AFIT/GIR/LAR/93D-10

BUSINESS PROCESS IMPROVEMENT APPLIED TO WRITTEN TEMPORARY DUTY TRAVEL ORDERS WITHIN THE UNITED STATES AIR FORCE

THESIS

Presented to the Faculty of the School of Logistics and
Acquisition Management of the
Air Force Institute of Technology
Air University
in Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Information Resources Management

Philip W. McDowell, M.S.
Major, USAF

David W. Morgan, B.A.
Captain, USAF

December 1993

AFIT/GLM/LAL/93S-1

BENCHMARKING PRACTICES OF AIR CARGO CARRIERS: A CASE STUDY APPROACH

THESIS

Mila D. Abalateo, Captain, USAF
Joni R. Lee, Captain, USAF

AFIT/GLM/LAL/93S-1

Approved for public release; distribution unlimited

The views expressed in this thesis are those of the authors and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

Acknowledgements

We would like to thank our advisors, Major Judy A. Ford and Professor Terence H. Berle, for their enthusiasm, guidance, and support during this research effort. Also, special thanks to Lieutenant Colonel Robert R. Edwards of the DOD Air Carrier Survey and Analysis Office at HQ AMC. His efforts in helping us contact sponsors and air cargo carriers were invaluable. In addition, we are indebted to Colonel Michael R. Engel and Major Mitchell O. Everhart at HQ AMC's Aerial Port Operations Division for sponsoring our research and participating in our investigative study. Although we regret we cannot mention every individual, we are also grateful to several people at UPS, FedEx, Emery, Airborne, DHL, Burlington, and the 436th APS at Dover AFB for their cooperation and participation in our study.

Our fellow "transporters" in the 93-S AFIT program deserve recognition for their help in the pretest of our interview questions and their continued support during our entire AFIT experience. Also, we owe many thanks to two other AFIT faculty members, Major Robert E. Pappas and Dr. Craig M. Brandt, who took time away from their busy schedules to review and edit our thesis drafts. Finally, completion of this thesis would not have been possible without the love and support of our families and friends. A simple "thank you" is not enough to express our gratitude.

Table of Contents

List of Tables

Abstract

This research effort used the benchmarking process and a case study methodology to determine what the Air Force can learn from commercial air cargo carriers. A literature search showed that the U.S. air cargo industry leaders are United Parcel Service, Federal Express, Emery Air Freight, Airborne Freight, DHL Airways, and Burlington Air Express. In addition, the 436th Aerial Port Squadron at Dover AFB, Delaware was chosen as the Air Force representative in the benchmarking study.

Observations of air cargo operations and interviews with operational managers or applicable experts familiar with air cargo operations were conducted at each carrier's hub and at Dover AFB. Observations identified that the Air Force can learn from the commercial air cargo carriers in four areas: cargo handling equipment, intransit visibility, operations interface, and safety. Observations and responses to interviews revealed disparities between the mission of the Air Force and the goals of the industry leaders. Therefore, a majority of the industry leaders' practices during surge periods cannot effectively be applied to the Air Force.

BENCHMARKING PRACTICES OF AIR CARGO CARRIERS: A CASE STUDY APPROACH

I. Introduction

Background

Changes in the past four years have turned our national focus from one of a global threat and a containment strategy to one of regional challenges and a new Regional Defense Strategy (19:1). However, the end of the Cold War and the break up of the Soviet Union have not eliminated the need for trained and ready Armed Forces. In fact, our Armed Forces have been busier than ever in this rapidly changing world (71:v).

> ... American troops have been committed in over two dozen crises, ranging from armed conflict in Panama and the Persian Gulf to peacekeeping and humanitarian assistance missions in several parts of the world, and to disaster relief operations at home and abroad. (19:v)

Because of the ongoing defense needs and the change in national defense strategy, the Department of Defense is undergoing many changes.

The change from a global to a regional strategy, compounded by smaller budgets for Defense, has led to a reduced number of forces and an increased reliance on strategic mobility. Troop drawdowns and base closures are already a reality. General Colin L. Powell, Chairman of the

Joint Chiefs of Staff, has proposed a "Base Force" below which the Armed Forces cannot go.

> This Base Force must be prepared to meet demands throughout a spectrum of environments from peace through the occurrence of multiple regional crises. (72:17)

An important part of the Base Force is the ability to reconstitute forces such as reserve units and to call on the industrial base.

Similar to the Base Force is an idea dubbed "Option C". Option C is actually one option listed in, "An Approach to Sizing American Conventional Forces For the Post-Soviet Era," a white paper written by Les Aspin and released in February 1992 while he was serving as Chairman of the House Armed Services Committee (48:42). Option C assumes a strategy that could respond to a major regional conflict such as Operation DESERT STORM, another Operation DESERT STORM equivalent's worth of strike air power for a second contingency such as Korea, and an extra aircraft carrier and enough forces to respond to a small regional conflict the size of Operation JUST CAUSE in Panama (48:44).

While Aspin's Option C calls for a military force considerably smaller than Powell's "Base Force", both are consistent with a multi-region defense strategy with smaller numbers of forces. "Our new regional focus, combined with major reductions in overseas troop levels, puts enormous emphasis on strategic mobility" (71:vii).

A major part of strategic mobility is military airlift. The closure of Air Force bases means there are fewer aerial ports of embarkation (APOEs). Of course, these base closures were made as a result of our new regional strategy and as a way to be more efficient in peacetime. In fact, General Powell notes that

> Many steps have been taken--some with little public notice--to respond to the rapidly changing world and to improve both effectiveness and efficiency. (71:vi)

To continue our peacetime and wartime efficiency and effectiveness in a changing world of smaller budgets and fewer troops, it is important to find ways to continually improve. Continuous improvement efforts may come from internal sources, such as the Air Force learning from the Army, or from external sources. Since strategic airlift is critical during a contingency, we may be able to improve our handling of airlift cargo by studying what commercial air cargo companies do during their peak workloads (e.g. Christmas).

General Issue

During Operation DESERT SHIELD/STORM, it became evident that the amount of cargo airlifted exceeded the Air Force's capability to move the cargo to support the war effort. Today, though we are operating in a peacetime environment, the news headlines feature reports on humanitarian cargo airlifted to the former Yugoslavia and Somalia, emphasizing the importance of airlifting cargo in a peacetime

environment. In today's Air Force, small budgets, reductions in personnel, and the quest for efficiency have fostered an attitude of having to "do more with less." An improvement in air cargo handling operations would help to move cargo by air more efficiently and effectively.

This thesis focuses on how the Air Force can be more efficient in its cargo handling operations by identifying and Benchmarking the air cargo industry's best practices.

> Benchmarking is the continuous process of measuring products, services, and practices against the toughest competitors or those companies recognized as industry leaders. (14:10)
>
> Why benchmark?
>
> The essence of continuous improvement is constantly searching for ways to better your products, services, and processes. What better way for companies to improve than by sharing improvement information? (42:20)

Specific Problem

The purpose of this study is to identify ways the Air Force can improve its ability to balance the efficiency and effectiveness of air cargo operations during peacetime and wartime. This is accomplished by employing a case study methodology to benchmark the best practices of U.S. air cargo industry leaders during surges in workload to determine if these practices can be applied to the Air Force's air cargo operations during contingencies and exercises. Surge planning and cargo handling operations are the main focus.

Research Question

What can the Air Force learn from air cargo industry leaders to improve the peacetime and wartime efficiency and effectiveness of moving cargo through air freight terminals?

Investigative Questions

This research uses the benchmarking process to answer these investigative questions:

1. ***Who are the U.S. air cargo industry leaders?***
2. ***Can the air cargo industry leaders be categorized by the type of cargo handled?***
3. ***What can the Air Force learn from observing day-to-day operations of air cargo industry leaders?***
4. ***What are the differences between how the Air Force and air cargo industry leaders plan for surge periods of increased workload (e.g., contingencies, Christmas)?***
5. ***What are the differences between how the Air Force and air cargo industry leaders' cargo handling equipment and personnel requirements change to accommodate increased workloads?***
6. ***What are the differences between how the Air Force and air cargo industry leaders measure the effectiveness of their air cargo handling operations?***

Scope/Limitations of the Research

This research assumes there *is* a difference between how the Air Force and air cargo industry leaders plan and operate during surges in workload. Only air cargo carriers, not airlines that move both passengers and freight, are examined. Also, this study does not cover unit deployments nor the movement of hazardous cargo.

Only the cargo handling process within the terminal is studied. This research does not include the movement of cargo before its arrival at the air terminal or after it leaves the air cargo terminal.

There is not one air cargo carrier that is definitively identified as an industry leader; therefore, benchmarking from the one best is not possible. However, the techniques of the benchmarking process, to include gap analysis, are used in this research.

A case study approach is part of the research methodology; however, complete, in-depth case studies are not accomplished due to the number of companies studied. Only specific areas of each company are analyzed instead of the total company analyses typically used in case studies.

Definitions of Terms

The following definitions are used throughout this thesis:

Benchmarking, as used in this thesis, is defined as a *process* that measures and compares the Air Force's air cargo operations against top performers within the

civilian air cargo industry and then searches for industry best practices that lead to superior performance.

A *contingency plan* is "a plan for major contingencies which can reasonably be anticipated in the principal geographic subareas of the command" (24:86).

Effective means "producing a decided, decisive, or desired effect; producing or capable of producing a result" (89:359).

Efficiency means "effective operation as measured by a comparison of production with cost (as in energy, time, and money)" (89:359).

An *exercise* is "a military maneuver or simulated wartime operation involving planning, preparation, and execution. It is carried out for the purpose of training and evaluation. It may be a combined, joint, or single service exercise, depending on participating organizations" (24:137).

A *gap*, as used in this thesis, is defined as "differences in practices, especially when external operations are better" (14:122).

Intransit visibility, as used in this thesis, is defined as the ability to continuously track the whereabouts of any cargo in a carrier's (or the Air Force's) possession.

Mobility is "a quality or capability of military forces which permits them to move from place to place while

retaining the ability to fulfill their primary mission" (24:238).

Organizational Culture is "the pervasive system of values, beliefs, and norms that exist in any organization" (38:744).

Regional Hubs are airports that serve as the focal points for the origin and termination of long-distance flights in a particular area of the country. Flights from outlying areas are fed into the regional hub airports for connecting flights to the carrier's hub (22:516).

Surge means "to rise suddenly to an excessive or abnormal value" (89:1164). In the context of this thesis, a *surge* means an increase in workload beyond what is normally experienced on a daily basis.

Significance of Research

Any air cargo industry practices that surface in this research effort have the potential to be applied to the Air Force. Observations of the day-to-day operations of the air cargo industry, along with industry practices in surge planning and/or cargo handling during periods of increased workload, may provide an avenue to improve the Air Force's efficiency and effectiveness of air cargo operations during peacetime and wartime.

Summary

This chapter provides an overview of proposed research into how the Air Force can improve its efficiency and effectiveness in air cargo operations by using benchmarking as a tool in a case study approach. To set the foundation for the remainder of the thesis, Chapter II presents a review of recent literature on benchmarking concepts and their varied applications in business and the Air Force. A brief history of the air cargo industry is given along with an examination of statistics that rank the air cargo carriers. Surge planning in the Air Force is also examined. Chapter III covers the case study methodology used in observing and interviewing industry leaders and Air Force air cargo specialists. Chapter IV presents the findings and analysis of the investigative questions, the observations, and the interviews. Chapter V provides limitations of the study, conclusions, and recommendations.

II. Literature Review

Overview

To determine how the Air Force can improve its movement of cargo on military aircraft by *benchmarking* the industry's best practices, a thorough review of current literature was conducted. This literature review defines benchmarking and the benchmarking process, provides a history of the air cargo industry, gives rankings of the air cargo carriers, and describes surge planning in the Air Force.

Benchmarking

In today's competitive, global economy many business organizations are striving to be the best in their industries. The process known as "benchmarking" is growing in popularity as a method of improving many aspects of an organization.

Webster's dictionary defines *benchmark* as "a point of reference from which measurements may be made; something that serves as a standard by which others may be measured" (89:102). The term *benchmarking* has its origin in the land surveying practice of comparing elevations (86:8). As applied in today's business world,

> Benchmarking is the formal process of measuring and comparing a company's operations, products, and services against those of top performers both within and outside that company's primary industry. (3:52)

Benchmarking has significant applications to the Air Force because it builds upon the idea that cross-industry comparisons are successful even if there are no similarities between two industries (18:93).

This section discusses the origin and process of benchmarking as it is used today. Also, a comparison of different types of benchmarking and some drawbacks of using benchmarking are discussed. The section titled "Why Benchmark?" examines the benefits associated with a benchmarking process. Finally, applications of benchmarking in the Air Force are discussed.

Origin of Benchmarking. The benchmarking process applied in modern businesses originated in 1979 as a result of Xerox Corporation's struggle to compete against low-priced Japanese copiers (14:6; 86:8). The most documented and perhaps most successful benchmarking project was Xerox's study of the L.L. Bean Company. Xerox saw a need to improve its logistics and distribution systems, and L.L. Bean was seen as the industry leader in warehousing and distribution. In the early 1980s Xerox benchmarked L.L. Bean's distribution system. This helped Xerox's own distribution system for its copiers and allowed Xerox to be competitive in the copier market.

Since its first benchmarking experience, Xerox has continually improved its benchmarking process. "Benchmarking has evolved into a mentality that stretches across the whole company rather than being just a formal

procedure that takes place in only a few areas" (3:55). To be successful at benchmarking, only certain aspects of an industry leader need to be benchmarked. (Xerox used only L.L. Bean's distribution system in their benchmarking project). Of course, Xerox is not the only corporation that benchmarks.

> In fact, in a survey *Distribution* recently conducted among Fortune 1000 companies, 65 percent of the respondents said their firms used benchmarking as a management tool. (36:31)

Since so many companies use benchmarking as a method of improving themselves, an understanding of the benchmarking process is necessary.

Benchmarking Process. Most companies have adopted benchmarking programs that are derived from Xerox's original benchmarking process developed by Robert Camp. His process has five phases. The process starts with a planning phase and proceeds through analysis, integration, action, and maturity (14:16).

The objectives of the planning phase are to determine what is to be benchmarked, to whom or what it will be compared, and how the data will be collected. After determining what, how, and who to benchmark, analysis and data gathering must be accomplished. During the analysis phase, a comparison of the company's internal practices and the benchmarking partner's practices help determine the current performance gap.

There are three types of performance gaps: positive, negative, and operations at parity. "What is desired in the gap's analysis is an objective assessment of their magnitude as well as an explanation of why the gap exists" (14:122). A positive gap exists when internal practices are superior. In this thesis, a positive gap means that the Air Force's practices are best. A negative gap exists when external practices are superior. This means that one of the air cargo industry leaders' practices are best. Operations at parity mean that there are no significant differences. In this thesis, parity exists if both the Air Force and industry leaders have similar operations performed with similar outcomes. After the type of gap is identified, future performance levels are projected.

In the integration phase of the process, the results of the planning and analysis phases are communicated to everyone in the organization, and functional goals are established. This is done to obtain support and commitment from all levels in the organization.

Benchmarking findings and goals are then converted to action plans. Then, these plans are implemented and their progress monitored. When the best industry practices are incorporated into all business practices, maturity will be reached (14:16-19).

General Electric, IBM, Alcoa, and Motorola all use similar processes in their benchmarking programs (7; 8; 26;

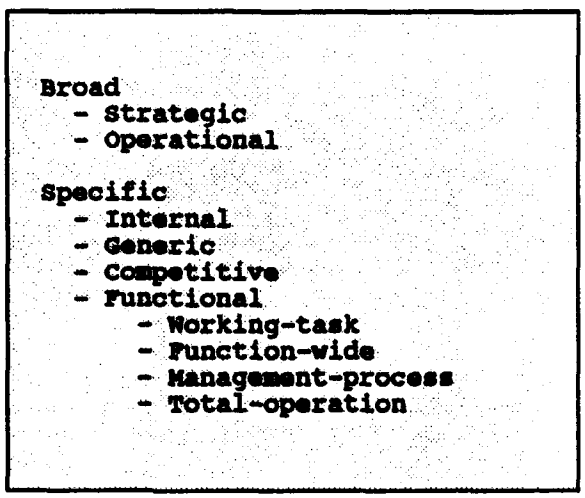
33; 36). An article by David Altany summarizes the benchmarking process quite well. He states:

> The process itself is so straightforward and simple. A senior manager typically will start by deciding what part of the company to benchmark. The manager then instructs specialists in that area to determine what company is the very best at that function and to start collecting data to exchange with that company. After analyzing the data, a strategic plan is developed to incorporate the most effective approaches used by the benchmarked company. (3:53)

After understanding the process, it is important to note that the process can be applied to different *types* of benchmarking.

Types of Benchmarking. The current literature focuses on six types of benchmarking. These are strategic, operational, internal, generic, competitive, and functional. These are categorized into two groups: broad and specific, as shown in Table 1.

TABLE 1: TYPES OF BENCHMARKING



Broad. D.R. Hull, manager in charge of benchmarking for AT&T, divides benchmarking into strategic

and operational benchmarking, with strategic being the most important to him. Hull says:

> Benchmarking, especially at the strategic level, must be highly structured, with both parties knowing well in advance what the questions and objectives are. Then, companies can find the answers to these questions by asking their counterparts at leading edge companies why they succeeded. (36:32)

While strategic benchmarking deals with long term goals, operational benchmarking deals with the near term. Examples of operational level benchmarking are warehousing, inventory control, and customer service. These operational levels use *specific* types of benchmarking.

Specific. Perhaps the simplest type of benchmarking takes place in large multi-division organizations that have similar functions at different locations. This "internal" benchmarking is often the first type of benchmarking tried by an organization (14:61-62; 42:22).

Generic benchmarking holds the potential of revealing the best of the best practices. This type of benchmarking is simply the benchmarking of a process or a function, regardless of dissimilarities of industries (14:65).

