward movement to a single SSA. Aircraft utilization and the means for collecting more accurate data for

lighter cargo loads has been a concern both within Air Mobility Command and the DOD (GAO, 2005:35). Although DOD officials understand that lighter cargo loads are due to the pure pallet initiative, they are also aware that the initiative can “reduce risk and customer wait time in theater...” (GAO, 2005: 35). As a result, AMC can meet deployed commanders’ requirements for time-definite delivery of cargo. What is not clear is if the same argument can be made for retrograde cargo with over 60 percent of it moves as TP 2 versus the majority of cargo in the distribution system moving TP1 999, the highest priority outside the “Green³” or “Purple⁴” sheet process.

The second concern is whether HQ Air Mobility Command and USTRANSCOM willing to move perhaps even lighter than normal palletized loads for the benefit of getting cargo to the depot faster? Is the customer willing to pay more for this service? These are questions beyond the scope of this thesis but the indication is that aircraft utilization is a major concern given the limited amount of airlift assets. Figures 25 and 26 are Dover aerial port weekly pallet summaries with metrics on the pure pallet volume and compliance with the CENTCOM routing plan. The first one is from January and February 2005 and the last one is of data collected during December 2006. Essentially, the reader should note from both slides the amount and tonnage of pallets in the upper and lower left hand corner. The amount of on-hand of about 600 short tons and the

³ Green Sheet Procedures are defined as “a procedure invoked by Department of Defense Components to identify specific cargo requiring precedence over all other cargo from that Department of Defense Component. Cargo of the other Department of Defense Components is not affected” (Source: AMCI 24-101, Volume 11).

⁴ Purple Sheet Procedures begin when “US Central Command requires the ability to prioritize sustainment cargo during lines of communication (LOC) stress or during shifts of contingency/combat operations. The Purple Sheet process authorizes specifically identified cargo in the AMC system in-transit to the CENTCOM AOR, including 999 and Green Sheet shipments, regardless of service lane or arrival date at the APOE. The COCOM utilizes Purple Sheeting to expedite movement of specific shipment(s) of National interest and operation necessity” (Source: AMCI 24-101, Volume 11).

pallets generated as well as the black line of the Transportation Working Capital Fund (TWCF) goal for breaking even on pallet utilization. Based on the data and variability of the number of shipments generated for retrograde, it does not appear to be a viable case for use of the pure pallet initiative as it is currently being implemented in the distribution system.

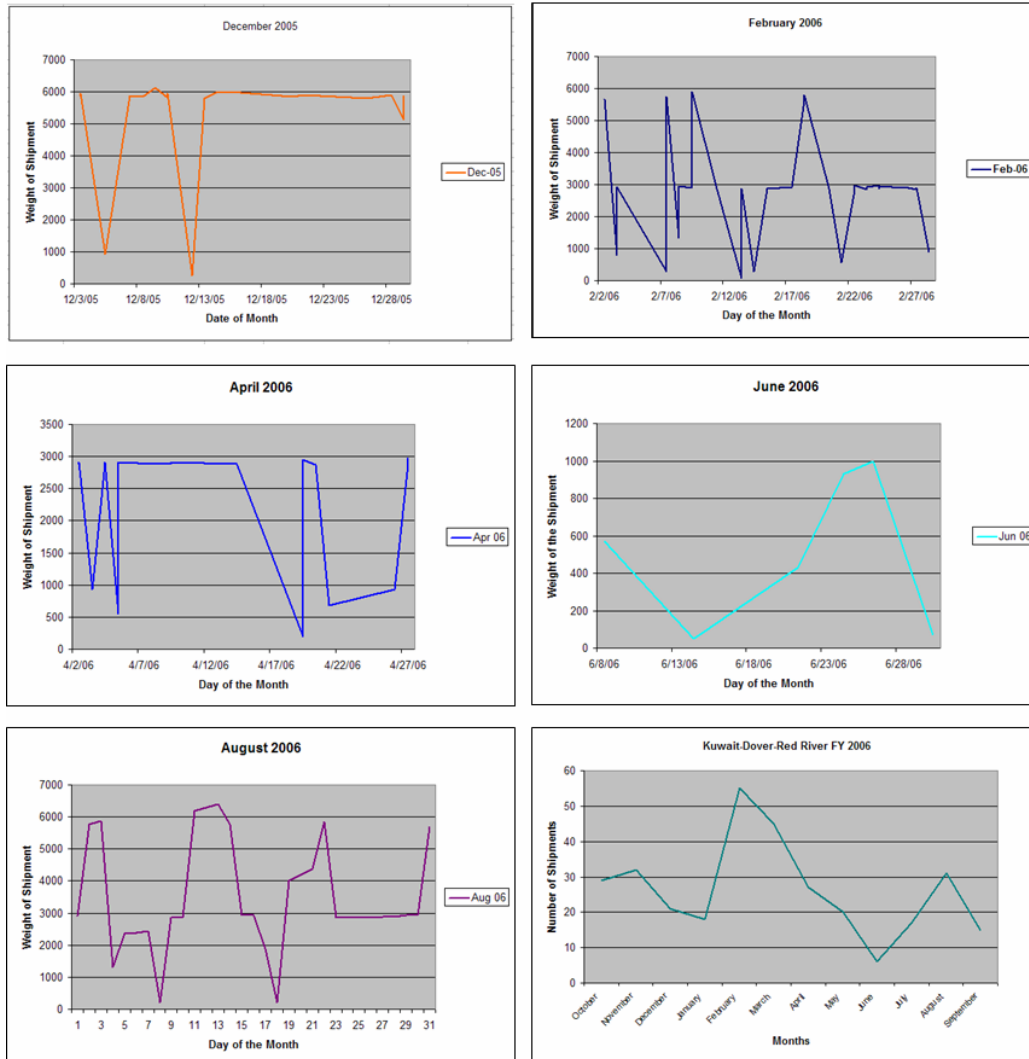


Figure 24: FY2006 Dover to Red River Retrograde Shipments (Weight and Total Number of Shipments)

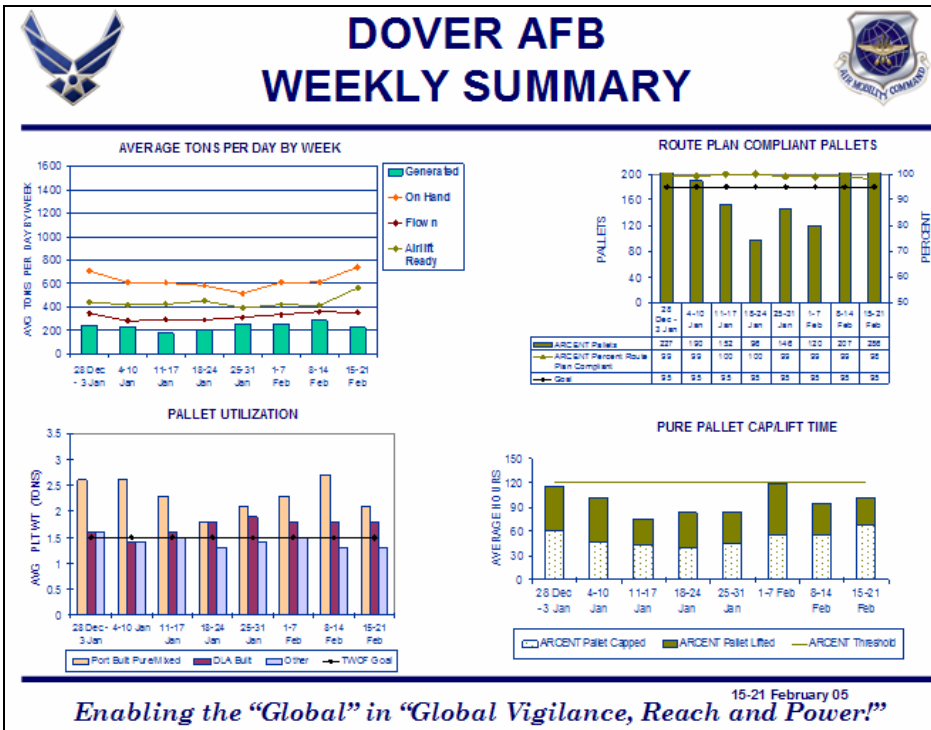


Figure 25: Dover AFB Weekly Pure Pallet Summary-Jan/Feb 05 (HQ AMC/A4TC, 2007)

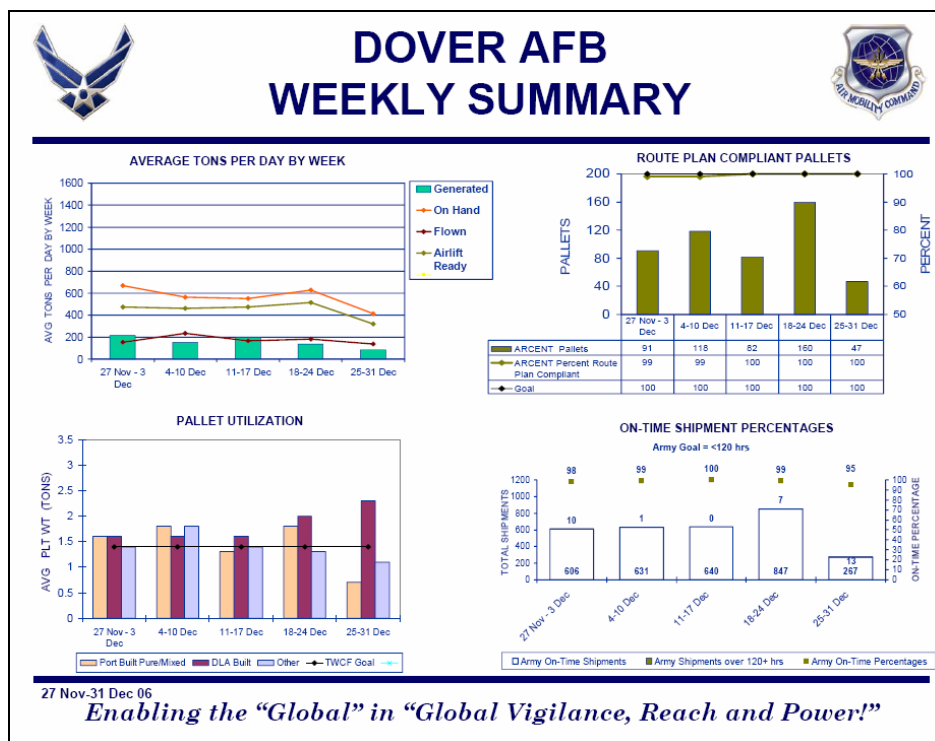


Figure 26 Dover AFB Weekly Pure Pallet Summary-Dec 06 (HQ AMC/A4TC, 2007)

Stage Three: Data Transformation

In stage three, Onwuegbuzie (2001) recommend “conducting a traditional exploratory factor analysis on the emergent themes” and Tashakkori and Teddlie (1998) cited “qualitized and/or quantitized” the data collected (Tashakkori and Teddlie, 2003: 375). To a less extent, an exploratory factor analysis with a look at the recurring themes from the interviews is briefly covered in this stage.