Competitive benchmarking is used to compare two companies in the same industry.

> While obtaining information may be difficult, it should still be pursued because the other parties also are interested in understanding best practices that make their operations successful or could further improve them. (14:63)

Camp asserts,

> It is not necessary to concentrate solely on direct product competitors. There is great potential for

> identifying functional competitors or industry leader firms to benchmark even if in dissimilar industries. (14:63)

This "functional" benchmarking is the type used most often.

AT&T's Hull divides functional benchmarking into four levels (36:34). Working-task is the lowest level and covers single activities. The next level is function-wide, and it looks at all tasks within a specific function. The third level is management-process benchmarking which looks at broad issues such as quality, employee motivation, and reward systems. The highest level is total-operation benchmarking which covers the entire operation.

Both the broad and specific groups of benchmarking are used by many companies striving for improvement. Although it appears that benchmarking is a process that is good for any organization, there are drawbacks associated with benchmarking.

Drawbacks. The benchmarking process itself has two drawbacks associated with it. The first problem encountered in many benchmarking studies is getting the best companies to exchange information (3:56). The other drawback is benchmarking's lack of predictive power. "At its worst, benchmarking is only a snapshot; at its best, it can provide clues to next-generation know-how" (33:72).

There are other drawbacks to benchmarking, but these drawbacks are not with the process itself but are caused by organizations trying to jump into benchmarking too quickly. Xerox's Robert Camp says the biggest failure he sees in

benchmarking is the lack of preparation and understanding of an organization's own processes before visiting another organization (36:36). Another barrier is instilling a culture change, but this can be overcome with education and training and by reinforcing the fact that new practices were successful at other companies (7:64).

While there are drawbacks associated with the benchmarking *process*, the drawbacks caused by the organizations can be overcome. This makes the drawbacks seem minimal when compared to all of the benefits of benchmarking. The next section will give some reasons *why* companies use benchmarking as their tool for improvement.

Why Benchmark?

> The essence of continuous improvement is constantly searching for ways to better your products, services, and processes. What better way for companies to improve than by sharing improvement information? (42:20)

Current literature provides many lists of benchmarking's benefits.

Jerry Balm, senior quality consultant with IBM Rochester sees two reasons why any organization that is trying to improve itself should benchmark:

> One is to help set goals toward becoming best at what you do, at all things that you do. Without benchmarking you don't know what that is. Secondly, you augment the good ideas that normally roll in from your own employees, with some creative and innovative ideas from other world-class companies, to get the best-of-the-best efficient and effective ways to make yourself best as well. (42:20-21)

Some of the benefits identified by Xerox include the following:

- o Benchmarking ensures that best practices will be identified and improvement targets set.
- o Benchmarking helps overcome disbelief about practices and convinces companies they can improve on them.
- o Benchmarking counters reluctance to try something different.
- o Benchmarking helps identify new technologies that may be used in other industries.
- o Benchmarking helps redirect companies from those having only an internal focus to ones that look outward toward the market place. (85:23)

Camp believes the basic benefits are derived from meeting customer requirements, becoming competitive, measuring true productivity, establishing goals, and ensuring the best industry practices are included in work processes (14:28). Customer requirements, becoming competitive, and measuring productivity are important aspects of benchmarking. Camp states:

> Understanding the work process outputs and benchmarking them against the best in the industry reveals true customer requirements. The best practices would not exist if they were not preferred by consumers. Benchmarking seeks to satisfy customer requirements in order to remain competitive. (14:31)

Becoming and remaining competitive can be achieved by benchmarking.

> The constant external focus and testing of ideas, methods, practices, and their incorporation in plans and programs for their delivery is the single approach for ensuring long-term competitiveness. (14:33)

The benchmarking process challenges the current way of doing business by bringing in these new ideas and practices from outside the organization.

Camp proposes that if everyone is involved in the benchmarking process, true productivity will be the result because everyone will have an appreciation of what the organization does well and an understanding of how other organizations do some things better (14:32). The teamwork concept helps the organization to become and remain competitive by concentrating on improving productivity.

Applications of Benchmarking in the Air Force. With improvement in mind, benchmarking is applicable to the Air Force. Like a profit-oriented business, the Air Force is faced with several challenges to improve its operation. The current recession within the United States, along with the tremendous budget deficit, has led to reductions in military funding and increased emphasis on improving the economy. The Air Force has implemented Total Quality Management in an effort to improve its overall processes for doing business. As the Air Force draws down to become 30 percent smaller, there is no choice but to work smarter and become more efficient since the global requirements have not changed (6:32).

In 1990, the Quality Council of the Headquarters Air Force Logistics Command (AFLC)--now part of the Air Force Materiel Command (AFMC)--published a benchmarking pamphlet (1:1). Almost identical to the Xerox model of benchmarking

(15:71), this pamphlet describes the need to continually improve processes within AFLC.

The Air Force currently uses techniques which could be classified as a type of benchmarking. Inspector General (IG) reports, cross-tell reports, and lessons learned are all a way of sharing good (best) practices among various Air Force bases.

Almost any nonprofit organization can establish benchmarks to improve upon current practices--including the Air Force. Inherent in the benchmarking definition is the need to find the best industry practices wherever they exist and incorporate these ideas where practical. Granted, measuring performance is more difficult for organizations with intangible objectives (43:19); however, quantifying the price of air defense is not the intent of benchmarking. Benchmarking has significant applications to the Air Force because it builds upon the idea that cross-industry comparisons are successful even if there are no similarities between two industries (18:93).

Benchmarking Summary. The fierce competition in today's business environment makes it necessary for organizations to continually strive for improvement. Benchmarking is a new *process* that measures and compares a company's operations, products, and services against top performers both within and outside that company's primary industry (3:52). The main objective of benchmarking is to

continually improve a company by taking the best practices of other companies and applying them to its operation.

Benchmarking ranges from the very broad, strategic or operational types, to the more specific types, and there are benefits and drawbacks associated with all types. However, the benefits clearly outweigh the drawbacks, which is why the majority of large corporations use benchmarking as a management tool for improvement.

Air Cargo Industry

Since the first step of the benchmarking p cess is deciding whom to benchmark from (benchmark partners), an examination of the air cargo industry is necessary before determining the industry's leaders. Some information about the air cargo industry follows.

The deregulation of the airlines in 1977 was the turning point for the air cargo industry. Deregulation led to increased competition throughout the industry by allowing free entry and exit into the market. The strongest growth in the air cargo industry took place in the 1980s with the creation of integrated or *express* carriers. Express carriers own both aircraft and equipment, and they emerged to move high-value, low-weight packages overnight (21:37).

In the early 1980s Federal Express began to emerge as a pioneer in the industry using its hub and spoke system.

> Its trucks would pick up the parcel or document at the shipper's office, transport it to the airport, and place it on a Federal aircraft. Airplanes from all over the country then flew to a hub in Memphis. There

> shipments were off-loaded, sorted onto giant conveyor belts, and then placed back on the aircraft going to the final destination. At the destination city, a Federal van would deliver the package to the consignee, meeting its promise to the shipper to do the job 'positively, absolutely' overnight. (21:38)

> Although the hub system seems likely to remain the basic key to air express operations, growth has necessitated some variations, primarily in the form of regional hubs. (82:A41)

The 1980s also saw an increase in competitive pricing. United Parcel Service, the largest carrier of packages in the United States by surface and air, expanded its second-day air and entered the next-day delivery market. This caused price competitions, mergers, and even some withdrawals from the industry. This intense competition is still prevalent today, and it shows the impact of competitive forces on the air cargo industry's markets.

Competitive Forces. Michael Porter explains that intense competition in an industry is rooted in its economic structure and goes beyond the behavior of current competitors. He says that the state of competition in an industry depends on five competitive forces: potential entrants (threat of new entrants), buyers (bargaining power of buyers), substitutes (threat of substitute products or services), suppliers (bargaining power of suppliers), and industry competitors (rivalry among existing firms) (70:3-4).

The first competitive force, threat of new entrants, was very strong in the 1980s when the air cargo industry began to take shape. Now, over 20 U.S. companies compete in

the air cargo industry (88:645). Because of economies of scale, capital requirements, and switching costs, the threat of more new entrants is not very likely. Economies of scale make it very difficult for a new company to compete with the established companies that have widespread market share and fleets of aircraft and equipment. The capital requirements to start an air cargo carrier business are extremely restrictive for new companies. The cost or rental fees for aircraft, warehouses, conveyors, equipment, and facilities is extremely high. If a new entrant emerged into the air cargo carrier industry, it would have to either meet an underdeveloped market niche or "steal" customers from another carrier. The cost for a shipper of cargo to switch to another company is often prohibitive because of time spent training employees on new systems.

Related to the problem of new entrants, is the bargaining power of buyers already in the market. Buyers can influence prices and demand higher quality, thus forcing more competition between carriers. Buyers, especially major corporations, are an extremely powerful force in the air cargo industry.

The threat of substitution is also very powerful in this industry. Some customers see overnight or express service as an integral part of the air cargo industry and often the only distinguishing feature in the market is price. For these customers, switching costs are not a factor. Therefore, since this industry can be highly

substitutable, price and performance are often stressed to customers in the market.

Another competitive force in this industry is the bargaining power of suppliers. The threat of raising prices or reducing quality of purchased goods and services can be a powerful force to air cargo carriers. Again, if suppliers exert this type of influence and negatively affect the carrier, the customer can easily substitute another carrier.

Finally, the most competitive force faced by the air cargo industry is the rivalry among existing carriers. This industry is extremely competitive and many of the carriers compete head-to-head for major corporate contracts. Also, most of the carriers are mutually dependent--a competitive move by one is often countered by others. While this industry is very competitive, some of the carriers concentrate on specializing on certain markets while others offer specialized services to help differentiate their services. Concentration on niches and specialized services are taken into account when choosing the leaders of this industry.

Industry Summary. This brief synopsis of the air cargo industry gives background information that is necessary for properly choosing which carriers are the best in this industry. The next section gives some industry statistics that are used to determine the industry's leaders.

Industry Leaders

The rankings found in the literature on air cargo carriers were based on sales and number of employees--not rankings of best to worse. The only air cargo carrier acknowledged as being superior in current literature was Federal Express as the 1990 winner of the Malcolm Baldridge Award for Quality in a service company (13:24). Since service is not the primary focus of this study, this award was not considered as a ranking of Federal Express as the industry leader. Therefore, the rankings found in the literature search are used in this thesis.

The literature ranked the U.S. air cargo carriers by sales and number of employees. Three separate rankings were found and all are included below. Table 2 contains *Dun's Business Rankings*, Table 3 shows the rankings from *Ward's Business Directory*, and Table 4 shows rankings found in the *Million Dollar Directory - America's Leading Public and Private Companies - Series 1992*. All information in the tables are extracted for ease of comparison and all rankings are from 1992. Only the top five companies from each ranking are included.

TABLE 2: DUN'S BUSINESS RANKINGS OF AIR CARGO CARRIERS FOR 1992

Ranked by Sales	Ranked by Number of Employees
1. United Parcel Service	1. United Parcel Service
2. Federal Express	2. Federal Express
3. Emery Air Freight	3. Airborne Freight
4. Airborne Freight	4. Emery Air Freight
5. Burlington Air Express	5. DHL Airways

(27:811-812, 1063-1064, 1441)

TABLE 3: WARD'S BUSINESS DIRECTORY RANKINGS OF AIR CARGO CARRIERS FOR 1992

Ranked by Sales	Ranked by Number of Employees
1. United Parcel Service	1. United Parcel Service
2. Federal Express	2. Federal Express
3. DHL Airways	3. DHL Airways
4. Emery Air	4. Emery Air
5. Airborne Freight	5. Airborne Freight

(88:637, 6345)

TABLE 4: MILLION DOLLAR DIRECTORY'S RANKINGS OF AIR CARGO CARRIERS FOR 1992

Ranked by Sales	Ranked by Number of Employees
1. United Parcel Service	1. United Parcel Service
2. Federal Express	2. Federal Express
3. Emery Air Freight	3. Emery Air Freight
4. Airborne Express	4. Airborne Express
5. Burlington Air Express	5. DHL Airways

(55:84, 632, 1367, 1488, 5177)

Surge Planning

Commercial air cargo carrier surge planning was not found by a review of current literature. However, since an organization must know itself before undergoing benchmarking, a review of Air Force airlift surge planning is necessary. Surge planning by the air cargo carriers is necessary for comparison during benchmarking, and this is investigated by interviewing carrier representatives.

Since the national security strategy has changed to focus on regional threats, contingency planning requires planning for uncertainty. "Our ability to predict political alignments and military capabilities weakens as we look farther into the future" (19:5). The Air Force still has a global requirement, but General Colin L. Powell, Chairman of the Joint Chiefs of Staff, describes the regional focus as follows:

> We will also retain the potential to defeat a global threat, should one emerge. However, our plans and resources are primarily focused on deterring and fighting regional rather than global wars. (72:11)

Based on the new regional defense strategy, contingency plans for each region or theater of the world are written based on known and foreseen threats. Two major areas of the new strategy, crisis response and reconstitution, have strong ties to the Air Force's airlift capability.

Regional contingencies are varied, yet U.S. forces need to respond rapidly. Air Force airlift assets are used to move cargo and troops to the area of crisis. When Air Force

units are deployed, personnel surge to work in mobility work centers and deploy all necessary personnel, equipment, and aircraft. To accomplish this the Air Force uses a regulation, AFR 28-4, *USAF Mobility Planning*, to provide deployment guidance, and each Air Force base has their own unique plan based on their mobilization requirements. For small deployments, only organic (Air Force) airlift assets are used.

When units of other services deploy, both those service members and Air Force airlift personnel work together to move troops and cargo. This is conducted under the guidance of AFR 76-6, *Movement of Units in Air Force Aircraft*. Again, if the deployment is small, only Air Force airlift assets are used.

For larger, or on-going deployments, the Air Force may not have enough assets readily available. When this happens reconstitution takes place.

> Our reconstitution strategy seeks to provide sufficient capability to create additional new forces and capabilities to deter and defend our interests as necessary, drawing on 'regeneration' assets (cadre-type units and stored equipment), industrial/technology base assets, and manpower assets. (19:17)

The most common way to "reconstitute" is to use Air Force Reserve and/or Air National Guard personnel, equipment, and aircraft. If more personnel are needed, retired military personnel or new recruits are available. If more equipment, such as forklifts, is needed, then the commercial industrial base is called upon. If more aircraft are needed, then the

Civil Reserve Air Fleet (CRAF) is used to supplement Air Force lift capability by using many different types of aircraft. For the long-range international segment of CRAF, DC-8, B-747, DC-10, L-1011, A310, and B707 aircraft are used (41:31).

The CRAF was developed in 1951 so that civilian air carriers could assist in national defense at three levels of need. Stage I activates approximately ten percent of the fleet, Stage II includes about 36 percent of the fleet, and Stage III is a recall of all aircraft in CRAF. Stage I and II aircraft have 24 hours to respond to a call-up request, and Stage III aircraft have 48 hours (41:30-31). The CRAF was first activated in the Persian Gulf War and was very successful in supplementing the Air Force's passenger and cargo airlift capability.

The ability to surge to meet a contingency or wartime requirement is a key component of our armed forces. With the move to a regional focus on defense strategy, fewer troops, and reduced defense budgets, the need to surge quickly and effectively is evident.

Summary

Benchmarking is a *process* that measures and compares a company's operations, products, and services against top performers within and outside that company's primary industry (3:52). The main objective of benchmarking is to

continually improve a company by taking the best practices of other companies and applying them to its operation.

To begin the benchmarking process, a brief history of the air cargo industry is given followed by rankings of carriers in the industry. This helps determine the industry leaders that are used as benchmarking partners.

Finally, the importance of surge planning in the U.S. armed forces is examined and is crucial to quick and effective responses during a contingency or war. A literature search does not reveal how surge planning is accomplished by commercial air cargo carriers; thus, this is investigated through interviews with air cargo carrier representatives.

Conclusion

This review of current literature explains benchmarking and the benchmarking process. A brief synopsis of the history and leaders of the air cargo industry is given, and Air Force planning for contingencies is reviewed. The remainder of the study continues the benchmarking process by using a case study methodology that focuses on the industry leaders to determine which practices are applicable to the Air Force.

III. Methodology

Overview

This chapter describes, in three sections, the methodology used to benchmark the *best* practices of air cargo industry leaders. This chapter is divided into three parts. The first section describes the research design and validity and reliability when using qualitative research. The second section presents the data collection techniques used in the research design to include purposeful sampling to select the air cargo carriers, an investigative study used to focus the research effort, a pilot study, a pretest of interview questions, observations, and personal interviews. Finally, this chapter describes how the findings from the data collection plan are analyzed to determine what the Air Force can learn from air cargo industry leaders.

Research Design

Benchmarking has traditionally been used to search for one organization that is the best at <u>one</u> practice in its industry. For the purpose of this study, benchmarking is used in conjunction with a case study approach to examine <u>several</u> leaders in the diverse air cargo industry and identify their best practices to the Air Force.

Emory defines research design as a "plan and structure of investigation so conceived as to obtain answers to

research questions" (30:138). The case study is one of numerous well-tested designs and techniques used to help guide inquiry and study a phenomenon systematically. The case study research design involves organizing the data by specific cases to permit in-depth study of these cases (69:303). Case studies can involve either single or multiple cases with numerous levels of analysis--they offer insights that can be construed as tentative hypotheses to help structure further research (28:534). The purpose of case study analysis is to gather comprehensive, systematic, and in-depth information about each case of interest. Since benchmarking, as described in the literature review in Chapter II, is the search for industry's best practices, the case study research design is well-suited to provide an in-depth study to help identify the best practices used by air cargo industry leaders.

Validity and Reliability. Case studies and qualitative research have often been criticized as lacking validity, reliability, and being "scientifically worthless" because they fail to meet minimal design requirements for comparison (30:143; 69:19). However, well-defined case studies often challenge theory and provide a source of new hypotheses (30:143).

Patton offers that the long-standing debate concerning the purpose of qualitative methods and how qualitative approaches fit into the larger purposes of social science depends on one's perspective of *truth* (69:268-269).

> ...scientific information varies with regard to its degree of approximation to some postulated absolute truth. In general, though, the true value of our information is best measured by criteria of usefulness--in predicting and explaining our experience in the natural world. Criteria of usefulness are derivable both from theoretical domains of science and from people's practical experience and problems. (69:272)

To ensure validity and reliability in case study research, various procedures are offered. These include "*triangulation*", or using multiple sources of data and multiple methods of investigation to confirm emerging findings, and performing "*cross-case analysis*" that searches for generalized categories and patterns between cases (69:331). This research effort uses these measures to reduce bias and ensure validity and reliability in the case study analysis.

Data Collection

Purposeful Sampling--Selection of Air Cargo Carriers. Patton suggests using purposeful sampling when one wants to learn and understand something about certain select cases. He further states that decision makers and evaluators can determine what cases they can learn the most from, and those are the cases that are selected for study (69:101). This research effort uses purposeful sampling to select air cargo carriers for the case study analysis. The researchers selected air cargo carriers based upon sales, the only rankings found in the literature (Chapter II). Although benchmarking requires using the *best* industry

practices, no such ranking exists in the literature. In addition, information obtained from Headquarters Air Mobility Command (HQ AMC) provided the basis for selection of the Air Force aerial port squadron. One Air Force aerial port squadron was chosen for study based upon maximum tonnage moved in 1992 (a specific categorization used by HQ AMC--not a ranking). The number of carriers selected was kept deliberately small to allow the survey to focus on depth of information versus breadth--qualitative versus quantitative analysis.

> Qualitative researchers usually work with smaller samples of people in fewer global settings than do survey researchers. Collecting data is a labor-intensive operation, traditionally lasting for months... (69:15)

Following a selection of air cargo carriers, the researchers conducted an investigative study to narrow the focus of the research.

Investigative Study. Yin suggests that "the investigator must learn to integrate real-world events with the needs of the data collection plan" (92:67). In an effort to narrow the focus of the study, integrate real-world Air Force issues, and solicit advice from Air Force policy managers, the researchers selected HQ AMC at Scott AFB, Illinois to conduct an investigative study.

A non-scheduled-structured personal interview was conducted with mid-level policy managers from HQ AMC. This interview was a structured encounter between the interviewers and respondents where major aspects of the

study were explained and respondents were given considerable liberty in expressing their definition of a situation that was presented to them (37:225). This interview was exploratory in nature with the goal of obtaining information to integrate real-world Air Force issues in the data collection plan and to obtain a consensus of what Air Force transportation policy managers consider to be the *best* practices in the air cargo industry. Questions asked during this study are listed in Appendix A. The researchers used the information obtained from the investigative study to prepare for the pilot study.

Pilot Study. Yin proposes conducting a pilot case study to prepare for data collection (92:74). A pilot case study serves to provide greater familiarity with the research topic, to refine data collection procedures for case study research, and to develop questions. Accessibility and geographical convenience are recommended criteria for selection of a pilot case study. Therefore, these criteria were used in accomplishing the pilot study for this research.

The researchers selected Airborne Express (the airline section of Airborne Freight) in Wilmington, Ohio as the pilot case organization. A site visit and an unstructured personal interview were conducted with the hub manager at Airborne Express. The unstructured interview and site visit were primarily exploratory with the intent to determine what the air cargo carriers perceive to be the *best practices* in

their industry. Questions asked during this study are listed in Appendix B. The researchers used information from both the investigative study and the pilot study to narrow the focus of the research and to develop the questions used in the interview process.

Pretest of Interview Questions. After the pilot study and the development of the interview questions, a pretest of the interview questions is recommended by Yin as a formal "dress rehearsal" (92:74). Pretesting is used to detect weaknesses in survey instruments and relies on colleagues, respondent surrogates, or actual respondents for the purpose of evaluating and refining a measuring instrument (30:377). The purpose of the pretest is to ensure validity and reliability of the interview questions and guard against interview bias. The pretest also helps prepare the researchers for the subsequent interviews and allows for constructive feedback.

Keeping conditions and times close to actual study conditions, pretests of the interview questions were conducted with ten professional transportation officers who were students at the Air Force Institute of Technology (AFIT). Based on inputs from the pretest respondents, minor changes were made to improve and clarify the wording of several questions subsequently used in the interview process.

Following the pretest and finalization of the interview questions, the researchers contacted personnel at the air

cargo carriers and the Air Force aerial port squadron by telephone to arrange for site visits and interviews. The researchers also requested informational literature from the commercial air cargo carriers to further prepare for the site visits.

Observation. Observational data permit the evaluator to understand a program to an extent not entirely possible using only the insights of others obtained through interviews (69:30). The value of observational data in research is that decision makers and information users can come to understand program activities through detailed descriptive information (69:124). Observational data must have depth and detail and are valuable tools to supplement the interviewing process (30:400).

Patton notes that direct, personal contact with and observations of a program have several advantages for evaluators: 1) the evaluators are better able to understand the context within which the program operates; 2) the evaluators can directly experience the program as a phenomenon unto itself and make the most of an inductive, discovery-oriented approach; 3) the evaluators have the opportunity to see things that may routinely escape conscious awareness among participants; 4) the evaluators can learn about things program participants may be unwilling to talk about in an interview; 5) by making their own perceptions part of the data available, evaluators are able to present a more comprehensive view of the case being

studied; and 6) with direct contact, the observers take in information and form impressions that go beyond what can be fully recorded in even the most detailed field notes (69:123-126).

Through site visits, the researchers observed non-behavioral, physical processes at each air cargo industry leader's hub and at one Air Force aerial port squadron. Observation is necessary to supplement the interview process and determine if any practices used by air cargo industry leaders are applicable to Air Force cargo operations. In general, the researchers observed the movement of cargo in all stages of cargo handling (i.e. receipt, consolidation, mission planning, loading). When possible, the researchers observed cargo operations during peak operating hours and completed the observations prior to the interview process for a better understanding of local hub operations. These observations were used to answer the third investigative question ("What can the Air Force learn from observing day-to-day operations of air cargo industry leaders?").

Interview Process. Following each observational tour of an air cargo carrier and the Air Force aerial port operation, schedule-structured personal interviews were conducted with operational managers or applicable experts familiar with the organization's air cargo operations. This type of interview used an open-ended format in which the questions, their wording, and their sequence were fixed and identical for every respondent (37:224). The interview

questions were written out in advance exactly the way they were asked during the interview. The schedule-structured and open-ended format of interviewing is used when it is important to minimize variation in the questions posed to interviewees (80:A-24). This reduces the possibility of bias that comes from having different interviews for different people (69:198). Notes and tape recordings were made in all cases, with the understanding that the discussions were strictly non-attributable (80:A-24). Responses requiring further clarification were followed up by telephone.

The researchers used the remaining investigative questions in Chapter I to formulate specific interview questions. The investigative questions, followed by the applicable interview question or approach used to answer the investigative question, are listed below. Appendix C contains a list of all interview questions.

1. Who are the U.S. air cargo industry leaders?

This investigative question is answered in Chapter IV by comparing sales and number of employees of all U.S. air cargo companies from Chapter II.

2. Can the air cargo industry leaders be categorized by the type of cargo handled?

Interview question one. What type of cargo do you specialize in handling and what other types of cargo do you handle?

3. What can the Air Force learn from observing day-to-day operations of air cargo industry leaders?

This investigative question is answered by observing the air cargo handling operations (through site visits) at one Air Force aerial port squadron and each air cargo carrier identified by investigative question one.

4. What are the differences between how the Air Force and air cargo industry leaders plan for surge periods of increased workload (i.e., contingencies, Christmas)?

Interview question two. Do you have written procedures in place for surge periods? If so, are these company-wide (Air Force wide), regional, or local? (A surge is to rise suddenly to an excessive or abnormal value).

Interview question three. How often are your surge plans updated and do you ever test your plans? (A test is a critical examination, observation, or evaluation).

5. What are the differences between how the Air Force and air cargo industry leaders' cargo handling equipment and personnel requirements change to accommodate increased workloads?

Interview question four. What effects do surges have on your cargo handling equipment?

Interview question five. If extra equipment is needed, do you obtain it through in-house resources or by contract? Do you go through company-wide (Air Force wide), regional, or local channels?

Interview question six. During surge periods, how do your personnel levels change?

Interview question seven. Do you go through company-wide (Air Force wide), regional, or local channels to get additional personnel? Are they hired as part-time or full-time?

Interview question eight. How do you train these additional employees and is there a learning curve associated with this training?

6. What are the differences between how the Air Force and air cargo industry leaders measure the effectiveness of their air cargo handling operations?

Interview question nine. How do you measure the effectiveness of your day-to-day (peacetime) cargo handling operations?

Interview question ten. How do you measure the effectiveness of your cargo handling operations during surges (contingencies/war)?

Findings and Analysis

Analysis of qualitative data is often described as a difficult task. Guba suggests that no infallible procedure exists for converting field notes and observations about issues into systematic categories (69:313). Uncovering patterns, themes, and categories is a creative process that requires the researchers to make carefully considered judgements about what is really significant in the data.

This research effort analyzes data collected from three sources: the literature review (Chapter II), observations recorded by the researchers during site visits, and answers given by respondents to questions asked in the interview process.

Gap analysis is used in the benchmarking effort to determine what type of performance gap or difference exists between the Air Force and air cargo industry leaders. To answer the investigative questions, the data collected from the literature review, observations, and interviews are analyzed by looking for common themes or patterns. Where possible, the data collected from the case study respondents in the interview process are matched against the literature review and observations in an effort to help answer the investigative questions.

Descriptive observations during the site visits to each company, along with para-phrased answers given by respondents during the interviews, are recorded by the researchers and presented in the Appendices D through J. The researchers analyze the data and provide summarizations of the analyses using cross-classification tables presented in Chapter IV.

Summary

The methodology described in this chapter uses a qualitative case study research design that includes purposeful sampling, a pilot study, observations, and

personal interviews to benchmark the best practices of air cargo industry leaders. The chapter describes the methodology used by the researchers to help answer the investigative questions from Chapter I. The next chapter of this thesis presents the findings and analysis of the literature review, observations, and interviews.

IV. Findings and Analysis

Overview

This chapter presents the findings and analysis of the research study. Findings of the literature review, observations, and interviews are analyzed by examining each investigative question. The appendices, which give detailed descriptions of the researchers' observations and paraphrased answers to interviews with each air cargo carrier and the aerial port, are summarized in Table 5.

TABLE 5: OBSERVATION AND INTERVIEW APPENDICES

Organization	Appendix	Observation (page)	Interview (page)
UPS	D	76	82
FedEx	E	93	101
Emery	F	108	116
Airborne	G	123	129
DHL	H	136	142
Burlington	I	149	155
Dover AFB	J	161	172

These findings are summarized in cross-classification tables that aid in the analysis. Triangulation, or multiple data sources, used to analyze findings, and cross-case analysis, which identifies generalized categories and patterns, are used to ensure reliability and validity in the analysis of the data collected (69:331). Finally, gap analysis is used to assess what differences exist between industry leaders

and the Air Force with respect to specific investigative questions.

Investigative Question One

Who are the U.S. air cargo industry leaders?

The literature review listed several rankings of air cargo carriers. There is not one air cargo carrier that can be identified as the industry leader. Therefore, since the same six companies are in all the rankings of the air cargo carriers, all six will be used as the leaders of the air cargo industry for this benchmarking study. The companies chosen as industry leaders are shown in Table 6.

TABLE 6: INDUSTRY LEADERS

United Parcel Service
Federal Express
Emery Air Freight
Airborne Freight
DHL Airways
Burlington Air Express

By choosing six companies as benchmarking partners, a cross-section of the industry is studied. These six companies represent those who specialize in small packages and express delivery, those who deliver large freight, and those who deliver a variety of freight and provide a variety of services. United Parcel Service (UPS) and Federal Express are consistently the top two leaders ranked by sales

and number of employees in the literature. However, since UPS moves a majority of its cargo by surface, the sales figures included in the rankings are misleading. If the airlift portion of UPS's business is considered by itself, it would probably rank behind Federal Express. The other companies used as benchmarks are not only mentioned in the literature with UPS and Federal Express but are all in close proximity to Wright-Patterson AFB and are easily accessible partners to analyze.

Since six of over 20 carriers were chosen as industry leaders, this gives a large sample size which will increase reliability. This large sample will also give a variety of companies' best practices from which to study.

Overview of Industry Leaders. United Parcel Service is a private company that moves almost any size of packages both domestically and internationally. A majority of UPS' business is providing surface transportation services. However, the airlift portion of the business is quite large and makes UPS the second largest carrier of packages by air. Standiford Field in Louisville, Kentucky serves as UPS' hub for its airlift operations.

Federal Express is a public company that specializes in the express (overnight) delivery of packages. While Federal Express will deliver packages of almost any size, the majority of its business is small packages weighing less than 70 pounds. Like UPS, Federal Express moves cargo both

within the U.S. and internationally. The Memphis, Tennessee airport is the hub for Federal Express' operations.

Emery Air Freight is a public company that moves any type of cargo, but its specialty is in cargo weighing over ten pounds. Emery also has both domestic and international operations, and its hub is located at the Dayton International Airport in Ohio.

Airborne Freight is a public company that specializes in moving small packages by express service. Airborne flies its own aircraft domestically and uses contracted airlift to move cargo internationally, where Airborne employees receive the cargo for onward movement. Airborne Freight owns its own airport, Airborne Air Park, in Wilmington, Ohio which serves as the hub for its operations.

DHL Airways is a private company and the largest international overnight package shipper (12:73; 54:32). DHL moves almost any type of cargo in the U.S. but is more competitive in the international market. Its hub is at the Greater Cincinnati-Northern Kentucky airport.

Burlington Air Express is a public company that specializes in moving heavy freight weighing over 70 pounds but also moves small packages. Like the other carriers, Burlington is active in both the domestic and international markets. Its hub is at the Toledo, Ohio airport.

The above information about these industry leaders was summarized from numerous articles on the air cargo industry

and from the carriers themselves. Several things that the industry leaders have in common are that they all specialize in meeting a certain market niche and all are active both domestically and internationally.

Federal Express and Airborne Freight concentrate on express delivery of small packages, while Emery Freight and Burlington Air Express both concentrate on the movement of heavy freight. UPS and DHL, the two private companies, concentrate on delivering almost any type of cargo anywhere in the world.

Air Force Air Terminals. To determine which Air Force air terminal is used to compare with the benchmark partners, a comparison is made of cargo handled by five major aerial ports in the U.S. from information obtained from Air Mobility Command. (Air Mobility Command does not rank its aerial ports by any type of measurement). After analyzing tonnage of originating, terminating, and intransit cargo handled, the following ranking of aerial ports (by tonnage handled) was compiled by the researchers:

1. Dover AFB, Delaware
2. Travis AFB, California
3. Charleston AFB, South Carolina
4. McGuire AFB, New Jersey
5. McChord AFB, Washington

Since Dover AFB handles the most cargo, it was chosen as the air terminal used in the benchmark study.

Investigative Question Two

Can the air cargo industry leaders be categorized by the *type* of cargo handled?

Information from the literature review and the first interview question ("What type of cargo do you specialize in handling and what other types of cargo do you handle?"), is summarized in Table 7. More detailed information can be found in the applicable appendices.

The air cargo industry leaders *can* be categorized by the *type* of cargo handled. United Parcel Service, Federal Express, Airborne Freight, and DHL Airways specialize in moving small (express) packages. Emery Air Freight and Burlington Air Express specialize in moving large (heavy weight) cargo.

Investigative Question Three

What can the Air Force learn from observing day-to-day operations of air cargo industry leaders?

The findings for this investigative question are based upon observations by the researchers. After observing all air cargo industry leaders and Dover AFB, nine categories of observations were noted. The nine categories are: setting, cargo handling equipment, aircraft, small package sort, large cargo handling, employees, intransit visibility, operations interface, and safety. Full details on each of the nine areas observed are in the applicable appendices.

TABLE 7: INVESTIGATIVE QUESTION 2 -- CAN THE AIR CARGO INDUSTRY LEADERS BE CATEGORIZED BY THE *TYPE* OF CARGO HANDLED?

Cargo Types	UPS	FedEx	Emery	Airborne	DHL	Burlington
Express (Priority Overnight)	Yes	Yes	Yes	Yes	Yes	Yes
Heavy Weight (> 70 lbs)	Yes	Yes	Yes	No	Yes	Yes
Specialty	Small Packages	Express Documents and Packages	Heavy Weight	Express Documents and Packages	Express Documents and Packages * Int'l Shipments	Heavy Weight

* Based upon literature review

To narrow the nine categories of observations into a form to answer this investigative question, only specific categories of observations which are deemed significant by the researchers are shown in Table 8. This reduces the number of categories to four--cargo handling equipment, intransit visibility, operations interface, and safety. Blank cells in the table do not imply that a company does not have that particular capability; instead, the researchers determined that the company's capabilities in these areas could not be used by the Air Force.

Table 8 is read by selecting an observation category, then reading across to the industry leader's entry for that category. For example, UPS is identified in the *cargo handling equipment* category for its see-through and collapsible containers and its pallet dollies. Federal Express is identified in the *intransit visibility* category for its bar code scanners and its future technology. Emery Air Freight is identified in the *operations interface* category for its operations-coordination tower. Burlington Air Express is identified in the *safety* category for its recycled air, required lifting belts, and calisthenics before work begins.

Investigative Question Four

What are the differences between how the Air Force and air cargo industry leaders plan for surge periods of increased workloads?