The areas and themes that were most common within the retrograde process was packaging and documentation, In-transit visibility, Inter-Modal Synchronization, the reverse supply chain infrastructure and reliability of retrograde movement. The groups were formed in the general sense based on the researcher reviews of both the transcription and review of the recordings. The list is certainly not all-encompassing nor does it provide all of the details mentioned in the interviews. Table 16 is a brief bullet comments on what the interview respondents collectively expressed as their primary concerns. Not all of them were limited to air transportation, such as in the packaging and documentation portion, however it was important as an issue. Many of the comments have been previously cited in stage two so the main point of the table is simply to focus more on the process as a whole versus the narrower focus of how the pure pallet program can be applied to better optimize the movement of retrograde. Tashakkori and Teddlie (2003: 375) draw the same conclusion by stating that meta-themes “represent a higher level of abstraction than the original emergent themes.”

Inter-Respondent Table	
Key Problem Areas	Comments
Packaging and Documentation	-Selection of DRMO eligible items earlier in the process...i.e. identification and proper documentation of material. -Little to no marking or labeling of shipments [more of a concern with containerized shipments] -More manpower/resources/training needed to improve packaging and documentation. -Missing or incomplete American Return Goods statements for importation through commercial ports.
In-transit Visibility	-Frequent would find no cargo without RFID tags affixed to shipment. -Loss of visibility during disassembly and transshipment points. -Access to near-real ITV systems data versus spreadsheets for movement of retrograde cargo. -Great success with Material Tracker; a slightly lesser extent with GTN but lauded for updates to improve customer service. -More effort needed to improve VLIPS reliability.
Inter-modal Synchronization	-Mixed cargo priorities on pallets and the need for smoother synchronization between the aerial ports and truck for onward movement to the depot.
Reverse Supply Chain Infrastructure	-More flexibility (i.e. policy change) in the movement of unserviceables and less individual handling. -More collaboration/cooperation between national maintenance and international maintenance programs. -Bottlenecks within Germany for through-load retrograde to meet US Customs/Ag requirements. -Lack of manpower and resources in the tactical environment cited as biggest obstacle for consolidating retrograde shipments [reasons for retrograde returning in "H" condition]. -Most cited consolidation as a good idea.
Reliability of Retrograde Movement	-Published schedules for retrograde flights. -Better planning and scheduling of retrograde missions from the AOR to plan around depot production.

Table 16: Inter-Respondent Table of Retrograde Process

Stage Six: Data Comparison

During this stage, both quantitative and qualitative sources are compared to form a data triangulation from the previous stages. Recall from Chapter 3 that purpose is to clarify any conflicts with both data types and to lead the reader to an interpretation of the data for the last stage. From the perspective of the researcher, the analysis simply boiled

down to determining the value, volume, and viability. First, value in what the customer is seeking from a transportation service and volume of cargo generated to offset any cost savings from delay in shipment. Viability has been used several times during this research study. Merriam-Webster defines viable as “capable of working, functioning, or developing adequately; having a reasonable chance of succeeding or financially sustainable” (Merriam-Webster Online, 2007). The point is that viable envelopes not only volume and value but cost and execution given the parameters of the pure pallet program as well as the limitations of the retrograde process.

In stage two, the set of interview questions were intended to measure customer value. It is value that determines the expectations and requirements for what the customer is looking from a supply chain. In this case, the need was to understand in very general terms whether the customer was seeking responsiveness or efficiency in retrograde movement. The interview participants indicated the desire for more reliability and predictability in retrograde movement. Efficient use of resources and the desire of the US Army for low cost or discount transportation for retrograde was cited during the interview process as expectations of the reverse supply chain. The data from the descriptive statistics on transportation priority and required delivery date seemed to reemphasized this point from historical patterns in the GATES data. The cost comparison was simply a way of developing a rough idea on whether any potential cost savings can be extracted for implementing a pure pallet concept given the tradeoffs in accumulation time at the theater aerial ports. The preliminary results did highlighted significant benefits from consolidated shipments under a pure pallet concept as it relates in transportation cost savings. However, the underlying reason for the absence of use may

be the lack of material benefits in using the project code. The trend data was simply to take a snapshot of volume being generated to serve as a costs savings and perhaps lend credence to the possibility of dedicated missions for retrograde movement. In a sense, both the cost comparison and the trend analysis would serve as a quasi “hurdle rates” for both Army Material Command as a cost consideration and Air Mobility Command on the level of risk with committing airlift assets to highly variability generation of retrograde cargo in order of meeting minimum TWCF goals for pallet utilization. All indications were the data simply did not support both the viability of the pure pallet concept in its current form based on volume. The possibility of dedicated missions is not “clear-cut.” There seems to be an annual cyclical pattern in the data set but consideration of any published retrograde channel missions is beyond the scope of this research study. The bottom line is triangulation of both data sources seem to fit and support each of the conclusions reached separately. So, the data integration is the last stage of analysis.

Stage Seven: Data Integration

Investigation Question Six: Does the intent and business rules of the AMC Pure Pallet Program meet the value expectations and requirements of the customer for movement of high priority US Army retrograde from the CENTCOM AOR?

This stage is suppose to serve as “the last link in the data analysis chain” (Tashakkori and Teddlie, 2003: 377). It is this stage that leads to the initial interpretation of the data. Onwuegbizie and Teddlie (2003) states that if “the analyst believes that the interpretation represents the most plausible explanation of the underlying data, conclusions are made and a final report is written” (Tashakkori and Teddlie, 2003:378). Therefore, it is the opinion of this researcher that the intent and business of the AMC

pure pallet program, as it is applied in the distribution, does not meet the customer requirements of the Army retrograde process. This researcher also believes that the interpretation is plausible based on the results of the data and is not in conflict with either of the data sources.

Assumptions and Limitations

First, the GATES data for retrograde originating from Kuwait, Iraq, and Qatar to Red River and Anniston Army Depots is a comparable representation of all retrograde shipped by air from CENTCOM to all CONUS Army depots. The GATES transportation data sample used for the cost comparisons of US Army retrograde shipments within the air transportation system is a general representation of high priority cargo on an annual basis. Deployed aerial ports, supply support activities and centralized collection points within Kuwait were adequately trained, manned, and the proper amount of equipment and resources for packaging, documenting and preparing consolidated cargo shipments into the airlift system. The fluctuations between the amount of cargo through the sealift ports and the airlift are minimal and the sealift mode represents the lowest priority retrograde to the depots. The Class 100 rates and commercial tender rate is only a rough estimate of the actual surface transportation costs for retrograde from Dover Air Force Base to Red River Army Depot. All consolidated shipments over 10,000 pounds was shipped out the same day or next day in full TL rates based on the tailored transportation contracts (TTC). The TTC from Red River Army Depot to Dover Air Base has a comparable rate structure for the movement of retrograde on the return route back to the depot. The 9GN project code was not widely known due to low marketing efforts and advertising to Army Material Command and HQ Army G4. This was assumed to be the primary contributing

factor to its very minimal use within the airlift system. The interviewees from DLA and Army Materiel Command are a true representation sample of the larger population familiar with the retrograde process and the areas that is of the most immediate concern to improve the level of service and accurately prescribe their value as a customer. Furthermore, the questions within the survey instrument are assumed to be interpreted the same way by each of the interviewees.

Time was, by far, the biggest limitation of this research study. The level of strategic transportation experience or knowledge of the entire US Army retrograde process needed for the interviews was too specialized, and it proved very difficult to find willing and available participants given the time constraints. As such, no depot personnel were available to participant in this research study. Without the depot's direct input, the level of depth and analysis needed for global optimization across all stakeholders was a severe limitation of this study. In addition, the number of interviews should have been higher to represent all major subordinate commands within Army Material Command, DLA, and the major Army depots providing the bulk of retrograde and component level repair. Availability of the raw data of retrograde shipments through the WWX program was another limitation is to quantify the amount, frequency of use and delivery times to compare with the military airlift system. This data could support the responses provided by the interviewees. It is still not clear whether an overall time savings in optimization over the retrograde process. This is a limitation of this research effort and would provide a better understanding in any intangible benefits of time.

Summary

This chapter began with the organization of the interview questions to extract that value from the interview participants. The mixed methods data analysis model was applied to both qualitative and quantitative sources. The interview responses were placed in word tables and common themes across all participants formed the basis for an inter-respondent matrix table. The results from the interviews concluded that efficiency and reliability is what the customer values most in the context of retrograde. Cost comparisons of both 9GN cargo and selected data sets during FY2006 provided a framework for examining costs of applying a flat rate for retrograde shipments and gleam potential savings for consolidated shipments from the deployed location under a pure pallet concept. The flat rate proved to be significantly higher in transportation costs with little indication of improved service to the customer. The triangulation from all data sources indicated that the AMC pure pallet program under its current business rules does not meet the customer requirements for retrograde movement. The next chapter concludes this study with implications of the results, recommendations and areas of future research.