TABLE 8: INVESTIGATIVE QUESTION 3 -- WHAT CAN THE AIR FORCE LEARN FROM OBSERVING DAY-TO-DAY OPERATIONS OF AIR CARGO INDUSTRY LEADERS?

Observations	UPS	FedEx	Emery	Airborne	DHL	Burlington
Cargo Handling Equipment	- See-through containers - Collapsible containers - Dollies	- Nose docks - See-through containers - Large door openings on containers - Dollies	- Large door openings on containers - Secure containers - Dollies	- Customized C-containers	- Large door openings on containers - Dollies	- Large door openings on containers - Dollies
Intransit Visibility		- Bar code scanning - Future technology: Radio Frequency tags or bar codes on containers				-Contrasting colored labels to distinguish overnight from non-overnight cargo
Operations Interface	-Consolidated Ramp Control Center (RCC) - Video cameras in RCC	- Video cameras - Hand-held computers - Heavily computerized - "Super-system" t.v. monitors	- Operations coordination from tower			
Safety	- Marked walkways					- Recycled air - Lifting belts - Calis-thenics

The findings for this investigative question are based upon interview questions two and three ("Do you have written procedures in place for surge periods? If so, are these company-wide [Air Force wide], regional, or local?" and "How often are your surge plans updated and do you ever test your plans?") and the researchers' experience. However, the majority of the findings for this investigative question are based upon the interviews conducted with operational managers or applicable experts familiar with the organization's air cargo operations. Detailed para-phrased responses to the interview questions are written in the appendices.

A summarization of the findings are listed in Table 9. Blank areas in the table indicate that this aspect of surge planning was not mentioned in the interview. An example of a comparison of differences in how UPS and Dover AFB/Air Force plan for surge periods follows. The *form* of surge plans for UPS are written, while Dover AFB/Air Force has some written plans for surge. The *type* of plans used by UPS are "peak plans" which are prepared 12 months prior to the anticipated surge with the operational portion of the peak plans written in August for the December/Christmas surge period. In contrast, the 436th APS at Dover AFB has written agreements with local reserve units for reserve augmentation and, based upon the researcher's experience but not mentioned in the Dover AFB interview, the Air Force also has

TABLE 9: INVESTIGATIVE QUESTION 4 -- WHAT ARE THE DIFFERENCES BETWEEN HOW THE AIR FORCE AND AIR CARGO INDUSTRY LEADERS PLAN FOR SURGE PERIODS OF INCREASED WORKLOAD?

Surge Plans	UPS	FedEx	Emery	Airborne	DHL	Burlington	Dover/Air Force
Form	- Written	- Written	- Not written	- Not written	- Written	- Written	- Some written
Type(s)	- Peak plans (12 mos. in advance w/operational plans in Aug. for a Dec. surge	- Strategic Plans (2-5 yr period) - Peak plans (10-11 mos.)	- Procedures for overload situations	- Prepare for Christmas surge on day after Thanksgiving	- Procedures based on Master Standard Data - Use statistical sampling of employees	- Bump procedures	- Reserve augmentation * Base mobility plans
Updated	- Every month, week, and day as peaks approach	- Peak Plans (updated weekly and monthly	- Overload procedures updated annually	- Anticipate surges on first and last day of business' quarters - Weekly meetings to determine concerns	- Bi-annually	- Approx. every other month	- Annually
Tested	- 2 wks. prior to peak	- Tested annually			- A few times each month for testing master standard data		- Real-world events (continuous)

* Based on the researchers' experience

base mobility plans that outline mobilization procedures of operations during contingencies/war. UPS' peak plans are updated incrementally every month, week, and day as the December peak period approaches. Plans used by the Air Force are updated annually. Finally, UPS' peak plans are *tested* two weeks prior to the peak period by increasing the manpower (and equipment, if necessary) within the sort facility to the level anticipated in the peak plan. The aerial port at Dover AFB has real-world events, such as Operation DESERT SHIELD/STORM and Operation PROVIDE COMFORT, that continually test surge plans.

A gap analysis of differences between the Air Force and air cargo industry leaders resulted in so many differences in the methods of planning for surge periods that a determination of a best practice cannot be made. Neither positive, negative, nor parity gaps exist. A major factor in these differences is the mission of the Air Force to move cargo during peak periods is not easily predicted. In some cases, the commercial air cargo carriers have peak periods that are anticipated for several months (i.e. Christmas).

Investigative Question Five

What are the differences between how the Air Force and air cargo industry leaders' cargo handling equipment and personnel requirements change to accommodate increased workloads?

The findings for this investigative question are based upon the researchers' experience and responses to interview

questions four, five, six, seven, and eight as listed in Appendix C. The results of the experiences and interviews are summarized in two tables, one for cargo handling equipment and one for personnel. Applicable appendices have more detailed information.

Table 10 shows the differences between industry leaders' and the Air Force's methods of obtaining additional cargo handling equipment. The method termed "in-house" refers to the ability to use company resources from either another area at the main hub or from a regional hub. "In-house" in the Air Force means to obtain equipment from another organization on the Air Force base or from another Air Force base.

As Table 10 shows, there are very few differences in the way the industry leaders and the Air Force obtain extra equipment. Therefore, *parity* exists--there are no significant differences.

As evident in Table 11, there are differences among the industry leaders in how their personnel requirements change to accommodate increased workloads. Because the industry leaders differ in their methods, it is difficult to compare their personnel practices with the Air Force.

For example, *overtime* is handled at DHL Airways by giving additional hours to currently employed part-time workers, while Dover AFB/Air Force gives additional hours to currently employed military personnel who are already working full-time. Also, the military personnel are given

TABLE 10: INVESTIGATIVE QUESTION 5 -- WHAT ARE THE DIFFERENCES BETWEEN HOW THE AIR FORCE AND AIR CARGO INDUSTRY LEADERS' CARGO HANDLING EQUIPMENT REQUIREMENTS CHANGE TO ACCOMMODATE INCREASED WORKLOADS?

Obtaining Extra Equipment	UPS	FedEx	Emery	Airborne	DHL	Burlington	Dover/ Air Force
In-House	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrow	No	No	No	No	Yes	No	* Yes
Lease	Yes	No	Yes	Yes	Yes	Yes	Yes
Buy	--	Yes	Yes	--	--	No	Yes

* Based on the researchers' experience
-- Not mentioned in interview nor observed by researchers

TABLE 11: INVESTIGATIVE QUESTION 5 -- WHAT ARE THE DIFFERENCES BETWEEN HOW THE AIR FORCE AND AIR CARGO INDUSTRY LEADERS' PERSONNEL REQUIREMENTS CHANGE TO ACCOMMODATE INCREASED WORKLOADS?

Types of Personnel Increases	UPS	Fed Ex	Emery	Airborne	DHL	Burlington	Dover/ Air Force
Overtime	Yes (Double shifts for part-time workers	Yes (More hrs to part-time workers)	No	Yes (More hrs to part-time workers)	Yes (More hrs to part-time workers)	No	12 hr shifts and fewer days off
In-House Resources	Yes (Air Cargo uses small package sort personnel	Corporate Staff Volunteers	No	Casual Employees	No	Scheduled casuals and contingent employees	* Yes, base augmentees and other ports
Temporary Hires	Yes, part-time (full-time for mangt)	No	Yes, part-time	Yes, part-time	Yes, part-time (Full-time for pilots)	Yes, part-time	Yes, civilians
Other Resources							AF Reserves, ANG, and Army augmentees

* Based on the researchers' experience

fewer days off to accommodate the overtime required. Burlington Air Express has *in-house resources* already on the payroll. These scheduled casual and contingent employees are used to supplement their current part-time employees. Dover AFB/Air Force also use in-house resources such as personnel from outside of the aerial port or augmentees from other Air Force bases. *Temporary hires* are used by Emery as an additional part-time worker pool, while Dover AFB/Air Force hires civilian employees for short-term surges. Finally, the Air Force has *other resources*, namely Air Force Reserves, Air National Guard, and U.S. Army augmentees. The industry leaders do not have anything comparable to this.

The major difference found between the industry leaders and the Air Force was the use of part-time versus full-time employees. This difference is because of the differing missions/goals of these organizations. The industry leaders work on fixed, time-sensitive schedules, and the Air Force has constantly changing schedules due to worldwide situations. Therefore, because the missions are different, the scheduling of personnel is different. There is such a great difference between the industry leaders and the Air Force that neither one nor the other is best. Neither positive, negative, nor parity gaps exist.

Investigative Question Six

What are the differences between how the Air Force and air cargo industry leaders measure the effectiveness of their air cargo handling operations?

Findings for this investigative question are based upon the researchers' observations and answers to the ninth and tenth interview questions ("How do you measure the effectiveness of your day-to-day [peacetime] cargo handling operations?" and "How do you measure the effectiveness of your cargo handling operations during surges [contingencies/war]?"). Findings are summarized in Table 12 and more detailed information is found in the applicable appendices.

The *measures* included in Table 12 were determined by the researchers after all interviews were completed. These measures are used as a way to simplify findings and to group similar measures. Any no in the table means the measure was not mentioned in the interview nor observed by the researchers. It does not mean the industry leaders or the Air Force do not use these measures of effectiveness.

An example of a comparison between industry leaders and the Dover AFB's measures of effectiveness of air cargo handling operations follows. Federal Express uses *on-time departures* while Dover AFB does not. DHL uses *on-time arrivals* while Dover AFB does not. *Time standards for certain tasks* are used both by Emery Air Freight and Dover AFB. Burlington Air Express uses *pieces per manhour* as one measure while Dover AFB does not. *Sort completion time* is used by Federal Express while Dover AFB has no similar operation. Airborne Freight uses a *service level* while Dover AFB does not. Finally, *on-time pickups and*

TABLE 12: INVESTIGATIVE QUESTION 6 -- WHAT ARE THE DIFFERENCES BETWEEN HOW THE AIR FORCE AND AIR CARGO INDUSTRY LEADERS MEASURE THE EFFECTIVENESS OF THEIR AIR CARGO HANDLING OPERATIONS?

Measures	UPS	FedEx	Emery	Airborne	DHL	Burlington	Dover/ Air Force
On-Time Departures	No	Yes	Yes	No	No	No	No
On-Time Arrivals	No	No	No	No	Yes	No	No
Time Standards for Certain Tasks	*Yes	No	Yes	No	Yes (M.S.D.)	Yes	Yes
Pieces per Manhour	Yes	No	No	Yes	Yes	Yes	No
Sort Completion Time	No	Yes	Yes (Build-up Area)	No	No	No	N/A
Service Level	Yes	Yes	Yes	Yes	No	No	No
On-Time Pickups and Deliveries	Yes	Yes (SQIs)	No	Yes	No	No	N/A

* Based on the researchers' observations

Note: No means that this measurement was not mentioned in the interview nor observed by the researchers.

deliveries are used by UPS, but Dover AFB has no similar function.

As evident by this example, there are many differences between how the Air Force and air cargo industry leaders measure the effectiveness of their air cargo handling operations. Again, the differing missions/goals of the various organizations make different measures a necessity. Because the measures are so different, finding a best practice is not possible. Neither positive, negative, nor parity gaps exist.

Summary

The findings of the research study are presented and analyzed through an examination of each investigative question. It is important to note that detailed descriptions of observations and interviews are provided in the appendices, while summarization of these findings are depicted using cross-classification tables presented throughout this chapter. Table 13 summarizes all the findings.

Based upon the literature and information from Air Mobility Command, six air cargo carriers and one Air Force aerial port are identified as benchmark cases. United Parcel Service, Federal Express, Emery Air Freight, Airborne Freight, DHL Airways, and Burlington Air Express are selected as the six air cargo industry leaders, while the

TABLE 13: SUMMARY OF FINDINGS

Investigated Areas	UPS	FedEx	Emery	Airborne	DHL	Burlington	Dover/ Air Force
Specialized Cargo Type	Small Packages	Priority overnight (express)	Heavy Weight	Express (priority overnight)	Overnight (letters and boxes)	Heavy Weight	All sizes (letters through tanks)
Observations	Containers, RCC, and pathways	Nose docks, containers, and technology	Containers and coordi-nation tower	Containers	Containers	Containers, labels, and safety practices	
Written Surge Plans	Peak Plans	Peak Plans	None	None	Master Standard Data	Bump Procedures	Augmen-tation
Extra Equipment	In-house and lease	In-house and Buy	Leased locally	In-house and contracts	In-house and local	Leased locally	In-house, lease, and buy
Extra Personnel	Temp. hires and In-house	Corp staff	Temp. hires	Casual employees	Temp. hires	Scheduled casuals and contingents	Air Force Reserves and ANG
Effective-ness	Time standards, pieces/hr, service level, and on-time pickups and deliveries	Sort complete time, on-time departures, and service level	Time standards and on-time departures	Service level, pieces/hr., and on-time pickups and deliveries	On-time arrivals, pieces/hr. and master standard data times	Time standards and pieces/hr.	Time standards

436th Aerial Port Squadron at Dover AFB, Delaware is chosen as the Air Force aerial port in this research study.

Following the selection of the air cargo industry leaders and an Air Force aerial port, the literature review and responses from interviews allowed categorization of the air cargo industry leaders by the type of cargo handled. UPS, Federal Express, Airborne Freight, and DHL Airways specialize in handling small (express) packages. Emery Air Freight and Burlington Air Express specialize in moving large (heavy weight) cargo.

Analysis of the observations conducted by the researchers revealed that it *is* possible for the Air Force to learn from the air cargo industry leaders' day-to-day operations. Four categories of observation (cargo handling equipment, intransit visibility, operations interface, and safety) are selected and identified as areas of interest to the Air Force. Observations in these four areas at each commercial air cargo carrier revealed specific examples from which the Air Force can learn.

Analysis of responses to interviews conducted with the air cargo industry leaders and Dover AFB reveals differences between how the Air Force and air cargo industry leaders plan for surges. These differences are so great that selection of a *best* practice is not possible. Neither a positive, negative, nor parity gap exists.

Interview questions and the researchers' experience were used to analyze differences between the Air Force and

industry leaders' cargo handling equipment and personnel requirements during surge periods. This analysis resulted in a parity gap with respect to changes in cargo handling equipment. Although there are slight differences in how air cargo handling equipment changes to accommodate increased workloads, the outcome or result for supporting the commercial air cargo operations during a surge period is similar to that of the Air Force. In contrast, there are vast differences in how the air cargo industry leaders and the Air Force respond to changes in personnel requirements. Therefore, selection of a single *best* practice for acquiring personnel during surge periods is not possible.

An analysis of interviews and researchers' experience depicts several differences between how the Air Force and air cargo industry leaders measure effectiveness of air cargo handling operations. However, due to the vastly different missions/goals, selection of a *best* practice in measuring effectiveness is not possible. Again, neither the industry leaders nor the Air Force have the best measurements; each measure the effectiveness of their air cargo handling operations based upon the type of mission/goal of the organization.

The findings and analysis of this research study aid in answering the investigative questions. The next chapter provides conclusions of this study and recommends further studies and research.

V. Conclusions and Recommendations

Overview

A case study approach was used to benchmark practices of air cargo carriers. Limitations of this study, conclusions, recommendations for implementation, and recommendations for future research are included in this chapter.

Limitations

Due to the "ground-breaking" character of this study, limitations in the observations and interviews, along with various time constraints, emerged. First, the researchers' observations of the air cargo carriers and the aerial port were of a general, all-encompassing nature. After all observations were made, the researchers categorized observations into nine general areas. Summaries of observations using the nine general areas are included in Appendices D through J. Since the actual observations were conducted prior to identifying the nine categories, some areas may have been given more attention than others.

A second limitation became evident when analyzing the responses to the interview questions. The researchers interviewed only one person (or very few people) at each company and the aerial port. Depending on their position within the organization, some of the interviewees had different operational experience levels than others.

Responses were generally made based upon the interviewee's experience in the air cargo industry, and may not reflect every aspect of the organization's practices or views. In addition, many of the respondents had different interpretations of a *surge* period. Although a definition was provided upon request, the responses to the interview questions revealed that a surge by one respondent implied a unique period of time (i.e. Christmas), whereas other interview respondents based their responses on daily/nightly fluctuations in workloads.

Finally, time was a limitation in the observations, interviews, and the entire research effort. It was not possible to obtain feedback from the air cargo carriers and the aerial port concerning the observations and para-phrased responses to the interviews. In addition, there was not enough time available to conduct an *in-depth* study typically required in case studies.

Conclusions

The research question for this study is "What can the Air Force learn from air cargo industry leaders to improve the peacetime and wartime efficiency and effectiveness of moving cargo through air freight terminals?". By implementing a case study methodology in this research effort, this study shows that the Air Force *can* learn from observing the air cargo carriers. Cargo handling equipment,

intransit visibility, operations interface, and safety are four areas from which the Air Force can learn.

This research reveals that air cargo industry leaders are just beginning to move large (heavy) freight. Based upon observations and the researcher's knowledge of Air Force air cargo operations, it is evident that the Air Force's ability to handle large cargo is superior to that of the commercial air cargo carriers.

In addition, requirements for intransit visibility of cargo moved by the commercial air cargo carriers was different than the Air Force. The *capability* of the Air Force to track cargo throughout the airlift system is not much different from the air cargo carriers. However, much of the cargo moved by the commercial carriers is delivered within one or two days; hence, the demand to continually trace the cargo over a long period of time is limited. The Air Force, on the other hand, may have cargo awaiting airlift for several days or weeks depending on mission requirements. Thus, the demands by customers to continually identify the whereabouts of their cargo differs between the commercial air cargo carriers and the Air Force.

Finally, most of the interview questions focused on surge planning and operations. However, the mission of the Air Force and the goals of the air cargo industry leaders are so different that industry leader practices in these areas cannot effectively be applied to the Air Force.

Recommendations

Based on the findings outlined in Chapter IV and the appendices, several recommendations are posed by the researchers. The recommendations are divided into two categories. First, the researchers recommend specific items for implementation in Air Force air cargo operations and, second, several possibilities are recommended for future research.

Recommendations for Implementation. Although the Squadron Operations Officer at Dover's aerial port stated that pallet dollies were not practical due to the amount of manpower required, a thorough investigation and a long-term test of a container and pallet dolly systems at one of the strategic aerial ports is recommended. This test should be a "stand alone" test and not in conjunction with using the 463L system of pallets, forklifts, and K-loaders. It is suggested that the test first be used on commercial aircraft with TA-40s; then, if successful, use on military aircraft should be tested. Customized containers with proper gravitational force restraint criteria for military aircraft accomplishing wartime maneuvers should be developed for this test. (Commercial containers should first be studied to determine if they meet the restraint criteria and can be integrated with the Air Force's 463L system). Also, see-through containers, secure containers, and collapsible containers should be developed and tested for use in the Department of Defense. Although the collapsible container

used by UPS is a good idea, the design of the container would not suit the Air Force's mission requirements.

Next, the Air Force should continue to support intransit visibility systems currently in use, such as the Cargo Movement Operations System (CMOS) and the development of Radio Frequency IDentification systems (RFID) to track aircraft parts (76). Technological advances used by commercial air cargo carriers and other industries should be monitored. For example, Federal Express is continuously developing new technology to improve intransit visibility of cargo shipments. These developments include studying the possibility of barcoding their containers or using radio frequency tags and transmitters to monitor the cargo within their freight facility.

Third, several safety practices are recommended for implementation during all cargo handling operations. Lifting belts (similar to weight-lifting belts) should be worn by all personnel handling cargo. The researchers recommend having a strip of reflective tape sewn on the lifting belts, so the belts can serve two purposes--a back support and a reflective belt for nighttime operations. Of course, when outer-garments are worn (i.e. cold weather gear), other reflective gear should be used.

Finally, similar to UPS' marked walkways for pedestrians, the researchers recommend Air Force aerial ports consider painting walkways to improve safety within the work environment. These walkways can easily be painted

onto the pavement in cargo handling areas and between work areas or aerial port facilities.

Recommendations for Future Research. Several opportunities exist to study other areas related to this research effort. The researchers determined that observing and studying other air cargo operations stimulates new ideas which have the potential to improve various aspects of Air Force operations. In this light, the following are four areas recommended for future study:

1) Similar studies should be conducted on passenger airlines that carry cargo. Since the Air Force moves passengers (troops) on many of its airlift missions, research in this area may reveal other methods to improve the Air Force's air cargo operation. The demands and limitations when moving passengers with cargo often pose great challenges to the Air Force aerial ports.

2) An *in-depth* case study of <u>one</u> specific air cargo carrier or passenger/cargo airline should be conducted. Since time was a major limitation in studying the six air cargo carriers, research on one company may allow more time for a detailed study. In addition, future researchers should choose specific areas of observation, e.g. cargo handling equipment, operations interface, intransit visibility, and safety.

3) The operations used by the United States Postal Service are recommended for study. The researchers found that some of the technology and practices used by the US

Post Office were adopted by the commercial air cargo carriers that were covered in this study.

4) The movement of hazardous cargo (to include explosives) by commercial cargo carriers (air or surface carriers) should be studied. Since Air Force aerial ports and transportation squadrons move hazardous cargo on a daily basis, research in this area would be extremely valuable.

Summary

This chapter provides conclusions and recommendations of this research effort using a case study approach to benchmark the air cargo industry leaders. The researchers found that the Air Force handles large cargo more effectively than commercial air cargo industry leaders; however, the Air Force can learn from the commercial air cargo carriers by observing their operations. Cargo handling equipment, operations interface, intransit visibility, and safety can be improved by adopting some of the industry leaders' practices.

Appendix A: Investigative Study Questions for the Air Force

These questions were asked of the air cargo managers at Air Mobility Command, Scott AFB, Illinois in an investigative study to narrow the focus of the research.

1. When planning for contingencies, does the Air Force use standing rental agreements or Contingency Standing Route Orders (CSROs) to increase vehicle and equipment capability?
   - If so, are these handled at the Air Force, MAJCOM, or wing level?

2. How do you measure our performance during contingencies?

3. Do any of the major (strategic) aerial ports have automated cargo handling equipment such as automated storage and retrieval systems or conveyors?

4. Have you ever heard of third party warehousing? Is there any such operation in the Air Force?

5. Is there a current study to determine the feasibility of using containers/conexes for the movement of general cargo during peacetime or wartime?

6. Has the Air Force ever considered using Commercial Off-the-Shelf (COTS) systems for tracking cargo?

7. If you could ask a civilian cargo company any question, what would you ask? Who would you ask and why?

8. What is the status of the 60K loader?

9. Do the Airlift Clearance Authorities (ACAs) in the CONUS work the same as the ACAs overseas?

Appendix B: Pilot Study Questions for the Air Cargo Industry

These questions were asked of the hub manager at Airborne Express in Wilmington, Ohio in a pilot study to narrow the focus of the study.

1. What is the organizational structure of Airborne Express?

2. What kind of cargo handling equipment is used in your hub operations?

3. What kind of cargo tracking system is used in your nation-wide operations?

4. How many personnel work in your hub and what kinds of shifts do they work?

5. How many aircraft per day are handled? How quickly is an aircraft downloaded and uploaded?

6. Who are your major competitors?

Appendix C: Interview Questions

These questions were asked of all cargo industry leader operational managers and of the aerial port operations officer at Dover AFB, Delaware.

1. What type of cargo do you specialize in handling and what other types of cargo do you handle?

2. Do you have written procedures in place for surge periods? If so, are these company-wide (Air Force wide), regional, or local?
   Clarifying definition: Surge is defined as "to rise suddenly to an excessive or abnormal level".

3. How often are your surge plans updated and do you ever test your plans?
   Clarifying definition: Test is defined as "a critical examination, observation, or evaluation".

4. What effects do surges have on your cargo handling equipment?

5. If extra equipment is needed, do you obtain it through in-house resources or by contract? Do you go through company-wide (Air Force wide), regional, or local channels?

6. During surge periods, how do your personnel levels change?

7. Do you go through company-wide (Air Force wide), regional, or local channels to get additional personnel? Are they hired as part-time or full-time?

8. How do you train these additional employees and is there a learning curve associated with this training?

9. How do you measure the effectiveness of your day-to-day (peacetime) cargo handling operations?

10. How do you measure the effectiveness of your cargo handling operations during surges (contingencies/war)?

Appendix D: United Parcel Service

Observation

Setting

The Louisville, KY airport, Standiford Field, was the setting of a June 1993 tour of United Parcel Service's (UPS) daytime, second day air, hub operations. During the day, between 20 and 25 aircraft transit the hub, while 65 to 70 aircraft arrive and depart the hub during nighttime operations. The nighttime operations were not observed.

UPS has several buildings connected together to form their package sorting facility. This facility was very clean, but was not very well lit inside. A large aircraft parking ramp surrounds the UPS complex at the airport. At one edge of the parking ramp was a parking area for all aircraft cargo handling equipment and other support equipment.

The most unique part of UPS' operation, compared to the other carriers observed, is that the hub relies heavily on its trucking interface. UPS calls the large tractor-trailers that interface at their hub their "feeders" because these trucks "feed" the majority of the cargo into the air system.

Cargo Handling Equipment

Small packages that arrive at the sort facility are fed into the facility from either a feeder truck or from an

incoming cargo container. The cargo containers are fiberglass airline cargo containers that are contoured to the shape of the aircraft. The containers have two doors on one side that open outward and provide an area for loading/unloading cargo that is about half as wide as the container.

UPS is testing a new type of container that is made of a clear, see-through material. These new containers are shaped and function just like the old containers but allow people to see if cargo space is available in a partially loaded container without having to open the door.

UPS has a unique collapsible container that is used in places that either cannot store containers or that have a high theft rate for their containers. These containers are made of corrugated cardboard covered with a plastic-type coating. The shape of these containers is maintained with small pieces of wood that support the sides and top of the containers. UPS claims that one container can be used seven to ten times before becoming unserviceable. Once this container is not useable, it is recycled and materials are used for a new container.

Dollies (or what the Air Force calls pallet dollies) are used to move cargo containers from the sort facility to the aircraft and vice versa. Tugs are used to transport the dollies.

As mentioned earlier, the sort facility has conveyors that move cargo through the sorting process. These

conveyors moved very quickly. Cargo that was considered too large for the sort facility never reached the conveyors; instead, the large cargo was sent to a separate area known as the air cargo area where it was palletized.

Forklifts were used in the air cargo area to move cargo pallets. The pallets were aluminum airline pallets ("cookie sheets") like those used by many of the other carriers. The actions observed in this area are further explained in the large cargo handling section of this observation.

Finally, K-loaders were used to load containers and pallets onto the aircraft. Containers and pallets are pushed from the dollies onto the K-loader which has rollerized flooring. Then, two containers or pallets can be raised to the main deck of the aircraft for loading.

Aircraft

All of UPS' aircraft are maintained by UPS employees, with the majority of the maintenance being performed at their main hub in Louisville. UPS has the following number and type of aircraft:

52	727s
30	757s
49	DC-8s
11	747s

Small Package Sort

Both feeder trucks and incoming containers arrive at the sort facility and are unloaded by sort personnel and placed onto the conveyor system. The cargo is first sorted

by zip codes and states (which are memorized by the primary sort personnel). Eventually, all cargo is sorted by a three letter airport code, then loaded into outgoing cargo containers. Cargo that is small enough to fit into a container, but may damage the conveyor system, is sorted manually and placed into an outbound container.

Large Cargo Handling

Cargo that weighs over 250 pounds is considered "air cargo" and is not handled in the sort facility. The air cargo building handles any size shipments; none of the cargo is moved by contracted means.

Air cargo is placed on aircraft cargo pallets, then covered with plastic and airline cargo nets which, in comparison to nets used by the Air Force, are thin and rope-like. After cargo is covered with the plastic and nets, the pallet is picked up by forklift and placed on a dolly. No dunnage was used under the pallets while they were being built; the pallets were placed directly on the floor. A worker was observed making many attempts to pick up a pallet from the floor. Outside of the air cargo building, pallets were stacked on top of each other, and the majority of useable pallets visible were warped.

UPS has the capability of "marrying" pallets together for extremely large loads. These coupled pallets were transported to the aircraft with large dollies, similar to the single-sized dolly.

Employees

Like all of the air cargo carriers observed, UPS' employees who sort and load/unload cargo are part-time workers. Most of the workers observed were young adults, both male and female.

Intransit Visibility

All of the packages sorted at the hub had, as a minimum, one barcoded label. Many customers placed their own barcoded labels on packages for their internal use. While each label was visually inspected for the proper zip code, state, and three letter airport code, scanning of the barcodes was not observed at the Louisville hub.

Since UPS heavily advertises their *Total Track* system, the observers asked how that service was given intransit visibility. Apparently, if the *Total Track* service is purchased by a customer, that cargo is scanned upon reaching and leaving the sort facility.

Operations Interface

The load planners at UPS were not located near the area where cargo containers or cargo pallets were filled with cargo. Instead, after a container or pallet was weighed, the weight and identification numbers were put into a computer. Then, load planners would use that information to create load plans for each aircraft. One load planner could load plan several different aircraft on a given shift. The

load planning personnel had radio contact with the load teams who were actually loading the cargo.

UPS' Ramp Control Center (RCC) was used to coordinate all functions of the hub operations. Representatives from maintenance, refueling, and the cargo load teams were present in the RCC. Video cameras were used for viewing all of the aircraft parking ramps and monitoring operations. All personnel within the RCC used radios to coordinate functions for their particular area, and one manager was in charge of the RCC and responsible for all decision making. This function is similar to the consolidated command post concept prevalent in the Air Force.

Safety

Clothing and protective gear are important part of employee safety. Employees did not have a uniform or any apparent dress code but were required to wear sturdy boots. Leather cargo gloves were optional for everyone. No lifting belts were observed on any employee. Hearing protection was optional for workers inside of the sort buildings and was mandatory for workers on the aircraft parking ramps. Since nighttime operations were not observed, effectiveness of outside lighting and reflective gear on employees was not observed.

UPS had clearly marked pathways for walking, and all vehicles were observed yielding to personnel on the

pathways. Also, all vehicles observed driving through the sort facility and on the ramp were operated safely.

Interview

Title of person(s) interviewed: Hub Manager, Second Day Air

District Customer Service, Area Manager

District Customer Service, Air Cargo

Note: Three different people were present during this interview. Each individual answered the questions from the perspective of his/her area of responsibility. During the interview, some of the answers given by the respondents pertained to different questions; thus, the researchers integrated all three of the interviewee's responses and placed the response(s) with the appropriate question.

1. What type of cargo do you specialize in handling and what other types of cargo do you handle?

UPS specializes in handling small packages. However, all types of cargo, except dangerous goods (i.e hazardous materials and explosives) and automobiles (however, new automobiles are allowed), are moved by UPS.

The Hub Manager of Second Day Air stated his portion of UPS' operation specializes in small packages that weigh less than 70 pounds. In addition to small packages, UPS has an Air Cargo Service section that handles cargo (large freight) that may weigh between 70 and 8,000 pounds. However, the weight limitations for large freight

are based on the capability of aircraft used to move the cargo.

Large freight includes food products, pharmaceuticals, tires, new autos, etc. UPS uses large freight as "space fillers" or to fill positions on the aircraft on a space available basis--the goal of Air Cargo Service is to fully utilize each aircraft lane segment. The Air Cargo Service section's customers are freight forwarders who consolidate multiple shipments and use UPS to move these shipments. The freight forwarders sell the positions (in most cases, 8,000 pounds are allowed for each aircraft position) to corporate customers, or the general public, and UPS will use its large aircraft to move the cargo. The Air Cargo Service section has a computerized system that is linked to over 80 gateways (airports with UPS service) that can input expected allocation for movements out of the gateway. This information, which can be adjusted daily, is used as a guideline to determine how many positions are available to move large freight from each gateway. Within the last few years, the demand for moving large freight has increased and UPS has taken advantage of this niche in the market.

2. Do you have written procedures in place for surge periods? If so, are these company-wide, regional, or local?

Yes, UPS' written procedures for surge periods are called "peak plans". UPS considers December its peak period for the majority of its cargo, with planning at the corporate level beginning in January (12 months in advance). However, Air Cargo Service (large freight) experiences a different peak period during the months of June through October. In addition to the Christmas peak period, UPS also has other surge periods such as Mother's Day and Easter. The development of these peak plans is a continual process that begins with a national plan that filters down to each region and then each district (local area). The plans are customized to fit the purposes of each district and are written to accommodate all conceivable contingencies or problems.

Operational personnel begin their planning in August. These operational plans are very detailed and include forecasts for the number of people required for the peak period and how much volume UPS anticipates to handle during the surge. The forecasts of personnel and volume are developed in conjunction with personnel from Marketing and Industrial Engineering with a goal to be within

five percent of the actual number of people hired and actual volume handled during the peak. Several reviews of the operational portion of the plans are accomplished with the district manager and his superior attending the review meetings.

Over the past two months, UPS has experienced some unanticipated surges. These unanticipated surges were handled by lengthening the sort period (the amount of time required to sort packages within the hub) and hiring more people.

In addition to peak plans, UPS also has "cut back plans" that plan for periods where there are *decreases* in workload (the opposite of surges). UPS attempts to accommodate these decreases in workload without laying off any employees.

3. How often are your surge plans updated and do you ever test your plans?

Peak plans are incrementally updated every month, week, and day as the December peak period approaches. From August through October, the peak plans are updated on a monthly basis. During November, the plans are updated every week. In the month of December, the plans are updated every day.

UPS will test the plan two weeks prior to the scheduled peak period (December for small packages). The workload estimated in the peak plan is tested by

increasing the manpower (and equipment, if necessary) within the sort facility to the level anticipated in the peak plan. For example, the plans may call for a specified number of pieces of cargo to be processed through the sort. In order to test the capability of the hub to process this specified amount of cargo, the operational managers will increase the number of employees within the hub facility to accommodate the increase in workload. The test helps to determine if there are any "pinch points" or flow problems that need to be worked out and if there are any additional changes that need to be made before the actual surge period.

Related to the operational test, adjustments to plans are likely to occur. For example, an account executive may have planned for a specific increase in an account (corporate customer) and this, in turn, necessitates an increase in the number of employees required within the sort to handle the additional workload. As the peak period approaches, the account executive may have a more accurate estimate on the actual customer requirements. Thus, the plan is updated to reflect this new estimate.

4. What effects do surges have on your cargo handling equipment?

If there is a "true" surge (versus a temporary surge period that lasts for a few weeks), there is an increase in the amount of cargo handling equipment needed by UPS to handle the added workload. A true surge implies that any increase in equipment will be in made in proportion to the increase in the workload. For example, UPS experienced a surge period two months ago and was uncertain whether or not the surge was permanent or temporary. It was later established that the added workload was a permanent increase and more equipment was ordered, more people were hired, and the hub facility was realigned.

5. If extra equipment is needed, do you obtain it through in-house resources or by contract? Do you go through company-wide, regional, or local channels?

UPS uses both in-house resources and contracts to acquire additional equipment when needed. The first choice is to acquire equipment from in-house resources and then, if necessary, contract out for additional requirements. For example, UPS may look at other gateways (airports) to determine if there is any equipment not being used and move the equipment, if required.

If additional requirements cannot be satisfied using in-house resources, UPS will lease equipment. For example, during surge periods there are requirements for rollerized equipment, and UPS will lease rollers for their flatbed ground feeders (tractor trailers) if there are not enough of these rollerized trailers available in-house. In addition, UPS will lease aircraft, if necessary.

Approval to lease additional equipment is contingent upon the dollar amount of the contract requirement. The higher the monetary value, the higher the level of approval--specific dollar amounts require either local, regional, or corporate approval. A proposal for additional equipment may originate at the hub and a committee evaluates the request to determine the best alternative. A committee evaluates proposals at each level of expenditure.