V. Conclusions and Recommendations

Chapter Overview

The preceding chapters answered the six investigative questions required to adequately answer the research question. This chapter will present major conclusions from the collective analysis of the data during this research effort. Recommendations for improving the Army retrograde process and conclude with areas for further research.

Conclusions

When examining the viability of the pure pallet program, the fundamental purpose of this research boiled down to three questions: What does the customer value? Does the intent of program match the customer's requirements? Will the program produce any cost savings in the movement of retrograde cargo? The type of supply chain needed to meet customer value and expectations ultimately drove the decision on whether the pure pallet program was feasible. When comparing the results of the five interviews using the three measures of customer value: service level, customer satisfaction, and supply chain performance, it became clear that an efficient supply chain was the preferred choice with some degree of flexibility for the movement of critical retrograde to prevent work stoppage in the production lines at the depots. The GATES transportation data revealed that the flat rate did produce a slight discount in total transportation costs versus using the conventional billing process of air shipments and LTL trucking to the depots. Aggregated shipments from the deployed locations to the depots under a cost comparison with the conventional billing of both air and surface modes yielded significant savings but with severe manpower and resource limitations in providing the proper packaging,

documentation, and ITV requirements for retrograde. Lastly, the trend analysis of channel retrograde movement and collectively from Kuwait, Iraq, and Qatar to the two major depots for depot level repair and the processing of unserviceable assets revealed a negative downward trend and large amounts of variability in generating a comparable level of retrograde to the distribution system when balancing the tradeoff of pallet utilization and velocity. As a result of these findings and the aforementioned complexity of item-by-item management within the retrograde process, the AMC Pure Pallet program is not a viable option in its current form and business rules as a policy or initiative for the movement of retrograde cargo.

The results from this thesis research had severe limitations with acquiring enough interview participants for a thorough cross-section of all affected stakeholders in the retrograde process to provide better insight from a customer perspective. With a wider group of participants, the type of supply chain(s) required to meet customer value may be completely different, given the various types of retrograde within Army Materiel Command. The cost comparison could have easily yielded a more robust analysis with the ability to examine the in-transit time from the deployed location to the depot and how long specific shipments were held at points within the reverse supply chain. With the availability of in-transit time, a cost-benefit analysis would have added more strength the quantitative portion of the findings.

Recommendations

One Process Owner

During this research, it became clear that what works in the distribution pipeline may not or will not always work for reverse supply chain. Overall, one of the largest

gaps in the supply chain (distribution and retrograde) integration is a clear owner. It would seem that USTRANSCOM has the responsibility but it is not understood from any of the available documentation or guidance at the time of this thesis. The DOD memo signed by Deputy Secretary of Defense Gordon England gives an indication that USTRANSCOM is responsible for “retrograde operations.” Regardless of who has ownership, the type of development in the distribution system is required for the DOD reverse supply chain. A clear process owner or any organization that encompasses all of the concerns and requirements of all of the stakeholders and develops policies, performance metrics, and a mechanism for feedback/collaboration is desperately needed within the DOD reverse supply chain.

Common Set of Metrics

Before any DOD policies and procedures are identified, Army Materiel Command should first take a thorough review of all of its policies and regulations on the movement of retrograde and how it is executed across all major subordinate commands. As a major customer in the retrograde process, AMC needs to develop a common set of metrics that provide the level of information needed to understand how the reverse supply chain is meeting their requirements and expectations.

Re-examination of Current Policies and Capabilities

This research effort has given the author a new found respect for the United States Army and the men and women of Army Materiel Command in trying to meet the needs of their soldiers on the battlefield. They have a monumental task, but it seems that policies and procedures do not always make their jobs any easier. The command should determine whether their policies, for example, encourage personnel to code assets in “H”

condition when additional effort may be required to properly diagnose and examine the true condition of serviceable or unserviceable assets. The conflict with transportation priorities and supply priorities was also an issue raised during the interviews and in at least two RAND studies. It is an area worth exploring further and determining whether they are service conflicts in the interpretation and application of transportation/supply policies and the need to review the movement of unserviceables versus depot level repair assets within the DTS.

Lack of manpower and training on packaging and document for retrograde shipments has been a consistent concern from the interviews in this study and through the literature review. In order to successfully prevent damage to shipments arriving in the CONUS, a functional solution analysis may be needed in order to determine if the gaps truly require a manpower, material or contracting solution.

Viability of Commercial Sector Concepts to the DOD

Commercial sector concepts can be applied to the DOD supply chain in the following areas: ownership of the process, centralization of the returns process, effective communications and IT support, matching products with the right supply chains, enterprise level management, and use of incentives. Sloan et al (2006) highlighted the fact that companies performed best when they had full-time managers responsible for the entire product returns process, and Monahan et al (2004) cite a “lack of accountability and cost management between reverse logistics and other departments” for “poorly defined return policies” (20). Recall from Chapter 1, the Secretary of Defense designated the USTRANSCOM Commander as the DPO with primary responsibility for distribution and retrograde operations. Although this is a critical first step, the DOD “reverse supply

chain” should be clearly defined along with the expectations and responsibilities of those individual owners in achieving global optimization. At the time of this research, DOD 4140.1-R (May 2003), DOD Supply Chain Materiel Management Regulation, Chapter 6-Return, provides guidelines for the individual service components on retrograde/returns but does not incorporate the DPO roles among the stakeholders, nor is it specific enough to determine how interoperability will be accomplished to reduce system-wide costs or “global optimization”. This leads to the next point of design and planning of the reverse supply chain.

Fleischmann et al (2004), Monahan, Bossche, & Harthan (2004), Prahanski and Kocabasoglu (2006), and Stock, Speh, & Spear (2006) all subscribed to centralization of returns as a viable solution for streamlining the process and producing better efficiency across the entire reverse supply chain. All of the authors make very convincing arguments for the centralized management of returns providing better capability to meet service and cost goals through more effective diagnosis, sorting, packing, and distribution based on the product’s value and serviceability for market resale. To further emphasize this point, Simchi-Levi et al (2004:66-67) state that:

In a centralized system, decisions are made at a central location for the entire supply network. Typically, the objective is to minimize the total cost of the system subject to satisfying some service-level requirements. This is clearly the case when the network is owned by a single entity, but it is also true in a centralized system that includes many different organizations. In this case the savings, or profits, need to be allocated across the network using some contractual mechanism...Similarly, in a decentralized system, each facility identifies its most effective strategy without considering the impact on the other facilities in the supply chain.

The DOD should seriously consider implementing a regional centralized retrograde center with the expertise and equipment to correctly diagnose, document, and

determine disposition of retrograde to either the depots or to DRMO. This is not the first time that this concept has been proposed as a systemic solution. In his paper, entitled, “Reverse Logistics,” Colonel Joseph Walden (2001) suggested Red River Army Depot as a centralized returns processing center for the DOD to ship all serviceable items, thereby relieving two other major depots from the same tasks and boosting productivity of repairing parts (43). Colonel Walden believed that “using regularly scheduled transportation for every installation will reduce the holding times at the installation while they wait for a full truckload of returned supplies” (2006:43). Dekker et al (2004) mention this backhauling strategy as well as mixed or partial loads for the movement of retrograde. Another possibility is the use of milk-runs from aerial ports of debarkation such as Charleston or Dover Air Force Base between two depots to maximize full truckloads. Walden also mentions that this solution would eliminate the embarrassment of shipping items to DRMO only later to be brought back by the government (2001:43-44). Lastly, it is worth noting that Walden’s recommendation is for the entire DOD, not just for the US Army. Where this researcher departs from Walden’s suggestion is location within the supply chain and scope of retrograde centralization. If any CRC is given serious consideration, the location should be as close to the end user, or “point-of-sale,” as possible. Thus, the CRC should be established somewhere in the AOR versus stateside. Implementing a CRC farther up the reverse supply chain provides the opportunity to be both efficient and responsive to retrograde shipments. Stock, Speh, & Spear (2006) cite the concept of postponement for “processing returned items nearer to the point-of-sale” to “save both time and money” by accessing value earlier in the reverse supply chain. The framework for implementation should follow a “push/pull strategy”

where the AOR pushes all retrograde to a CRC, and then serviceable retrograde and spare parts are pulled to the depots based on their production schedules. In this manner, a balanced tradeoff can be made on efficiency or responsiveness of the transportation portion of the reverse supply chain. If this strategy is incorporated and the execution of cross-docking at the aerial ports and transportation management functions is implemented for retrograde, the result should reflect lower overall costs and more importantly, global optimization. In the situation with the DOD, the CRC concept should be limited only to major weapons systems where the cost of an increased footprint in a theater of operations is worth the benefit of extended product life cycles of components that have historically resulted in high demand uncertainty and systemic surges of backorders. The last point relates to the first one, ownership, where the entire DOD could benefit from enterprise management across the reverse supply chain network.

Good communication has been frequently noted as an essential part of the reverse supply chain. Stock, Speh, & Spear (2006) found that a company's communication processes is central to an "effective and efficient returns process" and Monahan et al (2004) discuss how communication integration among the reverse supply chain stakeholders is essential to the ability to establish robust processes such as product tracking and inventory management. Richey's (2005) example of the Home Shopping Network demonstrated how replacing their warehouse management system to increase ITV on inventories and provide better real-time information on consumer credit on returns resulted in boosting supply chain responsiveness. The same enterprise level of communication across all stakeholders in the reverse supply chain and the ability to pull

retrograde from regional inventory supply points is something directly applicable to the DOD.

Fisher (1997) provided the foundation for matching supply chains (responsive or efficient) with the type of products being shipped through the network. Munnich (2006) discussed the interrelationship between responsiveness and efficiency and the need for planning to improve supply chain performance. Stock, Speh, & Spear (2006) advocated the need for knowledgeable employees with a deep understanding of the range of options for product returns in the fourth stage of their process. One could easily derive from their arguments that enterprise-level management would be needed to work with the depots, the CRC, and the other service component stakeholders to design reverse supply chains based on the type and/or composition of retrograde. For any of these suggestions to be realistically implemented, a thorough examination of policy is necessary through the cooperation of all stakeholders. This calls for the application of a full complement of policy incentives at the unit level to the service components to effectively work across the supply chain. As with any process change, leadership at the executive level is needed for any sustainable change across the services.

Areas of Future Research

A study of Red River and Anniston Army depot personnel on how the current retrograde process can be optimized to consider production schedules. This study could yield better insight how the depots operate and how the incorporation of Lean and Six Sigma has enhanced the production process for repairing retrograde. By examining the amount of retrograde repaired and shipped out of the depot, opportunities such as backhaul shipments could produce lower transportation costs.

A case study analysis on the implementation of a theater DOD centralized facility for processing depot level repair and unserviceables attached to high cost lifecycle weapon systems could prove useful in determining whether a slightly heavier footprint within theater can yield substantial cost savings in the condition of retrograde arriving in CONUS, processing only assets that are truly condemned and warrant disposition to DRMO, and higher levels of unserviceables to prevent both less use of premium air transportation and lower the risk of backorders and potential production work stoppages.

Attachment 1- Human Subjects Exemption Letter



DEPARTMENT OF THE AIR FORCE
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO

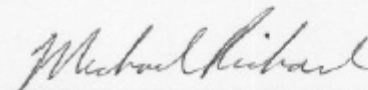
12 January 2007

MEMORANDUM FOR

FROM: AFRL/Wright Site Institutional Review Board

SUBJECT: Request for exemption from human experimentation requirements

1. Protocol title: Use of the Air Mobility Command Pure Program for High Priority US Army Retrograde
2. Protocol number: F-WR-2007-0023-E
3. The above protocol has been reviewed by the AFRL Wright Site IRB and determined to be **exempt** from IRB oversight and human subject research requirements per 32 CFR 219.101(b)(2) which exempts "research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior."
4. This exemption applies only to the requirements of 32 CFR 219, DoDD 3216.2, AFI 40-402, and related human research subject regulations. If this project is a survey, attitude or opinion poll, questionnaire or interview, consult AFI 36-2601, Air Force Personnel Survey Program, for further guidance. Headquarters AFPC/DPSAS is the final approval authority for conducting attitude and opinion surveys within the Air Force.
5. The IRB must be notified if there is any change to the design or procedures of the research to be conducted. Otherwise, no further action is required.
6. For questions or concerns, please contact the IRB administrator, Helen Jennings at (937) 904-8094 or helen.jennings@wpafb.af.mil OR Lt. Douglas Grafel at douglas.grafel@wpafb.af.mil or (937) 656-5437. All inquiries and correspondence concerning this protocol should include the protocol number and name of the primary investigator.


MICHAEL RICHARDS, Maj, USAF, MC, FS
Vice Chair, AFRL/Wright Site IRB



DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY (AETC)

MEMORANDUM FOR AFIT/ENS
AFIT/ENR
AFRL/HEH
IN TURN

27 Nov 2006

FROM: AFIT/ENS/GLM

SUBJECT: Request for Exemption from Human Experimentation Requirements (32 CFR 219, DOD 3216.2 and AFI 40-402) for the Use of the Air Mobility Command Pure Program for High Priority US Army Retrograde.

1. The purpose of this study is to determine whether the success and benefits associated with this initiative designed as a customer-oriented solution in the distribution system can ultimately provide the same results for the Army retrograde process. The results of this questionnaire will be used to capture the depot's value and requirements for transportation service as a customer within the retrograde process. As a customer-based program, determining the value the depot places on their transportation needs is critical for successful implementation. The results of this research study will be presented the thesis committee and to USTRANSCOM J5 and the US Army Material Command.

2. This request is based on the Code of Federal Regulations, title 32, part 219, section 101, paragraph (b)(2), which states "research activities in which the only involvement of human subjects will be in one or more of the following categories are exempt from this policy: (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior". Information obtained will not be recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects nor will any disclosure of the human subjects' responses outside the research reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation. Methodology used to collect information for research is based on survey procedures and involves less than minimal risk.

3. The following information is provided to show cause for such an exemption:

3.1. Equipment and facilities: No special equipment or facilities will be used. A tape recorder will be used for the telephone interviews within the AFIT facility complex but no additional equipment will be required to conduct this research.

3.2. Subjects: Subjects will be military and civilian leaders/managers at Red River Army Depot (located in Texarkana, Texas) and Anniston Army Depot personnel who have direct experience and knowledge working with Class IX Army retrograde component repair originated from Kuwait and Iraq that will participate in the study. The subject pool consists of 1,534 personnel from Red River and 1,763 personnel from Anniston Army depots.

3.3. Timeframe: Data will be collected between November and December 2006.

3.4. Data Collected: No identifying information will be retained or reported in the final thesis. In order to complete the research effort, data collected on individual subjects may include name and duty title, which will facilitate analysis and follow up for the duration of this study only. The telephone interviews will be recorded through the use of a digital voice recorder only for accuracy of the comments or responses made during the process, then transcribed verbatim by the researcher and sent via email to confirm their accuracy. This method minimizes bias and memory recall of how interviewees responded to the questions. Data gathering on individual subjects will be focused on determining what value or requirements (speed, velocity, reliability, visibility, etc.) they place on the transportation system and their perceptions of the impact of the supply and transportation priorities within retrograde process. The demographic information collected as a part of this study will include length of employment and organization level (entry level employee, supervisory or senior/executive), length of time in current job position and amount of experience in the depot component repair process, and where the interviewees work (Red River, Anniston, DLA, etc.).

3.5. Risks to Subjects: Individual responses of the subjects' written comments and/or recommendations only may be disclosed for specific feedback on the transportation portion of the retrograde process. However, there will not be any way to determine who provided comments and/or recommendations. This eliminates any risks to the subjects as noted in paragraph 2. There are no anticipated medical risks associated with this study.

3.6. Informed consent: All subjects are purposefully selected based on subject matter expertise to volunteer to participate in the interview process. No adverse action is taken against those who choose not to participate. Subjects are made aware of the nature and purpose of the research, sponsors of the research, and disposition of the survey results. A copy of the Privacy Act Statement of 1974 will be presented for their review.

4. If you have any questions about this request, please contact Dr. William Cunningham (primary investigator) at (937) 255-6565, extension 4283 or email at william.cunningham@afit.edu or SMSgt Will Jackson at william.jackson@afit.edu.

////signed////

WILLIAM L. JACKSON, Jr. SMSgt, USAF
Graduate Student, AFIT/ENS/GLM

////signed////

WILLIAM A. CUNNINGHAM, AD-24, DAF
Faculty Advisor, AFIT/ENS/GLM

Interview Questions Regarding Retrograde Process

1. Do you have any direct work experience or knowledge on depot component level repair of Class IX supply retrograde arriving by truck via airlift from the CENTCOM AOR?
2. What percentage of retrograde cargo arrives from the CENTCOM AOR by commercial cargo express carrier (DHL, FEDEX, UPS)?
3. What percentage of retrograde cargo arriving from the CENTCOM AOR has radio frequency identification tags affixed to the shipment?
4. What impact will the consolidation of Class IX retrograde airlift shipments from the AOR affect the depot internal production processes?
5. Can your depot support backhaul shipments from inbound Class IX retrograde cargo with outbound shipments destined to the CENTCOM AOR?
6. What is the primary system used by your organization for tracking the movement of inbound Class IX retrograde cargo shipments? (GTN, DAAS, SAMMS, RFID Server, etc.)
7. What criterion is used to determine high priority retrograde that shipped by air versus retrograde shipped by sealift? Is the depot involved in the determination process?

Interview Questions Regarding Customer Satisfaction

1. How would you rate your level of satisfaction of the transportation system, as a whole, from the deployed location to the depot (On a scale of 1-10 with 10 being the best)?

2. Which is most important to you as a customer for inbound retrograde shipments as it relates to transportation services...Speed/Velocity, Reliability, or Predictability? And Why?
3. What recommendation (s), if any, do you have to improving the Army Retrograde process from the CENTCOM AOR?
4. What information about the transportation system is not being provided to you as a customer of the retrograde process that would help you do your job more efficiency?

Interview Questions Regarding USTRANSCOM Transportation Initiatives

1. Do you understand the purpose and goals of the Air Mobility Command Pure Pallet Program? If so, do you feel that the depots can benefit from this program?
2. Are you familiar with the 9GN project code which charges a flat rate for the movement of retrograde cargo from the CENTCOM AOR to the CONUS depots?

Demographic Questions

1. How long have you been employed in the Department of Defense and at what organizational level (Employee, Supervisory, or Executive Level)?
2. How long have you been employed in your current job position and how much experience they have with depot level component repair & retrograde?
3. Where do you work (Red River Depot, Anniston or DLA)?