The Air Cargo Service section at Louisville uses outside vendors for all of the ground movement of cargo (i.e. large freight moved to the hub facility). The ground feeders used to move the large freight to the Air Cargo warehouse facility are leased, and the contracts are negotiated both locally and nation-wide. However, UPS seldom has to lease additional equipment for

Air Cargo Services. Since the Air Cargo Service experiences a peak period from June through October, extra equipment required within the Air Cargo warehouse facility is often obtained from the small package sort area (since their peak is in December). This reduces the requirement to lease equipment used within the Air Cargo Service facility.

Some gateways used by UPS to move large freight do not have their own equipment. For the gateways that do not have equipment to handle air cargo movements, UPS has contracts in-place to lease equipment within the local area of the gateway to move large freight during peak periods.

6. During surge periods, how do your personnel levels change?

Personnel levels increase in proportion to the workload levels. Basically, if the volume increases by 20 percent, the manning required to handle this workload increases 20 percent. In addition, if the volume increases by 50 percent, the manning increases by 50 percent.

UPS will "double-shift" employees to accommodate increases in workload. For example, during surge periods, employees from the day shift sort may volunteer to work the night shift if there is an anticipated increase in workload for

the nighttime operation (this refers to part-time employees who work in the sort facility and normally work a four hour shift).

7. Do you go through company-wide, regional, or local channels to get additional personnel? Are they hired as part-time or full-time?

Additional personnel required to work during any surge periods are hired through the Human Resources Department at the local level. In addition to personnel hired to work at the hub in Louisville, each regional hub hires personnel from their perspective local area (i.e. the hub in California uses their Human Resources Department to hire from within California).

Depending on the requirement, additional personnel may be hired for management in full-time or part-time positions. However, management positions are first advertised internally within UPS and, if the necessary expertise cannot be found, personnel from outside of UPS are hired to fill these management positions. Most additional personnel hired to work within the sort operation are hired as part-time workers.

8. How do you train these additional employees and is there a learning curve associated with this training?

UPS' training program is modified to accommodate additional employees hired to work in

the small package sort facility for the peak period. Since these employees are hired for a specific amount of time, they do not learn all facets of the operations. Instead, they are trained specifically for the job they will perform during the peak period. UPS has training packets for personnel hired during the peak period.

The Air Cargo Service section of UPS in Louisville has not had to hire part-time employees to cover any surges in their operation. Since the peak period for Air Cargo is longer and covers a different timeframe than the peak period for the small package sort operation, many of the employees from the small package sort will work in Air Cargo during an increase in workload. In addition to using employees from internal sources to work large freight, the Air Cargo section will use double shifts, if necessary, to handle any requirements during a surge period. Normally, personnel working in the Air Cargo warehouse facility receive three weeks of training.

9. How do you measure the effectiveness of your day-to-day cargo handling operations?

UPS measures the effectiveness of the small package sort in two primary areas, cost and service. Cost measures are based upon the volume of packages handled per hour (pieces/hour). All

work is measured and there are planned times for completion of the work. The goal is for the sort to be within five percent of the predicted performance level and cost. Service measures are based on the amount of on-time deliveries, the number of packages damaged, and other service measures.

The personnel within Air Cargo Service section (specifically for the personnel who make reservations for large freight customers) measure effectiveness in four areas: 1) service failure frequency or the number of positions moved versus what was booked for movement; 2) service level percent effective (i.e. cost of phone calls of the personnel working Air Cargo Service reservations); 3) cost in hours per position moved; and 4) On-Job-Supervision (OJS) where workers are observed and feedback is given.

10. How do you measure the effectiveness of your cargo handling operations during surges?

The same day-to-day effectiveness measurements are used during surge periods.

Appendix E: Federal Express

Observation

Setting

The Federal Express (FedEx) "superhub" at the Memphis International Airport was the setting of a June 1993 tour of FedEx's nighttime hub operations. During a four hour window every Monday through Friday in the month of June, an average of 109 aircraft arrived and departed the superhub.

Several large interconnecting buildings with six input areas form the sorting facility. The lighting inside of the sorting facility was good, and the work areas were clean. However, due to the amount of equipment and vehicles constantly moving in the facility, along with the summertime heat, the work areas were very hot and congested. Narrow driving lanes and very narrow walk paths were constantly in use by tugs pulling pallet dollies and various other vehicles and people.

The outside of the superhub was surrounded by a very large aircraft parking ramp which was lit by very few lights attached to buildings. The majority of the light shining on the aircraft came from portable light carts. This left the area between aircraft very dark.

The most unique features of the superhub are the "nose docks" which are used to park and unload aircraft. Aircraft park directly next to these docks, then the crew departs and

the offloading and onloading of cargo begins. These docks eliminate the need for specialized aircraft loading equipment and they feed cargo directly into a sorting facility. Although the nose docks allow for fast onload/offload of cargo, there are only a few nose docks. Also, the conveyor system within the attached sort facility is not capable of handling large cargo.

Besides the amount of aircraft ramp space surrounding the superhub, the amount of cargo handling equipment and other vehicles was impressive. FedEx uses very large parking lots to store the enormous amounts of equipment it uses on a daily basis.

Cargo Handling Equipment

Like many of the other air cargo carriers, FedEx uses tugs to pull dollies filled with cargo containers. Each dolly can hold one cargo container or one cargo pallet. Compared to the other carriers, FedEx has the largest variety of cargo containers. They have many different size containers to fit a wide variety of aircraft types, plus they have containers that fit into the belly compartments of many of their largest aircraft. Most of FedEx's containers are made of a clear, see-through material so that partially full containers are easily identified. FedEx still uses some of the typical, white, fiberglass containers, but they are transitioning to the all clear, see-through containers.

FedEx also has a variety of doors on their containers. The containers that are currently being purchased have a "door" opening that is about half the width of the container and opens outward like a double door. Other containers have vinyl, tarp-like "door" openings through which cargo is loaded and unloaded. These large openings allow any piece of cargo that can physically fit into a container to be placed inside of the container without wrestling it through a small door opening.

For large cargo that cannot fit into a container, they use aluminum, airline pallets. The large, or heavy weight, cargo is placed onto the pallet and covered with a plastic sheet. Then, commercial cargo nets made of a thin, rope-like material are used to provide the same restraint that a container would give to a similar load of cargo. Forklifts are used to place these pallets onto dollies for transport to aircraft just like the containers are transported.

To load containers or pallets onto the aircraft, FedEx uses different size K-loaders depending on the type of aircraft being loaded. Each loader has a rollerized flooring on which containers or pallets can easily be pushed from the dollies. Then, two containers or pallets can be raised up simultaneously to the main deck of the aircraft for loading.

Aircraft

FedEx has a fleet of 455 aircraft, varying in size as listed below. Maintenance for their fleet of aircraft is accomplished in-house at the superhub.

8	MD-11s
8	B-747s
30	DC-10s
161	B-727s
216	Cessna 208s
32	Fokker F-27s

Small Package Sort

Like all other air cargo carriers, FedEx sorts its small packages several times with the help of very fast moving conveyor belts. As soon as a package is removed from a container, its barcoded label is scanned. Then, if the package is in a document (letter) package, it is sorted by hand before going to the primary sort area of the facility. In the primary sort area, documents are sorted by the region of the country for which they are destined; then, the documents move on conveyor belts to the secondary sort area.

Small boxes are primarily sorted by a regional code that is manually keyed into a computer by a technician. This code identifies the correct diverter to send the package to the proper secondary belt. Then it passes through two electric eyes (lasers) that measure its length to trigger a diverter to push the package down the proper slide to the secondary belt at the right time. From there, the packages move on a conveyor belt to the secondary sort area.

In the secondary sort area, all documents and small boxes are sorted by a three letter airport code. After this sort, all packages move by conveyor to the container upload area. In this area, all packages are manually checked by city, state, and zip code, then the barcoded label is scanned before placing the package into a container.

Any cargo that is too bulky for a person to maneuver, or that has rough edges that can damage a conveyor belt, is individually moved through the sort process. When this cargo arrives at the container loading area, it is handled the same way other cargo is handled.

During this observation, part of the sorting facility was under modification for a semi-automated, primary sort process for small boxes. Once on-line, this process will use a computer to scan the package label instead of a technician keying in the regional code. This new process should save a lot of time and use fewer people.

Large Cargo Handling

Cargo that weighs over 150 pounds is considered large or heavy weight cargo. This type of cargo is built onto airline cargo pallets in a separate building called the heavy weight cargo area. Once the cargo is on a pallet and covered with plastic and restraint nets, it is picked up by a forklift then weighed and placed on a dolly. It was observed that all of the pallets were placed on wooden

dunnage while they were being loaded with cargo. This allowed easy access for the forklift to pick up the pallet.

Observation in the heavy weight area showed a lot of large pallets built and awaiting airlift. The heavy weight section was also undergoing an expansion project.

Employees

Like all of the air cargo carriers observed, FedEx's employees who sort and load/unload cargo are part-time workers. Both male and female workers were observed in all areas.

Intransit Visibility

All of the packages sorted at the hub had, as a minimum, one barcoded label. Also, many customers placed their own barcoded labels on packages for their internal use.

FedEx was the only carrier observed to scan the barcoded labels on each package as it reached the superhub and when it was loaded into a container or onto a pallet leaving the superhub. Also, they are researching new technology that will provide more intransit visibility.

In the future, FedEx will either barcode each container or use radio frequency tags and transmitters to track the location of each of its containers. This will ensure more visibility over its cargo than they currently have.

Operations Interface

A Systems Control section tracks all aircraft inbound to the superhub and outbound from the superhub. Federal Express' Control Room controls the sorting process and monitors package flow through the sorting facilities. Also, inbound aircraft arrivals and approximately 30 unloading teams are coordinated by the control room. All of this is accomplished through the use of video cameras, computers, and hand-held radios. The unloading team chiefs (supervisors) carry hand-held computer terminals which allow them to access information on aircraft arrivals, load sequences, and various other types of information. The supervisors also carry hand-held radios, but the computer is the primary source of information.

Once cargo has transited the sort facility and is loaded into containers or onto pallets, it is load planned. Load planners at FedEx were in a centralized location where containers are weighed. Each load planner is responsible for planning the weight and balance on several aircraft during the nighttime operations. Once a load planner begins a load plan, all of the information is stored in a computer. Nearly anyone with a FedEx computer terminal can see load plans, however, only the load planner can make changes to the load.

Once a load plan is complete, the load teams begin to load the cargo onto the proper aircraft. Onload teams (separate from offload teams) are assigned monthly to the

flights scheduled for loading. (Some offload teams also assist in some onloads). The load team chiefs are handed a copy of the load sequence by the load planner for the aircraft they are assigned to work. While the load team chiefs also have hand-held radios primarily for speaking with outbound senior managers, they use the "Supersystem" for aircraft parking and departure information. The Supersystem computer updates a series of screens located throughout all of the sort buildings. These screens reduce the amount of radio traffic and keep everyone updated on pertinent information.

Safety

Clothing and protective gear are important parts of employee safety. All of FedEx's sort and ramp personnel wore uniforms which consisted of black shirts, black shorts, and boots. Some employees wore grey shirts which were part of an old uniform that was being phased out. Cargo gloves were optional.

Employees working on or around the aircraft parking ramp were required to wear hearing protection and a very small reflective arm band. These arm bands held their aircraft ramp badge/FedEx identification and were worn on their left arm. With the identification taking up most of the space on the arm, only a few inches of reflective material could be seen on the average size person.

As mentioned previously, the traffic congestion inside of the superhub made the drive paths and walkways very narrow. The poor lighting outside, coupled with the black uniforms and very little reflective gear, made the ramp area very unsafe. Also, there were no visible driving lines or paths on the outside of the sorting facility or on the ramps.

With numerous vehicles quickly moving from the sort facility to the aircraft parking ramp, poor lighting, black uniforms, and little reflective gear, it was extremely difficult to see anything outside. In fact, the areas between aircraft where there were no portable lights were totally black.

Interview

Title of person(s) interviewed: Senior Manager, Field Sort Operation-South/Hub Engineering

1. What type of cargo do you specialize in handling and what other types of cargo do you handle?

Federal Express (FedEx) specializes in priority overnight movement of small boxes and documents that weigh less than 150 pounds. Another type of cargo moved by FedEx includes "heavy weight" cargo that weighs more than 150 pounds. The maximum allowable weight for overnight heavy weight shipments is 1,500 pounds. "Deferred service" includes all cargo (any weight)

that can fit on FedEx's aircraft and is not requested to be moved overnight.

2. Do you have written procedures in place for surge periods? If so, are these company-wide, regional, or local?

Yes, FedEx employees develop "peak plans" to accommodate any surges in workload. Peak plans are completed with inputs from all levels of the operation. Regional hubs develop their own peak plans. Meetings are conducted monthly; then as the peak (surge) period draws closer, meetings are held every week. Prior to development of peak plans, meetings are held to determine what lessons, if any, can be learned from the previous peak period. For example, FedEx conducts "post-mortem" meetings in January to discuss any lessons learned from the previous peak period (Christmas). Peak plans for December are started in February to prepare for the next Christmas surge period.

FedEx also develops strategic plans. These plans cover a two to five year period and plan how facilities will incorporate forecasted peak periods.

3. How often are your surge plans updated and do you ever test your plans?

Peak plans are updated and tested annually. The success of the plans is based upon experience of the previous year and how customers were

serviced. The plans are fine-tuned on a monthly, bi-monthly, or weekly basis as the peak period approaches. Plans for a specific period are finalized 90 days prior to the projected surge period and include a formalized timeline for the 90 days before the peak period begins.

4. What effects do surges have on your cargo handling equipment?

Peak periods require more cargo handling equipment. FedEx's plans are based on what is anticipated for the peak period. Ground Support Equipment (GSE) and equipment spares are ordered prior to the peak period. During non-peak periods, the equipment is kept as excess until the next peak period. However, peak periods are fairly close together. For example, GSE acquired for the December peak is held by FedEx until March when the volume reaches another peak.

When acquiring GSE, FedEx factors in a certain amount of spares to cover equipment that is out of service (in maintenance). However, peak plans are developed with all on-hand equipment taken into consideration to include spare equipment purchased.

5. If extra equipment is needed, do you obtain it through in-house resources or by contract? Do you go through company-wide, regional, or local channels?

Management at all hubs participates in the GSE planning process. If more equipment is required than what was originally planned, the decision to acquire more equipment is made at the superhub in Memphis (centralized). The Memphis superhub first determines if in-house resources can be moved from other hubs to accommodate the added requirement. If in-house resources are not available, the superhub will purchase equipment from outside vendors.

6. During surge periods, how do your personnel levels change?

Personnel levels increase during surge periods. Last year FedEx required 350 more people to handle a one week peak period during the nighttime sort. (There are approximately 8,000 employees working during a nighttime sort operation). FedEx did not hire extra people to handle this peak period; instead, employees from the corporate staff volunteered to work in positions within the sort operation. In addition, employees who worked during the daytime operation were moved to the night shift for the one week period.

7. Do you go through company-wide, regional, or local channels to get additional personnel? Are they hired as part-time or full-time?

FedEx uses local channels when hiring additional personnel. Each regional hub hires personnel from the local area. As explained above, additional employees are not hired during surge periods (corporate staff and daytime employees are used to handle a nighttime surge).

8. How do you train these additional employees and is there a learning curve associated with this training?

FedEx employees who work during the peak period are trained locally. Corporate staff employees who temporarily work in the sort operation are placed in positions that do not require extensive operational training (i.e. positioning boxes on conveyors for visual scanning by keyboard operators). Employees who are more experienced and are properly trained, are moved to applicable areas (i.e. loading aircraft).

9. How do you measure the effectiveness of your day-to-day cargo handling operations?

FedEx uses three measurements to determine the effectiveness of their day-to-day cargo handling operations: 1) completion of the sort operation at a specified time; 2) on-time aircraft departures; and 3) service levels provided to the

customer. Each measurement is given equal weight and all measurements are equally important.

The first measurement used by FedEx is whether or not the sort operation is completed on time. FedEx refers to this as "the sort going down on-time" and a goal is set every night to complete the sort operation at a specific time. If the sort goal is not met, FedEx looks at what factors affected their inability to meet the goal.

The second measurement, on-time aircraft departures, is tracked every day, week, and month. FedEx reviews how many minutes its aircraft are delayed and what factors affect any delays (i.e. maintenance, loading, fuels, etc.). Even if the sort operation is late, the overall goal is still to get the aircraft out on-time.

The last measurement is the overall service provided to the customer. FedEx has an internal measurement system called Service Quality Indicators (SQI) which are 12 items that help measure the satisfaction of FedEx customers. The SQI include: 1) right day lates (cargo that arrives on the right day but late); 2) wrong day lates (cargo that arrives on the wrong day and is late); 3) international service; 4) traces (how many calls they receive to trace cargo);

5) complaints; 6) the number of missing proof of deliveries; 7) invoice adjustments requested; 8) missed pick-ups; 9) damaged packages; 10) lost packages; 11) over-goods (packages that break open or spillage); and 12) abandoned calls (the number of calls not answered in a certain period of time).

10. How do you measure the effectiveness of your cargo handling operations during surges?

The same day-to-day effectiveness measurements are used during surge periods.

Appendix F: Emery Air Freight

Observation

Setting

The Emery hub at the Dayton International Airport was the setting of a July 1993 tour of Emery's nighttime hub operations. During a four hour window every Monday through Friday, approximately 37 aircraft transit the hub.

Emery uses one building to sort all incoming and outgoing cargo, regardless of cargo size. This sort facility was clean and well-lit, with entries into the building on two sides, North and South. The predominant characteristic, in comparison with the other commercial carriers observed, prevalent in the sort facility was the large number of forklifts.

Outside of the sort facility was a large, well-lit parking ramp on which aircraft were well-spaced for safety reasons. The ramp had enough space for growth and could most likely hold twice the number of aircraft currently handled.