Attachment 2-DOD Passenger and Cargo Channel Rates

U.S. GOVERNMENT DEPARTMENT OF DEFENSE (DoD) AIRLIFT RATES

PASSENGER AND CARGO CHANNEL RATES

EFFECTIVE: 01 Oct 05 through 30 Sep 06

1. Instructions for use of U.S. Government-DoD Channel Rate Tables:

a. To obtain any rate, consult the alphabetized listing of stations in the end of this file (ATCH 1: Department of Defense Channel Tariffs). Any passenger or cargo moving under terms of Acquisition and Cross Servicing Agreements (ACSA) are entitled to the DoD rate.

b. The rates are categorized by outbound channels only (movement away from CONUS), even though the outbound and inbound rates are identical (TP-4 is the exception). For example, a passenger/cargo rate is desired for movement from Adana, Turkey to Ramstein AB, Germany. Since Adana, Turkey is farther from CONUS than Ramstein, Germany, the outbound channel would be Ramstein to Adana. Thus, by turning to the rate page indicating Ramstein GE as the To/From station, we find the passenger/cargo rate to Adana, Turkey. If unable to determine outbound channel, then check the inbound channel, which in this example would be Adana, Turkey to Ramstein, Germany.

c. Reference DOD 4500.9-R and DOD 4515.13-R, C1.4.2.2. Excess baggage charges will be assessed on a per piece basis, based on the passenger fare. Each passenger is authorized two pieces of baggage not to exceed 70 pounds each or 62 linear inches. The sum of linear measurements (length/height/width) must not exceed 62 inches. Bags larger than 62 linear inches and/or heavier than 70 pounds will be counted as two pieces and checked baggage exceeding the free weight criteria will be counted as an extra piece for each increment of 70 pounds. Items exceeding 100 pounds and/or 80 linear inches will not be accepted, and must be moved as freight. Piece rate charges are listed here and based on ranges of passenger fares. For example, if the passenger fare for the Baltimore - Aviano channel is \$422, the rate for each piece of excess baggage is \$75. Authorization for excess baggage must be included on travel orders to properly charge the unit. Otherwise, the charge for excess baggage is the responsibility of the traveler. However in accordance with AMCI 24-101, Vol 15, para 4.2.1 and DOD 4515.13-R, C1.4.2.2, space available passengers are not authorized excess baggage. Disposition of unauthorized excess baggage is the responsibility of the passenger.

Excess Baggage Piece Rates*/Pet Rates*

Pax Fares**	Rate Per Piece/Pet Rate
\$25-\$60	\$11 minimum
61-115	21
116-170	33
171-230	43
231-285	54
286-340	64
341-400	70
401-455	75
456-510	81
511-570	86
571-and above	92 maximum

* Minimum charge is \$11; maximum charge per piece is \$92.

** Passenger fare is basis for charge. See Para 1.h. for more information on pets and excess baggage tariffs.

d. When segmentized air movement designators (AMD) are issued to permit an authorized delay at an intermediate AMC channel transit point, charges will be based on the channel segment rates. For example:

A TDY passenger is traveling from Ramstein to Adana and the order requires a Mildenhall stopover. The AMDs would be issued from Ramstein (RMS) to Mildenhall (MHZ) and Mildenhall to Adana (ADA). The rate would be computed as follows:

RMS	MHZ	\$343
MHZ	ADA	<u>\$449</u>
Total		\$792

The rate of \$368 listed for Ramstein to Adana is applicable for a through AMD and would apply, for instance, if a stopover at Mildenhall were made for AMC convenience or passenger safety.

e. Excess Charges for Overweight Passengers - Upon request and advance arrangement of exclusive use of two seats by a passenger, payment will be made for two full adult fares applicable between the points which the seats are used. Also, the free baggage allowance for such passengers will be twice the normal allowance.

f. Charges for carrying cargo are assessed by pound or cube. The rate per pound is dependent on the size of shipment. The rate reflects the five weight breaks, i.e., shipments weighing 1-439 pounds, 440-1099 pounds, 1100-2199 pounds, 2200-3599 pounds, and shipments weighing 3600 pounds or more. The cubic foot measurement indicated on each shipping requisition is multiplied by the cube density minimum of 10 pounds per cubic foot and compared to the weight. The chargeable weight is the actual net weight or volume weight equivalent; whichever is greater as indicated on the transportation control movement document (TCMD). The chargeable amount will depend on the actual weight break of the shipment even though the cube weight may put the shipment in a higher or less expensive weight break. For example: 2600 lb package has a cube density of 4500 (cube density equals cubic feet x 10 lbs)—since the cube density is greater, multiply cube density by the weight break rate applicable to actual weight of 2600 lbs (4th weight break cost per pound) to get total customer cost.

g. All DoD cargo shipments will have a minimum line item charge of \$25.00. All charges will be rounded to nearest whole dollar. Rounding to nearest whole dollar doesn't apply to split shipments.

h. Reference DOD 4515.13-R, Chapters one and eight. Movement of pets (cats and dogs) within authorized areas on AMC military or Patriot Express flights are reimbursed by determining the Non-US Government passenger tariff located in the tariff section or Para 3.a. After determining this tariff, use the Pet Rate Table in Para 1.c. for pet rate. Pets and their containers with a combined weight up to 70 lbs will be charged as one piece; 71 lbs - 140 lbs will be charged as two pieces and 141-150 lbs will be charged as three pieces. These rates will apply regardless of the number of pets in the container. Pets and their containers with a combined weight in excess of 150 lbs will not be accepted for shipment. POC for pet movement information is TACC/XOG, DSN 779-7862.

i. TP-4 cargo is basically moved as space available cargo. Charges for carrying deferred air freight (TP-4) cargo are assessed on a per cubic foot basis versus actual weight. All non-air eligible freight and certain retrograde repairable cargo may be moved as filler cargo within the deferred air service capability offered. Air eligible TP-1 and TP-2 cargo will not be moved as TP-4. The applicability of the TP-4 rates is subject to the availability and allocation of space. If there is no TP-4 rate listed, it will be billed at the regular cargo rate. TP-4 rates listed are one-way. To facilitate computation of cash charges for overweight household good shipments, TP-4 household good rates are quoted in dollars per hundred-weight. The density factor to be used for calculating TP-4 (HHG) is 6.0 pounds per cubic foot.

j. To compute AMC costs for unaccompanied baggage (identified as commodity Code J); determine the appropriate channel rate using the fourth weight break category. Cubic minimums of 10.0 pounds per cubic foot apply to all unaccompanied baggage shipments.

2. Aeromedical Evacuation. Aeromedical evacuation furnished DoD/Non-DoD U.S. Government Agencies patients within overseas areas and between overseas and the CONUS will be charged as follows:

a. For a litter patient with no attendant, the overseas/ international charge will be three seats at the DoD Tariffs Rate published herein. For each attendant, an extra seat will be charged with appropriate Tariff Rate.

b. For an ambulatory patient, the overseas/international charge will be one seat at the DoD Tariff Rates published herein. For each attendant, an extra seat will be charged with appropriate Tariff Rate.

c. For aeromedical evacuation movement on mixed aeromedical evacuation/channel missions, when a Patient Support Pallet (PSP) (standard 463L pallet) is used for patient movement, the overseas/international charge will be billed at the minimum 2.5 ton/pallet rate for the given route. The pallet space rate will be calculated based on the channel routing's 5th weight break cargo rate, multiplied by 5,000 pounds. This is the per pallet space rate. If cancellation of pallet space "precludes" the port from loading cargo, the bill payer will be charged for that space.

Example: RMS - CHS \$7,245 per pallet space (\$1.449/lb x 5,000lbs)

d. Urgent or Priority Transportation. If aeromedical transportation is required on a special assignment mission (that is, urgent or priority), the tariffs prescribed for Special Assignment Airlift Missions hourly tariff rates will apply.

3. Computation of Charges for US. Government-DoD Passenger and Cargo offered, but not included in rate tables attached. For non-forecasted channel service not shown:

a. For passenger, obtain the nautical mileage between points where transportation is to be furnished and multiply the mileage by \$0.270999 for passenger fare. Round passenger fare to the next whole dollar – minimum tariff is \$25.

b. For the cargo, see ATCH 2: FY06 Zone List and ATCH 3: FY06 Channel Cargo Regional Rates. To compute cargo rate, multiply the zone to zone rate by the following multiplier:

Shipment Size	Multipliers
1-439 pounds	1.245486580
440-1099 pounds	1.120029330
1100-2199 pounds	0.997474320
2200-3599 pounds	0.870546487
3600 pounds and over	0.766457140

4. Rates may be obtained by request to HQ USTRANSCOM/J8-BT at DSN 779-1126 or 779-1128 or e-mail to USTC-RATES@ustranscom.mil.