There was a lot of activity on and around each aircraft during the observation. Each arriving and departing aircraft had cargo load teams, forklifts, containers, pallet dollies, K-loaders, and slave racks--all of which will be described in the next section.

Cargo Handling Equipment

The majority of Emery's cargo is transported by some type of forklift. Propane-powered forklifts transport containers and pallets of cargo to and from aircraft. The same forklifts also move empty containers or pallets to the cargo build-up area in the sort facility.

Cargo that is too large to move through Emery's conveyor system, is transported in "truck totes" or wire cages to the cargo build-up area. Small forklifts, called "schrecks" are used to transport the truck totes around the sorting facility.

A majority of the cargo that Emery receives is moved in fiberglass cargo containers that are contoured to the shape of the type of aircraft on which it will be loaded. These containers have vinyl, tarp-like "door" openings through which cargo is loaded and unloaded. The "door" comprises the entire side of a container. These large openings allow placement of any piece of cargo that can physically fit into a container without wrestling the cargo through a small door opening.

Emery was the only carrier observed to have specialized secure cargo containers. Each of these containers are painted bright yellow and have hard fiberglass doors which can be locked. These are used to ship high value or high theft items.

For cargo that is too large to fit into a container, truck totes or forklifts are used to transport it to a large

cargo build-up area on one end of the sorting facility. Here, this cargo is palletized as explained later.

Dollies (slightly larger and taller than what the Air Force calls pallet dollies) are used to transport containers to and from aircraft to the sort building. Each dolly can hold two containers, and up to two dollies are pulled by tugs.

Before containers and pallets can be placed on K-loaders for uploading on the aircraft, they are first placed onto a "slave rack". A slave rack is a metal platform with metal rollers on the top side of the platform (similar to rollerized forklift tines used by the Air Force). This rack is used so that the forklifts do not damage the containers or the pallets with forklift tines. Slave racks are also used to transport containers and pallets inside of the sorting facility. Once the slave racks are placed on the floor of the sort facility, the containers and pallets can be easily maneuvered because of the rollers on the rack.

K-loaders are used to load containers and pallets onto the aircraft. Containers and pallets are placed onto the K-loader by a forklift, then one container or pallet can be raised to the main deck of the aircraft for loading.

Aircraft

All of Emery's aircraft are maintained by Emery employees, with the majority of the maintenance performed at

its main hub in Dayton. Emery has the following types of aircraft: 707s, 727s, and DC-8s.

Small Package Sort

Like all other air cargo carriers observed, Emery sorts its small packages several times. The initial sort is based on the decision of whether the cargo can move on the conveyor belts that run throughout the facility or if it must bypass the belts. All cargo that is small and light enough (under 70 pounds), and has no rough edges that could damage the conveyors, is sent through the initial sort process. Cargo that fits into a container, but cannot be moved on the conveyors, is transported individually to the container loading area.

The primary sort is a manual sort of all packages by a three letter airport code. This sort sends packages to either the North or South side of the sort facility. This decision is based upon the side of the building in which a particular city's cargo will be loaded into containers. Fast moving conveyor belts are used to move the packages throughout the sort facility.

There are three modules in the sort facility, and each module is responsible for loading containers destined to several cities. The secondary sort is by three letter airport code and is used to send packages to each module.

The secondary sort includes a section with tilt trays that sort cargo again. Cargo arrives in the section by

conveyor belt, then a technician enters the three letter airport code into a computer. The computer then moves this piece of cargo onto a conveyor belt with wooden trays that tilt at the appropriate time and deposit cargo down a chute to one of the modules. Each chute may handle only one city's cargo (if the city has a large amount of cargo), or it may handle several city's cargo.

The final sort takes place when an employee loading the container checks the three letter code, then places the package in the proper container. This makes the person loading the container responsible for checking each piece for its proper destination.

Large Cargo Handling

Any cargo that is too large or too heavy (greater than 70 pounds) to be placed on the conveyor belt system is moved by schreck or forklift to a pallet build-up area on one end of the sort facility. Aluminum aircraft cargo pallets or "cookie sheets" are used for shipping large pieces of cargo. Single empty pallets are placed on slave racks, then plastic is placed on the empty pallet. Next, cargo is placed on top of the pallet using a forklift. Once a pallet is full or no other cargo is available for the destination of that pallet, it is covered with plastic and nets. The plastic is for temporary protection from the weather since a pallet is only exposed to weather for a few minutes. Emery is the only carrier observed to place plastic on the bottom of the

pallet before cargo is loaded. The nets used are commercial air cargo nets which are a thin rope-type net. These nets are placed over the cargo to provide the same restraint that a cargo container would provide for a similar load.

Each pallet is transported to the aircraft by forklift. Once at the aircraft, the forklift places the pallet onto the K-loader by sliding the pallet off of the slave rack. In other words, the slave rack does not get loaded onto the aircraft.

Employees

Like all of the air cargo carriers observed, Emery's employees who sort and load/unload cargo are part-time workers. Both male and female workers were seen in all areas of the operation.

Intransit Visibility

All of the packages sorted at the hub had, as a minimum, one barcoded label. Many customers placed their own barcoded labels on packages for their internal use. While each label was visually inspected several times for the proper three letter airport codes, no scanning of the barcodes was observed at the Dayton hub. Instead, packages are scanned before departing for Dayton and after arriving at their destination airport. The scanning of packages at regional hubs or outlying terminals saves the Dayton hub valuable time at night, but true intransit visibility did not appear to be possible.

Operations Interface

The load planners at Emery were not located near the area where cargo containers or cargo pallets were filled with cargo. Instead, after a container or pallet was weighed upon leaving a module, the weight and identification numbers were put into a computer. Then, load planners would use that information to load plan several different aircraft.

At the beginning of the evening there are three load planners working on pre-load plans. By the end of the evening, personnel from the hazardous materials (hazmat) area move to the load planning section and work on the remaining flights. All of the load planning personnel could contact the teams that were building cargo containers or pallets as well as the cargo load teams.

Emery has its own tower which overlooks the entire aircraft ramp at the Dayton hub, and employees in the tower coordinate aircraft arrivals, parking, maintenance, de-icing, and loading/unloading. Both radios and telephones were used to coordinate all aircraft functions.

Aircraft unload teams worked on both the top (main) decks and in the belly compartments of the aircraft. However, the upload teams were separated into top deck loaders and main deck loaders. On occasion, one load team would load both the top deck and the bellies. A load/unload team consists of ten to 12 people.

Safety

Clothing and protective gear are important elements of employee safety. Emery's employees are issued uniforms. These uniforms consist of navy blue pants and orange and blue shirts (Friday is casual night and uniforms are optional). Steel-toed boots are mandatory and employees are given vouchers for 50 percent of the cost of boots. Cargo gloves and lifting belts are available to all personnel. Employees working outside on aircraft and on the parking ramp are required to wear reflective vests and hearing protection.

Lighting, another important safety area, was very good both inside and outside of Emery's facilities. Good lighting is essential due to the amount of vehicle traffic and congestion in the sorting facility. Within the sort facility, forklifts and schrecks were often lined up back-to-back waiting to move heavy weight cargo to the pallet build-up area. Because everyone observed was safety conscious and used horns and signaling devices, the operation was safe.

Because of the amount of activity surrounding the sort facility and the aircraft ramp areas, no walking is allowed on the outside of the sort building or on the ramps. Instead, vans and buses move workers to and from parking lots, aircraft, and the sort facility.

Interview

Title of person(s) interviewed: Supervisor, Quality Assurance

1. What type of cargo do you specialize in handling and what other types of cargo do you handle?

Emery specializes in handling heavy weight cargo that weighs over 70 pounds, with approximately 1,000 shipments handled per night. The average weight of Emery's cargo is approximately 110 pounds. Other types of cargo that Emery moves include live animals, automotive material, and clothing (fashion industry cargo), hazardous materials, signature service, constant surveillance cargo, and a variety of government cargo (to include sensitive cargo requiring couriers--however, Emery does not handle classified cargo).

2. Do you have written procedures in place for surge periods? If so, are these company-wide, regional, or local?

No, Emery does not have written procedures in place for surge periods. Although the heavy peak period is around Christmas-time (September, October, and November), Emery has a variety of periods of increased workload depending upon customer requirements. For example, Emery just completed a surge in workload when General Motors (GM) had its "build-out" that finished its 1993 product and began to produce vehicles for 1994.

This build-out resulted in a heavy increase in workload for Emery.

Emery focuses on customization and any increases in workload are handled on a day-by-day basis. Procedures and standards are in-place for overload situations; however, every day is different and adjustments are made depending on the requirements for that day. For example, on one day Apple computer may send in 50 skids of cargo and Emery would have to make adjustments to normal procedures to handle the overload for that specific day and then return to normal procedures when the cargo is moved.

Although Emery does not have plans specifically for surge periods, operational manuals provide guidance for employees in the event of an overload situation. An overload situation may occur with incoming or outgoing cargo. As an example, Emery has reports that state a requirement to move 225,000 pounds to Dallas, Texas; however, only one DC-8 aircraft, with a maximum capacity of 100,000 pounds, is scheduled for Dallas. There are procedures to accommodate this overload situation and to find the best and most cost-effective means of delivering the customer's cargo.

3. How often are your surge plans updated and do you ever test your plans?

As stated previously, Emery does not have specific written procedures for surge periods. However, the

operational manuals used by Emery employees for a variety of tasks (i.e. purchasing manuals and books), to include procedures for overload situations, are updated annually.

4. What effects do surges have on your cargo handling equipment?

Surges in workload result in added wear and tear on the cargo handling equipment.

5. If extra equipment is needed, do you obtain it through in-house resources or by contract? Do you go through company-wide, regional, or local channels?

Emery examines the most cost effective means to determine whether or not extra equipment is rented or purchased. If the requirement for more equipment is a short-term requirement, Emery will temporarily rent the equipment. If there is a long-term requirement for more equipment, the equipment is purchased.

Emery has two regional hubs. Other locations serviced by Emery are called "terminals" or "outstations". Equipment is not moved between the regional hubs, outstations, and the main hub during surge periods.

Price limits are set on specific decisions--decisions to acquire extra equipment that exceed the price limit require corporate approval. However, Emery's main hub at Dayton will usually

not go through the corporate office to lease or buy extra equipment (decentralized decision-making process). In addition, the two regional hubs and outstations will usually not go through Emery's main hub in Dayton to get approval to acquire extra equipment.

6. During surge periods, how do your personnel levels change?

Personnel levels increase during surge periods. Cargo is sorted during a specified timeframe and it is not possible to extend this window to have the same employees work longer hours. If Emery is inundated with cargo, they find it best to bring more people on during the surge period to handle the workload.

7. Do you go through company-wide, regional, or local channels to get additional personnel? Are they hired as part-time or full-time?

When hiring additional permanent employees for the hub at Dayton or for the regional hubs, approval from the corporate office is required. These permanent employees are hired as part-time employees from their perspective local economies. Emery uses a temporary employment agency to hire personnel required for a short period of time. The decision to hire temporary employees is made at the local level and does not require corporate approval.

8. How do you train these additional employees and is there a learning curve associated with this training?

Permanent employees go through a one week orientation period which consists of three days of classroom training and two days of hands-on experience. Then, the employees are placed in their actual position. Employees hired for positions that require more skill receive additional training on the job.

Temporary employees hired for surge periods are given a brief orientation (i.e. information required for FAA purposes such as hazardous material moved throughout the facility). Most temporary employees are given on-the-job training. During these periods, personnel within the hub operation are shifted around with more experienced personnel (permanent employees) placed in positions that require more skill and temporary employees given jobs that require less skill.

9. How do you measure the effectiveness of your day-to-day cargo handling operations?

Each department has different goals to meet and specified targets times. For example, ramp operations are required to download a DC-8 in 27 minutes. Ramp personnel offloading the aircraft are timed and these times are entered

into the computer by personnel in the tower (these times are monitored and tracked).

The breakdown operation also has target times to meet. When the cargo is offloaded and brought into the breakdown area, Emery records hourly and overall cycle times, or how many containers are turned over or broken down per hour by a team.

The build-up area is required to close-out or complete their operation within a specified period of time. Missorts (the amount of cargo that is missorted) are also used to measure the effectiveness of the build-up area. Emery is performing at a 99.995 percent ratio (low amount of missorts). Currently, Emery has an audit team that, after a container is built-up, will randomly select a container filled with cargo and break the cargo down to look for any inconsistencies such as missorts or mishandling.

If the various department do not meet their goals, immediate feedback is given; usually, this feedback is given at the beginning of the next shift. In addition to the department goals, Emery has a company-wide goal to have all aircraft depart on-time. Emery has a program set up that monetarily compensates employees at the end of the year if standards are met. Although each

department has their own separate goals, the overall company goal is to service the customer.

10. How do you measure the effectiveness of your cargo handling operations during surges?

The same day-to-day effectiveness measurements are used during surge periods.

Appendix G: Airborne Freight

Observation

Setting

Airborne's hub in Wilmington, OH was the setting of an April 1993 tour of Airborne's nighttime hub operations. While approximately 75 aircraft arrive and depart Wilmington within a four hour window every Monday through Friday night, the most interesting observation was not the number of aircraft being handled. Instead, the airport out of which Airborne operates is clearly the most unique part of their operation. Called the Airborne Air Park, this airport is totally owned and operated by Airborne Freight. Since Airborne is in control of all facilities and personnel at the airport, this is its major advantage.

Another aspect of the setting which needs mentioning is that Airborne uses three buildings to sort its next-day air express cargo during the nighttime operations. All three buildings have the same capability, and cargo is taken to the building nearest to the aircraft from which it was downloaded. All sort buildings were extremely clean, well lit, and had very fast moving conveyor belts on which the majority of the cargo was placed for sorting.

Outside of the sort facilities is a very large aircraft parking ramp on which aircraft are well spaced for safety reasons. While there was a lot of activity on and around

each aircraft, safety was prevalent. The extremely well-lit parking ramp made it seem like it was midday instead of midnight.

Cargo Handling Equipment

Airborne only buys aircraft that were formerly used to transport passengers then converts these into cargo carrying aircraft. Because of the unique nature of its aircraft buying, Airborne has designed a cargo container that is different from those used by all other carriers observed. These containers are called "C-Containers" and are manufactured and maintained at the Wilmington, OH hub.

C-Containers are small and light-weight and are loaded through the existing passenger door on all of the aircraft. Each container has wheels attached to the bottom so they can be pushed easily by hand, thus not requiring any forklifts or container moving dollies (or what the Air Force calls pallet dollies).

Since it is not practical to physically push each container to an aircraft, Airborne has several pieces of equipment that can carry an entire aircraft load of C-Containers. This piece of equipment is called a "dragon" by Airborne employees. Each C-Container is pushed by hand onto the dragon, which is only a few inches off of the ground, and has a ramp which lowers to the ground. Then, the dragon is driven by its own power to the aircraft for uploading. Airborne also has several large carts that are

used to transport C-Containers to the aircraft. Once at the aircraft, the C-Containers are loaded the same way from both the dragons and the carts.

To move C-Containers from the dragon to the aircraft, aircraft loaders or K-loaders are not used. Instead, Airborne uses conveyor belts to move the C-Containers from the dragon to the passenger door of the aircraft. The same conveyors are typically used by airlines and other cargo carriers to load loose cargo into belly compartments of aircraft.

Aircraft

Airborne uses three different types of aircraft, all of which were previously passenger aircraft. They have the following number and type of aircraft:

24	DC-8s
47	DC-9s
11	YS-11s

The modification, overhaul, and maintenance on these aircraft are accomplished by Airborne employees at their Wilmington, OH hub.

Small Package Sort

Like all other air cargo carriers, Airborne sorts its small packages several times. The primary sort is simply removing cargo from an incoming C-Container and sorting it by the region of the country for which it is destined. Eventually all cargo is sorted by a three letter airport code, then loaded into outgoing C-Containers.

All cargo that is small enough and has no rough edges that could damage the conveyors is sent through one of the sort buildings on the conveyor system that runs through each building. Cargo that is too large (over 70 pounds), too long to fit into a C-Container, or has metal banding or other material that could damage the conveyors is placed in a separate area. Then, if the cargo fits into a C-Container, a tug is used to move this cargo to the C-Container build-up area. If cargo will not fit into a C-Container, it is taken elsewhere and sent by a contracted freight forwarder to its destination.

Large Cargo Handling

Cargo that weighs over 70 pounds is considered large by Airborne. This cargo is never refused, but it is not moved on Airborne's aircraft. Instead it is trucked to a contractor and moved by a contracted flight to its destination airport, then handled by Airborne employees at that airport.

Employees

Like all of the air cargo carriers observed, Airborne's employees who sort and load/unload cargo are part-time workers. Unlike the other carriers, Airborne had a large number of female employees in these areas--nearly 50 percent.

Intransit Visibility

All of the packages sorted at the hub had, as a minimum, one barcoded label. Many customers placed their own barcoded labels on packages for their internal use. While each label was visually inspected for the proper regional and three letter airport codes, no scanning of the barcodes was observed at the Wilmington hub. Instead, packages are scanned before departing for Wilmington and after arriving at their destination airport. The scanning of packages at regional hubs saves the Wilmington hub valuable time at night, but true intransit visibility did not appear to be possible.

Operations Interface

Airborne had load planning stations near the end of the sort operations in each of its sort buildings. As a C-Container was filled, it was weighed by the person who loaded it. Then, that person would write the weight on a grease board next to the scales. (Each departing flight had its own grease board near the scales). Then, the C-Container was pushed outside of the sort building to an awaiting dragon or cart. If a dragon or cart was not available, the C-Containers were pushed aside in a group so they could easily be loaded onto a dragon or cart when one was available.

When all C-Containers for a flight were weighed, a load planner would fill out the necessary load planning documents

and give the sequence to the load team that would actually load the aircraft. When the load team reached the aircraft, a load planning computer on-board each aircraft could be used to double check the C-Container sequence.