Appendix 3-GATES Original Data Set

TCN	APOE	APOD	APODCor	Country	Project	CONSIGNEE	CONSIGNOR	TP	Pieces	Weight	Cube1	RDD
W91XP532104001XXX	KWI	DOV	C	KU	ARI	W31G1Z	W91PAM	3	1	170	30	
W31G1Z3273X001XXX	KWI	DOV	C	KU	GEN	W31G1Z	W91YLD	1	1	1640	94	999
W90U1J30481002AXX	KWI	DOV	C	KU	GEN	W31G1Z	W81PLY	1	1	600	23	999
W31G1Z3277X001XXX	KWI	DOV	C	KU	GEN	W31G1Z	W91YS0	1	1	300	22	999
W55XGG32635023XXX	KWI	DOV	C	KU	9GN	W45G19	W91P9H	2	1	4385	180	
W91S2P32450610AXX	KWI	DOV	C	KU	GEN	W45G19	W91PAM	2	1	1650	344	
W81Y1C22365010XXX	KWI	DOV	C	KU	ARI	W45G19	W55XGJ	3	1	3520	105	
FB48043277X008XXX	IUD	DOV	C	QA		W45G19	FB4804	1	1	2450	78	999
W31G1Z3288X001XXX	KWI	WRI	C	KU		W31G1Z	W91YS0	3	1	110	6	
W55XGH3287X001XXX	KWI	WRI	C	KU	GEN	W31G1Z	W33RPV	2	1	260	25	
W91QSU32050089XXX	KWI	DOV	C	KU	9GN	W45G19	W91P9H	2	1	3529	110	
W58H0Z3259Z396XXX	KWI	DOV	C	KU	ARI	SW3227	W91PAM	3	1	330	31	
W91XP532081005XXX	KWI	DOV	C	KU	GEN	W45G19	W91PAM	3	1	375	35	
W58H0Z3295Z371XXX	KWI	DOV	C	KU		SW3227	W91PAM	1	1	320	22	
W45H0Z3272Z363XXX	KWI	DOV	C	KU	ARI	SW3227	W91PAM	3	1	1490	69	
W58H0Z3258Z360XXX	KWI	DOV	C	KU	ARI	SW3227	W91PAM	3	1	930	160	
W91DXY31980052ZXX	IUD	DOV	C	QA	OEF	W45G19	W91DXY	1	1	270	182	
W902P432384000XCX	IUD	DOV	C	QA		W45G19	FB4804	1	1	3155	99	777
W902P432384000XZX	IUD	DOV	C	QA		W45G19	FB4804	1	1	3155	99	777
W902P432384000XAX	IUD	DOV	C	QA		W45G19	FB4804	1	1	3155	99	777
W902P432384000XBX	IUD	DOV	C	QA		W45G19	FB4804	1	1	3155	99	777
W58H0Z3260Z324DXX	KWI	DOV	C	KU	ARI	SW3227	W91PAM	3	1	560	44	
W58H0Z3260Z324CXX	KWI	DOV	C	KU	ARI	SW3227	W91PAM	3	1	560	44	
W58H0Z3254Z393XEX	KWI	DOV	C	KU	ARI	SW3227	W91PAM	3	1	560	36	
W58H0Z3260Z324CXX	KWI	DOV	C	KU	ARI	SW3227	W91PAM	3	1	560	36	
W91XP532081004XXX	KWI	DOV	C	KU	ARI	W45G19	W91PAM	3	1	560	36	
W58H0Z3260Z324AXX	KWI	DOV	C	KU	ARI	SW3227	W91PAM	3	1	560	44	
W58H0Z3260Z324BXX	KWI	DOV	C	KU	ARI	SW3227	W91PAM	3	1	560	44	
W91TBQ32510016XXX	KWI	DOV	C	KU		W31G1Z	W91P9H	2	1	7980	250	999
W91TW232520002XXX	KWI	DOV	C	KU		W31G1Z	W91P9H	2	1	7810	250	999
W91YWG32190006XXX	KWI	DOV	C	KU		W31G1Z	W91P9H	2	1	7880	250	999
W9102732340006XXX	KWI	DOV	C	KU		W31G1Z	W91P9H	2	1	7950	250	999
W91P9H32690041XXX	KWI	DOV	C	KU		W31G1Z	W91P9H	2	1	8000	250	999
W91X2132523006XXX	KWI	DOV	C	KU	ARI	W45G19	W91PAM	3	2	980	120	
W91VDT32463099XXX	KWI	DOV	C	KU	9GN	W31G1Z	W91P9H	2	1	5600	168	
W91YWG32530010XXX	KWI	DOV	C	KU	9GN	W31G1Z	W91P9H	2	1	4965	214	
W58H0Z3280Z315XXX	KWI	DOV	C	KU		SW3227	W91PAM	1	1	860	106	
W91P9H32690041XAX	KWI	DOV	C	KU		W31G1Z	W91P9H	2	1	7700	250	999
W91YWG32080082XXX	KWI	DOV	C	KU	9GN	W45G19	W91P9H	2	1	5640	140	
W91XZ232590014XXX	KWI	DOV	C	KU	9GN	W45G19	W91P9H	2	1	5475	237	
W91UVQ31720005XXX	KWI	DOV	C	KU	9GN	W45G19	W91P9H	2	1	4335	347	
W91RXD31920511XXX	KWI	DOV	C	KU	9GN	W45G19	W91P9H	2	1	5425	358	

GATES Retrograde Air Transportation Data (Original) (USTRANSCOM J5, 2006)

Appendix 4-DOD Channel Traffic Passenger and Cargo Rates

Department of Defense Channel Tariffs
Passenger and Cargo Rates By Channel
 Effective: 01 Oct 2005 to 30 Sep 2006

To/From Station	Passenger Rate		Cargo Rates (Cents Per Pound)							Effective Date	TP4 Rates		
	Pax Rate (Dollars)	Effective Date	Zone to Zone	0 to 439 LBS	440 to 1099 LBS	1100 to 2199 LBS	2200 to 3599 LBS	Above 3600 LBS	Zone to Zone		TP4 Rate Dollars/ Cu Ft	TP4 HHG Dollars/ Hundred-Weight	
DOVER AFB DE (DOV) - Zone 01													
CAIRO EAST EG (CAI)	1,353	01 OCT	01 - 09	296.4	288.6	237.4	207.2	182.4	01 OCT	01 - 09	2.02	33.72	01 OCT
CAIRO WEST EG (CWE)	1,348	01 OCT	01 - 09	296.4	288.6	237.4	207.2	182.4	01 OCT				
CIGLI TK (IGL)	1,221	01 OCT	01 - 09	296.4	288.6	237.4	207.2	182.4	01 OCT	01 - 09	2.02	33.72	01 OCT
DJIBOUTI DJIBOUTI (JIB)	1,992	01 OCT	01 - 12	675.1	607.1	540.6	471.8	415.4	01 OCT				
DOHA INTL (DOH)	1,611	01 OCT	01 - 09	296.4	288.6	237.4	207.2	182.4	01 OCT				
JACOBABAD (JAG)	1,706	01 OCT	01 - 11	352.5	317.0	282.3	248.4	216.9	01 OCT				
KANDAHAR AF (KDH)	1,643	01 OCT	01 - 18	652.6	588.9	522.7	458.2	401.6	01 OCT				
KARSHI KSRSHI UZ (KSQ)	922	01 OCT	01 - 14	501.9	451.4	402.0	350.8	308.9	01 OCT				
KIRKUK (KIK)	1,419	01 OCT	01 - 17	279.0	250.9	223.4	195.0	171.7	01 OCT				
KUWAIT CITY KUWAIT (KWI)	1,817	01 OCT	01 - 17	279.0	250.9	223.4	195.0	171.7	01 OCT	01 - 17	2.36	39.32	01 OCT
LAJES FIELD AS (LGS)	806	01 OCT	01 - 06	235.4	211.7	188.5	164.5	144.9	01 OCT				
MANAS BISHKEK KG (FRU)	1,404	01 OCT	01 - 14	501.9	451.4	402.0	350.8	308.9	01 OCT				
MASIRAH OMAN (MSH)	1,736	01 OCT	01 - 09	296.4	288.6	237.4	207.2	182.4	01 OCT				
MILDENHALL UK (MHZ)	507	01 OCT	01 - 06	235.4	211.7	188.5	164.5	144.9	01 OCT	01 - 06	1.37	22.92	01 OCT

Date/Time Prepared: 11/02/2006 - 15:50:18

Notes: 1. Direct service is not available between all points for which a rate is published.
 2. See instruction section III prior to quoting cargo/passenger baggage rates.
 3. TP-4 rates are subject to the availability and allocation of space.
 4. TP4 HHG rates are quoted in hundred-weight to facilitate computation of cash charges for overweight shipments.

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DOD Channel Tariff Passenger and Cargo Rates by Channel (DOD Airlift Rate Instructions, 2006:20)

Appendix 5-DOD FY06 Channel Cargo Regional Rates

FY06 Channel Cargo Regional Rates (Average Rate/lb)																		
ZONE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	-	\$ 4.150	\$ 1.210	\$ 3.160	\$ 2.630	\$ 1.890	\$ 3.940	\$ 4.030	\$ 2.380	\$ 2.210	\$ 2.830	\$ 5.420	\$ 2.225	\$ 4.030	\$ 2.710	\$ 2.750	\$ 2.240	\$ 5.243
2	\$ 4.150	\$ 1.710	\$ 1.210	\$ 3.160	\$ 2.630	\$ 1.890	\$ 3.160	\$ 4.030	\$ 2.380	\$ 2.710	\$ 2.380	\$ 3.080	\$ 2.225	\$ 4.030	\$ 2.710	\$ 2.750	\$ 2.800	\$ 6.425
3	\$ 1.210	\$ 1.210	\$ 2.830	\$ 2.920	\$ 2.470	\$ 2.470	\$ 2.470	\$ 2.470	\$ 4.130	\$ 3.310	\$ 4.130	\$ 5.460	\$ 4.290	\$ 5.780	\$ 4.420	\$ 4.290	\$ 6.160	\$ 14.200
4	\$ 3.160	\$ 3.160	\$ 2.920	\$ 4.070	\$ 3.090	\$ 3.090	\$ 3.090	\$ 3.090	\$ 5.460	\$ 3.310	\$ 5.460	\$ 6.160	\$ 5.460	\$ 14.200	\$ 5.460	\$ 5.460	\$ 7.460	\$ 14.200
5	\$ 2.630	\$ 2.630	\$ 2.470	\$ 3.090	\$ 1.170	\$ 2.450	\$ 3.460	\$ 3.460	\$ 3.090	\$ 2.680	\$ 3.090	\$ 3.090	\$ 3.090	\$ 3.460	\$ 3.460	\$ 3.090	\$ 3.090	\$ 8.880
6	\$ 1.890	\$ 1.890	\$ 2.470	\$ 3.090	\$ 2.450	\$ 1.170	\$ 2.450	\$ 2.450	\$ 2.920	\$ 1.170	\$ 3.610	\$ 4.850	\$ 3.610	\$ 5.130	\$ 3.460	\$ 3.610	\$ 3.310	\$ 5.310
7	\$ 3.940	\$ 3.160	\$ 2.470	\$ 3.090	\$ 3.460	\$ 2.450	\$ 3.460	\$ 3.460	\$ 3.090	\$ 3.090	\$ 3.090	\$ 3.090	\$ 3.090	\$ 3.460	\$ 3.460	\$ 3.090	\$ 3.090	\$ 7.460
8	\$ 4.030	\$ 4.030	\$ 2.470	\$ 3.090	\$ 3.460	\$ 2.450	\$ 3.460	\$ 3.460	\$ 3.090	\$ 3.090	\$ 3.090	\$ 3.090	\$ 3.090	\$ 3.460	\$ 3.460	\$ 3.090	\$ 3.090	\$ 8.150
9	\$ 2.380	\$ 2.380	\$ 4.130	\$ 5.460	\$ 3.090	\$ 2.920	\$ 3.090	\$ 3.090	\$ 1.310	\$ 4.150	\$ 3.310	\$ 14.200	\$ 3.620	\$ 6.760	\$ 4.420	\$ 4.000	\$ 1.950	\$ 6.120
10	\$ 2.210	\$ 2.710	\$ 3.310	\$ 3.310	\$ 2.680	\$ 1.170	\$ 3.090	\$ 3.090	\$ 4.180	\$ 3.910	\$ 1.540	\$ 2.200	\$ 3.310	\$ 5.980	\$ 2.920	\$ 1.540	\$ 4.070	\$ 7.010
11	\$ 2.830	\$ 2.380	\$ 4.130	\$ 5.460	\$ 3.090	\$ 3.610	\$ 3.090	\$ 3.090	\$ 3.310	\$ 1.540	\$ 1.540	\$ 3.390	\$ 1.540	\$ 3.090	\$ 3.390	\$ 1.540	\$ 3.620	\$ 5.870
12	\$ 5.420	\$ 3.080	\$ 5.460	\$ 6.160	\$ 3.090	\$ 4.850	\$ 3.090	\$ 3.090	\$ 14.200	\$ 2.200	\$ 3.390	\$ 3.620	\$ 4.180	\$ 8.680	\$ 3.310	\$ 3.390	\$ 4.420	\$ 8.880
13	\$ 2.225	\$ 2.225	\$ 4.290	\$ 5.460	\$ 3.090	\$ 3.610	\$ 3.090	\$ 3.090	\$ 3.620	\$ 3.310	\$ 1.540	\$ 4.180	\$ 1.540	\$ 7.550	\$ 3.390	\$ 1.540	\$ 5.460	\$ 5.870
14	\$ 4.030	\$ 4.030	\$ 5.780	\$ 14.200	\$ 3.460	\$ 5.130	\$ 3.460	\$ 3.460	\$ 6.760	\$ 5.980	\$ 3.090	\$ 8.680	\$ 7.550	\$ 3.090	\$ 5.980	\$ 7.550	\$ 8.680	\$ 3.090
15	\$ 2.710	\$ 2.710	\$ 4.420	\$ 5.460	\$ 3.460	\$ 3.460	\$ 3.460	\$ 3.460	\$ 4.420	\$ 2.920	\$ 3.390	\$ 3.310	\$ 3.390	\$ 5.980	\$ 1.950	\$ 3.390	\$ 6.160	\$ 7.010
16	\$ 2.750	\$ 2.750	\$ 4.290	\$ 5.460	\$ 3.090	\$ 3.610	\$ 3.090	\$ 3.090	\$ 4.000	\$ 1.540	\$ 1.540	\$ 3.390	\$ 1.540	\$ 7.550	\$ 3.390	\$ 1.540	\$ 5.460	\$ 5.870
17	\$ 2.240	\$ 2.800	\$ 6.160	\$ 7.460	\$ 3.090	\$ 3.310	\$ 3.090	\$ 3.090	\$ 1.950	\$ 4.070	\$ 3.620	\$ 4.420	\$ 5.460	\$ 8.680	\$ 6.160	\$ 5.460	\$ 1.950	\$ 6.120
18	\$ 5.243	\$ 6.425	\$ 14.200	\$ 14.200	\$ 8.680	\$ 5.310	\$ 7.460	\$ 8.150	\$ 6.120	\$ 7.010	\$ 5.870	\$ 8.680	\$ 5.870	\$ 3.090	\$ 7.010	\$ 5.870	\$ 6.120	\$ 6.120

DOD FY06 Channel Cargo Regional Rates (DOD Airlift Rate Instructions, 2006:56)

Appendix 6-Project 9GN Code Cost Comparison

Project Code w/o Flat Rate													
W911THB52760505XXX	10/3/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5620	\$9,648.78		
W91QCR52760002XXX	10/3/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5785	\$9,932.06		
W91P9H52800161XXX	10/7/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5670	\$9,734.62		
W91P9H52800167XXX	10/7/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5860	\$10,060.82		
W91P9H52830094XXX	10/10/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5830	\$10,009.32		
W91P9H52830088XXX	10/10/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5830	\$10,009.32		
W91P9H52830090XXX	10/10/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5840	\$10,026.49		
W91P9H52840710XXX	10/11/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5770	\$9,906.31		
W91P9H52840705XXX	10/11/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5790	\$9,940.64		
W91P9H52840626XXX	10/11/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5790	\$9,940.64		
W91P9H52840717XXX	10/11/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5830	\$10,009.32		
W918JT52859012XXX	10/12/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	3670	\$6,300.89		
W91P9H52850169XXX	10/12/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5840	\$10,026.49		
W91J3L52908003XXX	10/17/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5860	\$10,060.82		
W91ESV52920003XXX	10/19/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5840	\$10,026.49		
W91J3L52958003XXX	10/22/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	4500	\$7,725.89		
W91DWQ52969026XXX	10/23/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5820	\$9,992.15		
W91GMR52960003XXX	10/23/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5990	\$10,284.02		
W91GMR52990002XXX	10/26/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	6615	\$11,357.06		
W91ESR53050002XXX	11/1/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5795	\$9,949.23		
W91DW253089004XXX	11/4/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	6815	\$11,700.43		
W91QCR53110001XXX	11/7/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5795	\$9,949.23		
W91ESR53340003XXX	11/30/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5850	\$10,043.65		
W91GMR53370007XXX	12/3/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5860	\$10,060.82		
W91GMR53370006XXX	12/3/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5950	\$10,215.34		
W91DVU53419000XXX	12/8/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5860	\$10,060.82		
W91ZKW53420091XXX	12/9/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5850	\$10,043.65		
W91QCR53430001XXX	12/13/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	6130	\$10,524.38		
W91C3853478000XXX	12/20/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5790	\$9,940.64		
W91J3L52958003XXX	12/26/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5835	\$10,017.90		
W91GMR53600001XXX	12/26/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5785	\$9,932.06		
W91P9H53620228XXX	12/28/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5885	\$10,103.74		
W91P9H53630157XXX	12/29/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5125	\$8,798.93		
W91P9H53630183XXX	12/29/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5805	\$9,966.40		
W91P9H53630161XXX	12/29/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5875	\$10,086.58		
W91VS962150933XXX	8/4/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	5760	\$9,889.14		
W91VS962160936XXX	8/11/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	5870	\$10,077.99		
W91J3T62230038XXX	8/13/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	2865	\$5,586.82		
W91C4P62250001XXX	8/21/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	2865	\$5,586.82		
W91XV762330002AXX	8/21/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	2935	\$5,723.32		
W91XV762330002XXX	8/24/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	2935	\$5,723.32		
W91P9H62360022XXX	8/24/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	4010	\$6,884.62		
W91P9H62360024XXX	8/24/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	4195	\$7,202.24		

Project Code w/Flat Rate													
												Total	\$769,935.06
W911THB52760505XXX	10/3/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5620	\$15,076.21	140	
W91QCR52760002XXX	10/3/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5785	\$15,518.84	140	
W91P9H52800161XXX	10/7/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5670	\$15,210.34	140	
W91P9H52800167XXX	10/7/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5860	\$15,720.04	140	
W91P9H52830094XXX	10/10/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5830	\$15,639.56	140	
W91P9H52830088XXX	10/10/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5830	\$15,639.56	140	
W91P9H52830090XXX	10/10/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5840	\$15,666.38	140	
W91P9H52840710XXX	10/11/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5770	\$15,478.60	140	
W91P9H52840705XXX	10/11/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5790	\$15,532.25	140	
W91P9H52840626XXX	10/11/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5790	\$15,532.25	140	
W91P9H52840717XXX	10/11/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5830	\$15,639.56	140	
W918JT52859012XXX	10/12/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	3670	\$9,845.14	140	
W91P9H52850169XXX	10/12/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5840	\$15,666.38	140	
W91J3L52908003XXX	10/17/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5860	\$15,720.04	140	
W91ESV52920003XXX	10/19/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5840	\$15,666.38	140	
W91J3L52958003XXX	10/22/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	4500	\$12,071.70	140	
W91DWQ52969026XXX	10/23/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5820	\$15,612.73	140	
W91GMR52960003XXX	10/23/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	2	5990	\$16,068.77	140	
W91GMR52990002XXX	10/26/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	6615	\$17,745.40	140	
W91ESR53050002XXX	11/1/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5795	\$15,545.67	140	
W91DW253089004XXX	11/4/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	6815	\$18,281.92	140	
W91QCR53110001XXX	11/7/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5795	\$15,545.67	140	
W91ESR53340003XXX	11/30/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5850	\$15,693.21	140	
W91GMR53370007XXX	12/3/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5860	\$15,720.04	140	
W91GMR53370006XXX	12/3/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5950	\$15,961.47	140	
W91DVU53419000XXX	12/7/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5860	\$15,720.04	140	
W91ZKW53420091XXX	12/8/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5850	\$15,693.21	140	
W91QCR53430001XXX	12/9/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	6130	\$16,444.34	140	
W91C3853478000XXX	12/13/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5790	\$15,532.25	140	
W91J3L52958003XXX	12/20/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5835	\$15,652.97	140	
W91GMR53600001XXX	12/26/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5785	\$15,518.84	140	
W91P9H53620228XXX	12/28/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5885	\$15,787.10	140	
W91P9H53630157XXX	12/29/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5125	\$13,748.32	140	
W91P9H53630183XXX	12/29/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5805	\$15,572.49	140	
W91P9H53630161XXX	12/29/2005	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	1	1	5875	\$15,760.27	140	
W91VS962150933XXX	8/3/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	5760	\$15,451.78	70	
W91VS962160936XXX	8/4/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	5870	\$15,746.86	70	
W91J3T62230038XXX	8/11/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	2865	\$8,729.40	60	
W91C4P62250001XXX	8/13/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	2865	\$8,729.40	60	
W91XV762330002AXX	8/21/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	2935	\$8,942.69	60	
W91XV762330002XXX	8/21/2006	KWI	Dover	KU	9GN	Red River	Camp Arifjan KU	2	1	2935	\$8,942.69	60	

Appendix 7-SDDC Baseline Class 100A Rates

ITEM 50 (C)

BASELINE CLASS 100 RATES IN CENTS PER HUNDRED POUNDS

*To use table below, follow this example: An FAK shipment weighing 2,639 lbs. at a distance of 362 miles, would fall into weight bracket (2000-4999) and mileage bracket (351-374) resulting in a baseline rate of 1308 cents per hundred pounds (cwt). The carrier's rates are published in Section E, Table D, of the tender as a percentage of class, e.g., 47 percent. This indicates that the carrier is offering to move this shipment at a rate which is 47 percent of the applicable baseline rate. Using these shipment parameters, CFM automatically calculates the charges as follows:

$$1308 \text{ cwt} \times .47 (\%) = 615 \text{ (614.76 rounded)} \times 26.39 \text{ (2639 lbs./100)} = \$162.30 \text{ (16229.85/100 rounded)}$$

Mileage Base	Minimum Charge	Minimum Weights								
		0 to 499	500 to 999	1000 to 1999	2000 to 4999	5000 to 9999	10000 to 19999	20000 to 29999	30000 to 39999	40000 and Over
0-50	\$36.00	1179	943	802	696	607	519	466	407	383
51-75	\$36.00	1284	1028	873	758	661	565	507	444	417
76-100	\$36.00	1373	1098	933	810	707	604	542	474	446
101-125	\$36.00	1536	1229	1044	906	791	621	557	487	458
126-150	\$36.00	1596	1277	1085	942	822	646	579	507	477
151-175	\$36.00	1680	1344	1142	991	865	680	610	534	502
176-200	\$36.00	1819	1455	1237	1073	937	736	660	578	543
201-225	\$36.00	1895	1516	1289	1118	976	833	747	654	615
226-250	\$36.00	1956	1565	1330	1154	1007	860	771	675	635
251-275	\$36.00	2003	1603	1362	1182	1032	881	790	692	650
276-300	\$36.00	2049	1639	1393	1209	1055	901	808	707	665
301-325	\$36.00	2135	1708	1452	1259	1099	939	842	737	693
326-350	\$36.00	2177	1741	1480	1284	1121	958	859	752	707
351-375	\$36.00	2217	1773	1507	1308	1142	975	875	765	720
376-400	\$39.00	2364	1891	1607	1395	1217	1040	933	816	768
401-425	\$39.00	2443	1954	1661	1441	1258	1075	964	844	793
426-450	\$39.00	2483	1986	1688	1465	1279	1093	980	858	807
451-475	\$39.00	2520	2016	1714	1487	1298	1110	996	871	819
476-500	\$42.00	2558	2046	1739	1509	1317	1126	1010	884	831

**This paragraph added for clarity March 10, 1998*

ISSUED: April 15, 1989

EFFECTIVE: June 15, 1989

Headquarters
Military Surface Deployment &
Distribution Command
Fort Eustis, Virginia 23604-1644

Table 6: Baseline Class 100 Rates in Cents per Hundred Pounds (HQ SDDC Distribution Command Operations Center, 2007:19)

Appendix 8-ABF Online Quote

	LTL Rate Quotation Effective Date: 21-FEB-2007 Expiration Date: 23-MAR-2007		Quotation ID: OGY2840527
Total Charge	\$6,406.87	[Pickup] [Bill of Lading]	
Transit Time	4 Days	Excludes Saturday, Sunday and holidays.	
Need it there sooner? Try our guaranteed TimeKeeper® service.			
Shipper		Account#	000000 0000
Origin	BRIAR PARK, DE 19901	Term#	284 DIRECT
Consignee		Account#	000000 0000
Destination	TEXARKANA, TX 75504	Term#	005 DIRECT

Description	Class	Lbs.	Rate	U.S. Dollars
CHARGES BASED ON SUPPLIED NMFC CLASS	CL100	5760	9285	\$5,348.16
/ LIMITED ACCESS PICKUP MILITARY SITE		LAPM	MAX	\$213.70
/ SINGLE SHIPMENT		SS	N/A	
/ FUEL SURCHARGE		FSC	15.8%	\$845.01
Totals (cash customer):		5760		\$6,406.87

Rate Tariff: **ABF504**

Payment Terms: **Prepaid** | HHG Miles: **1,219** | Cubic Feet: **60**

Guaranteed Transit Options	Charges	Pickup Date	Delivery Date/Time*
 [See Quote Details] TimeKeeper® includes a 100% satisfaction guarantee. Just write "TimeKeeper Delivery by 02-26-07 by 5:00 PM " to secure this service.	\$9,193.80 [Book]	Wed, 21-FEB-2007	By Mon, 26-FEB-2007 By 5:00 PM
 [See Quote Details] TimeKeeper® includes a 100% satisfaction guarantee. Just write "TimeKeeper Delivery by 02-27-07 by 12:00 PM" to secure this service.	\$9,069.93 [Book]	Wed, 21-FEB-2007	By Tue, 27-FEB-2007 By 12:00 PM
 [See Quote Details] TimeKeeper® includes a 100% satisfaction guarantee. Just write "TimeKeeper Delivery by 02-27-07 by 5:00 PM " to secure this service.	\$8,264.82 [Book]	Wed, 21-FEB-2007	By Tue, 27-FEB-2007 By 5:00 PM
 [Quote] Provides guaranteed delivery on the date you select. TimeKeeper® includes a 100% satisfaction guarantee.	800-874-2061		

Origin	
Country*:	☒ United States ☐ Canada ☐ Mexico
Zip Code*:	19901 OR City: BRIAR PARK DELAWARE
☐ I will bring the shipment to the serving ABF origin terminal.	

Destination	
Country*:	☒ United States ☐ Canada ☐ Mexico
Zip Code*:	75504 OR City: TEXARKANA TEXAS
☐ I will pickup the shipment at the serving ABF destination terminal.	

Shipment Specifics	
Pickup Date*:	2007 , Feb , 21 Wed
Load/Unload Options: Shipper Load -- Consignee Unload --	
Total Dimensions: Length: ft Width: ft Height: ft	
OR Cube: 60 cubic feet [Cube Calculator]	

Commodities	
☒ Provide a quote for the specified shipment. ☐ Provide a rate line for each class selected (weights will be ignored). ☐ Provide a rate line for all classes.	
Handling Units: # of type Packages: # of type Weight*: 5760 (lbs) Class*: 100 NMFC: Item Sub Haz: ☐	(e.g. 2 pallets of 50 total cartons) Description:
+ More Commodities	

Additional Service Options	
Pickup Options ☐ Liftgate-Ground Pickup ☐ Inside Pickup ☒ Limited Access Pickup Military Site ☐ Residential Pickup	Other Options ☐ Arrival Notification ☐ Capacity Load ☐ COD (collect for goods) ☐ Excess Liability Charge ☐ Over-Dimension ☒ Single Shipment ☐ Sort & Segregate / Special Handling
Delivery Options ☐ Construction Site Delivery ☐ Liftgate-Ground Delivery	

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Vita

Senior Master Sergeant William L. Jackson, Jr, is a native of Los Angeles, California but he spent most of his childhood in Jackson, Mississippi. Sgt. Jackson graduated from Provine High School and entered the United States Air Force Reserve (USAFR) in October 1987 in the delayed enlisted program. During his time in the AF Reserve, he was assigned to the 41st Mobile Aerial Port Squadron at Keeler Air Force, Mississippi and the 25th Mobile Aerial Port Squadron at Maxwell Air Force Base, Alabama. In June 1989, Sgt. Jackson separated from the USAFR and entered active duty. Sgt. Jackson earned his Bachelor's Degree in Professional Aeronautics from Embry-Riddle Aeronautical University in 2003.

His first active duty assignment was at Scott Air Force as an aircraft services specialist in the 375th Transportation Squadron. Other assignments include Andersen Air Force, Guam; McChord Air Force, Washington; Dhahran AB, Kingdom of Saudi Arabia; Charleston Air Force Base, South Carolina; Ramstein Air Base, Germany and Shaw Air Force, South Carolina. In August 2005, Sgt. Jackson entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation, he will be assigned to Headquarters Air Force, Directorate of Logistics Readiness, the Pentagon, Washington, DC.

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Last year, Congress approved \$17.1 billion dollars, an increase of \$4 billion dollars more than originally was requested by the Bush Administration, for US Army vehicles to be repaired or replaced (commonly referred to as reset) as a result of military operations in Iraq and Afghanistan. A large portion of the repair workload falls upon the Army depots in Anniston and Red River in Texas, and must rely on the DOD transportation system for air and surface movement of retrograde cargo deemed serviceable and unserviceable to fill requisitions and backorders for entry into the national supply inventory. Headquarters Air Mobility Command developed an initiative for distribution to the US Central Command to allow supply requisition shipments to accumulate based on customer defined delivery timelines to a single unit destination to eliminate the need of mixed destinations on a single pallet, thereby avoiding intermediate handling and increase in-transit visibility. This research viewed of the depot and the item managers as the customers due to the value they collectively add in equipment repairs and how retrograde is directed to meet the needs of the end user. Subject matter experts from Army Materiel Command provided their inputs through a series of focused interviews to calculate their value placed on transportation system and convergence with a cost comparison of the accumulation principles of the AMC pure pallet program. The results indicated that the AMC pure pallet program was not a viable option due to conflicts with customer requirements, high variability in the volume of retrograde generated to successfully utilize this option despite the savings in using consolidated shipments.					
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					(937) 255-6565, ext 4283; e-mail: william.cunningham@afit.edu
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