To eliminate confusion, aircraft are parked in the same parking spots every night. Also, load teams and maintenance personnel know in advance which aircraft they will be working.

Safety

Clothing and protective gear are part of employee safety. Employees did not have a uniform or any apparent dress code, but they were required to wear sturdy boots that covered their ankles. Leather cargo gloves were optional for everyone. Hearing protection was optional for workers inside of the sort buildings and was mandatory for workers on the aircraft parking ramps. Reflective gear was worn by employees working outside on and near aircraft on the parking ramp. No lifting belts were observed on any employee.

Lighting is another critical part of nighttime safety. Both inside and outside lighting was excellent. Movement by vehicles to and from sort buildings and around aircraft was quick, but horns and signals were used and everyone seemed to be conscious of everyone else's movements. There were no noticeable driving or walking lines painted on the ground,

but everyone seemed to know where they could or could not walk safely.

Interview

Title of person(s) interviewed: Senior Director, Hub Operations

1. What type of cargo do you specialize in handling and what other types of cargo do you handle?

Airborne's specialty is in the movement of what it calls air express cargo. 60 percent of air express cargo weighs between one and five pounds, with the average weight being two pounds. Approximately 40 percent of the remaining air express cargo weighs between five and 70 pounds. Nearly one percent of air express cargo is classified as "exceptions". Exceptions are odd size cargo (over 108 inches long) which cannot physically fit into one of the C-Containers. Also, anything weighing over 70 pounds fits into this category.

Another type of cargo that Airborne moves is that categorized as Select Day Service (SDS). This type of cargo allows for controlled delivery by Airborne when the customer specifies a required delivery date for the cargo. Airborne says this type of cargo has seen the most growth in the past year.

2. Do you have written procedures in place for surge periods? If so, are these company-wide, regional, or local?

Airborne does not have written procedures for surges in workload. Due to the excessive growth experienced each year, surges in workload during previous years cannot be used to predict future surges. However, because Christmas is traditionally a major surge period for Airborne, it "gears up" for the surge on the day after Thanksgiving. Also, the first and last day of a business' quarter require a push by Airborne to help corporate customers move their packages.

To help customers at the beginning and end of quarters, Airborne uses some of its aircraft that it holds in reserve for such occasions. (These aircraft are also held as maintenance spares). Also, Airborne relies on regional hubs during these surges in Airborne's workload.

3. How often are your surge plans updated and do you ever test your plans?

Although Airborne has no written surge plans, weekly scheduling committees meet to determine concerns. Also, daily sales and marketing meetings take place to discuss issues dealing with its major corporate accounts.

4. What effects do surges have on your cargo handling equipment?

Airborne's equipment is only used for six to seven hours per day, allowing a lot of flexibility during periods of increased workload. Since next-day (overnight) express cargo is sorted at night, the daytime operations are not as busy. To help alleviate some of the sorting burden on the nighttime operations, Airborne uses its daytime operation to sort cargo for the Select Day Service. This allows better utilization of both facilities and equipment.

5. If extra equipment is needed, do you obtain it through in-house resources or by contract? Do you go through company-wide, regional, or local channels?

Before any outside equipment and/or aircraft are requested, Airborne uses in-house resources. The decision to move resources from the Wilmington hub to other regional hubs, or vice versa, is made at the Wilmington hub. If in-house resources are not available, then other companies are used.

If extra equipment or aircraft are needed, Airborne uses charter companies. No standing contracts are used; only the goodwill of Airborne and its previous business relationships are used to contract anything extra that is needed.

6. During surge periods, how do your personnel levels change?

Cargo load/download personnel and sort personnel are all hired as part-time during normal operations. If additional personnel are needed during periods of increased workload, current part-time employees are asked to work more hours. If that is not enough, then more people are hired.

When a person is first hired for a job at Airborne, they are hired on a casual basis. Approximately 20 percent of its employees are in a casual status at any given time. Casual status is basically a 60 day probationary period in which all newly hired personnel are placed. If more personnel are needed for surges, the casual employees are converted into part-time employees, then more casuals are hired. The major distinguishing characteristics between casual and part-time employees are that casuals may or may not be asked to work on a given night and they do not have all the benefits of a part-time employee.

7. Do you go through company-wide, regional, or local channels to get additional personnel? Are they hired as part-time or full-time?

Additional personnel for sort and aircraft load/download are all hired as part-time employees. The approval to hire more personnel is centralized at the Wilmington, OH hub. However,

the actual hiring is accomplished locally. So, if one of Airborne's regional hubs needs additional personnel, the Wilmington hub would give hiring approval, and the personnel would be hired by the regional hub.

8. How do you train these additional employees and is there a learning curve associated with this training?

All casual employees are trained the same way, whether hired for a surge period or for a routine period. Each casual employee spends one week in orientation to the company which includes familiarization with material handling equipment, departmental policies, and safety issues. Then, depending on the job that they will be doing, they receive specialized training in that particular work area.

9. How do you measure the effectiveness of your day-to-day cargo handling operations?

A daily hub report is produced to show productivity by supervisor and area supervised. The sort, ramp, and overall hub productivity are summarized as is regional hub performances. Also, by 1400 hours each day, a report on the aircraft service into each destination is reviewed. This report shows the service or on-time arrivals into each destination. A goal of 95 percent on-time

arrivals (called a service level) is sought at all times.

The percent of volume of different types of cargo are also summarized monthly to determine if markets are changing. This allows Airborne to change service levels by adding more or larger aircraft to a route, by changing arrival and departure times, or by realigning cargo handling equipment to meet changing market demands.

Airborne uses the standard pieces of cargo handled per manhour to determine if a worker's performance is effective. They maintain standards which must be met by all employees.

Finally, on-time pickups and deliveries are monitored daily by Airborne Freight to see if they are meeting their customers' demands. The airline part of Airborne Freight, Airborne Express, receives this information on a weekly basis to determine if they need to change flights, sorting times, etc. to maintain the 95 percent service level.

10. How do you measure the effectiveness of your cargo handling operations during surges?

During periods of increased workload, Airborne attempts to watch the number of hours worked and the number of employees working. They do not want productivity to go down, but the

solution is not always to put more people to work. Airborne tries to keep the standard pieces handled per manhour constant.

While costs are a major concern, they are not examined very closely during surges. This is because expenditures are examined before anticipated surges in workload occur.

Appendix H: DHL Airways

Observation

Setting

DHL's hub at the Greater Cincinnati-Northern Kentucky Airport was the setting of a July 1993 tour of DHL's nighttime hub operations. This is the U.S. domestic hub for DHL's worldwide operations. Approximately 40 aircraft arrive and depart the DHL "superhub" every Monday through Friday night, but only about half of these aircraft are large enough to carry cargo containers and/or pallets. The other aircraft are much smaller and serve customers by loading packages loose in the cargo bay of these aircraft.

DHL has three aircraft parking ramps, all of which were observed in operation. However, due to the diversity of aircraft types, a detailed list of aircraft number and type had to be provided by DHL.

DHL used one well-lit building for its sort operations. Conveyor belts were prevalent throughout the building, and these conveyors were the slowest moving ones observed in this study.

The aircraft parking ramp area utilized by DHL was small, yet three separate ramps were used. Due to airport expansion, part of the ramp was under construction during this observation. The two ramp areas closest to the sort facility were well-lit, and aircraft were parked very close together. The third parking ramp was used to park DHL's

smallest aircraft for the nighttime hub operations, but it was a common user parking area during the day. This area did not have as much light as the two main parking ramps.

Cargo Handling Equipment

No forklifts were observed at DHL's hub. All of the cargo was placed into cargo containers or onto aluminum aircraft cargo pallets and transported on pallet dollies pulled by tugs. The cargo containers were made of fiberglass and had canvas (tarp-like) door openings through which cargo was loaded and unloaded. These large openings allow any piece of cargo that can physically fit into a container to be placed inside of the container without wrestling it through a small door opening. Nearly all of the cargo sorted through the facility was placed into these containers. Cargo that was too large to fit into a container, but could fit onto an aircraft pallet, was placed on pallets in the large cargo area.

Dollies were pulled by tugs and were used to transport containers and pallets from the sort facility to an aircraft and vice versa. After an aircraft's load of containers on dollies was ready to be uploaded, a K-loader was used to load the aircraft. Containers or pallets were pushed from dollies to the K-loader which had a rollerized flooring. This K-loader could raise two containers or pallets up to the main deck of an aircraft at the same time. Then, the containers or pallets were pushed into the aircraft.

Aircraft

DHL has the following type of large aircraft that carry cargo containers and/or pallets:

12	727-100s
6	727-200s
10	SA-227s

The smaller aircraft used by DHL are contracted. Some of these aircraft are: Dornier 228s, Cessna 208s, Convair CV 580s, and Convair CV 640s.

Small Package Sort

Like all other air cargo carriers, DHL sorts its small packages several times. The primary sort is simply removing cargo from incoming containers or pallets and sorting it by the region of the country for which it is destined. Since DHL is the leader in international movement, all international cargo is sorted by its stateside destination where it is placed onto a specific international flight. Eventually, all cargo is sorted by a three letter airport code, then loaded into outgoing containers or onto pallets.

The majority of cargo arriving at the hub goes through the conveyors in the small package sort process. Cargo that is nonconveyable (due to shipment size, weight, fragility, or bulk of some shipments) is moved through the sort process individually. Cargo that is too large to fit into a container is moved to the large cargo area.

Large Cargo Handling

Cargo that is too large to fit into a container, but is small enough to fit onto a single aircraft pallet, is moved to the large cargo handling area. For cargo that cannot fit onto a single pallet or for large shipments, DHL uses a freight forwarder to contract space on another carrier.

The area designated for large cargo was extremely small and located outside of the sort facility in a dark alley between two buildings. Only a small amount of large cargo was observed during this visit. In this area, cargo was placed onto pallets, then covered with plastic to protect it from the weather. Commercial cargo nets resembling thin nylon ropes were placed over the cargo for restraint. It was also observed that metal cargo was placed directly onto the aluminum pallet. This observation was noted because the Air Force has strict guidelines that prohibit this practice.

Employees

Like all of the air cargo carriers observed, DHL's employees who sort and load/unload cargo are part-time workers. Most of their employees in these two areas were male. All of the supervisory personnel were distinguished by wearing a uniform consisting of a white shirt with a DHL logo.

Intransit Visibility

All of the packages sorted at the hub had, as a minimum, one barcoded label. Many customers placed their

own barcoded labels on packages for their internal use. While each label was visually inspected for the proper regional and three letter airport codes, no scanning of the barcodes was observed at the superhub.

Operations Interface

Once a container or a pallet was filled with cargo, it was weighed. When several (usually four) containers for the same aircraft were filled, they were transported to the aircraft by pallet dollies and tugs. When all of the cargo for a particular aircraft was loaded into containers or onto pallets, a load planner completed the load plan. Meanwhile, most of the cargo was already positioned at the aircraft, thus saving critical time in transporting from the sort building to the aircraft.

Load team chiefs and supervisors were kept abreast of normal operations and any changes through hand held radios. Once all of the cargo for an aircraft was at the aircraft and a load plan was complete, the load teams used K-loaders to upload the cargo.

Unlike other air cargo carriers observed, DHL's load teams were also used to marshall aircraft into and out of parking spots and to connect ground power units to the aircraft. This saved the maintenance personnel for only aircraft maintenance functions.

A crucial part of DHL's hub operation is the System Operations Control (SOC) which is manned by one person.

This individual provides centralized control and decision making for the night's operation. Requests to "tail swap" aircraft (use a different aircraft for a particular flight), are made by the cargo supervisors (not maintenance) to the SOC. The SOC then coordinates these types of requests and makes the ultimate decision.

Safety

Clothing and protective gear are important parts of employee safety. Employees, other than supervisors, did not have a uniform or any apparent dress code, but they were required to wear sturdy boots. In addition to the boots, employees who worked on aircraft or on the aircraft parking ramp were required to wear hearing protection and reflective gear.

No lift belts were observed on any employees, and several employees were observed not wearing the required protective gear. Cargo gloves were optional, with some employees wearing the gloves.

Lighting is also an important part of safety during nighttime operations. Lighting was good throughout the sort facility and on the primary aircraft parking ramps. The only area that was poorly lit was the large cargo area where cargo was palletized.

There was a lot of vehicle movement on the aircraft parking ramps. Tugs pulling pallet dollies and vans with supervisory personnel were constantly in motion, but

everyone was safety conscious. All vehicles used headlights, hazard lights, and horns to let people know they were being placed in motion. While there were no visible walking or driving lines, most of the vehicles used the aircraft taxi centerline.

Interview

Title of person(s) interviewed: Manager, Systems Development and Industrial Engineering

1. What type of cargo do you specialize in handling and what other types of cargo do you handle?

DHL handles three types of cargo: 1) letter material (overnight) or small material which comprises 60 percent of their total cargo; 2) boxes, larger than letter material and up to one cubic yard in size, which are 35 percent of their total cargo; and 3) nonconveyable material or cargo physically too big or too heavy to be moved on the conveyors. This type of cargo is usually referred to as air freight and comprises four to five percent of DHL's total cargo.

2. Do you have written procedures in place for surge periods? If so, are these company-wide, regional, or local?

Yes, DHL at the Cincinnati hub has written procedures that specify operations for any level of volume; however, these procedures are applicable for all circumstances and not

specifically for surge periods. These procedures are based on Master Standard Data, a scientific methodology used to determine the number of work hours required to move specific amounts of cargo and provide very specific written guidance.

Surges are forecasted just like any other period. A ten to 15 percent increase in DHL's ramp operations is not considered a surge. Cargo volume may vary up to 40 percent on a given night of the week. Each regional hub has its own procedures for surge periods.

3. How often are your surge plans updated and do you ever test your plans?

The statistical portion of the Master Standard Data is updated bi-annually; however, the work method portion of the Master Standard Data is changed whenever the physical structure of the work area changes. These Master Standard Data plans are tested prior to development of a training program for actual employees who operate within the new work environment. The work methods are designed and tested, and feedback is given by a sample of employees. After feedback from the sample employees, statistical applications are made and the work method is retested. Following final approval, the work method is fully implemented.

Although work methods for increases in volume are statistically tested and forecasted (using scientific modeling) to determine the productivity of a given work area, DHL does not operationally test procedures during surges in workloads. DHL uses statistical sampling to determine whether employees in a given work area are performing to previously determined capacity. Sampling of employees is conducted a few times each month, dependent upon the supervisor's decision.

4. What effects do surges have on your cargo handling equipment?

Surges have no physical effect on DHL's cargo handling equipment. Machinery is built to such high quality standards that surges have no physical impact on the equipment. However, surge periods do strain the capacity of the equipment if logistical operations are not in the right order (i.e. if people/managers are not in the right place at the right time or are not controlling resources properly, this ultimately diminishes the capacity of the machinery). Therefore, DHL uses 93 percent as the stated capacity of their equipment to accommodate any factors that influence the control of its resources.

5. If extra equipment is needed, do you obtain it through in-house resources or by contract? Do you go through company-wide, regional, or local channels?

Depending on the requirement, DHL uses both in-house and contracted resources to acquire additional equipment. In-house resources are used first and, if necessary, equipment is contracted from outside sources. All decisions to obtain extra equipment for the main hub or any regional hub within the continental United States, either through in-house or contract sources, are centralized at the main hub in Cincinnati. Every alternative is explored and cost factors are weighed heavily in any decision to obtain extra equipment.

DHL will also borrow equipment from other airlines and have reciprocity with the equipment. This does not cost any money and helps accommodate any surges in workload when equipment is needed.

6. During surge periods, how do your personnel levels change?

After forecasting the surge level, DHL adjusts manning levels up or down commensurate with any changes in volume due to a surge or slow period. If necessary, more people are hired or more hours are worked.

7. Do you go through company-wide, regional, or local channels to get additional personnel? Are they hired as part-time or full-time?

Requirements for additional personnel are approved by the corporate office (in Redwood City, CA); however, any requirements for replacement personnel are handled at the Cincinnati hub. Sort and ramp employees are hired as part-time workers, while pilots are hired on a full-time basis. The overall goal is to keep costs down--DHL's budget is developed for the number of hours worked and not the number of employees. During Christmas, blanket approval is given by the corporate office for the Cincinnati hub to hire more personnel (with an upper control limit on the amount).

8. How do you train these additional employees and is there a learning curve associated with this training?

Additional temporary employees hired for surge periods are not given the depth of training as permanent employees; however, they are given sufficient levels of training to perform their assigned duties--which are usually simplistic in nature

Yes, there is a learning curve associated with training all employees. DHL expects new employees to be 80 percent proficient with their job during the first month, 90 percent proficient

during the second month, and 100 percent proficient by the third month. These proficiency levels are the same for both temporary and permanent employees.

9. How do you measure the effectiveness of your day-to-day cargo handling operations?

Two forms of measurement are used by DHL: effectiveness of the overall airline's performance and productivity of sort and ramp operations. Effectiveness of the overall airline performance is based upon on-time arrivals. The determining factor of the airline's performance is whether or not the aircraft arrives at its intended destination (within a 15 minute timeframe) so that DHL employees are able to deliver the packages on time.

Effectiveness of productivity within the sort and ramp operations is based upon a pieces per hour target of 204. Daily, monthly, and annual productivity reports are analyzed. On a daily basis, supervisors are given productivity reports from the previous night and are required to brief the information to their employees for timely feedback. Annual productivity reports are also compared to operations during the same time period of the previous year.

There is some correlation between the two

effectiveness measures. For example, if sort operations are slow, this usually reflects in the airline performance of on-time aircraft arrivals.

10. How do you measure the effectiveness of your cargo handling operations during surges?

The same day-to-day effectiveness measurements are used during surge periods.

Appendix I: Burlington Air Express

Observation

Setting

Burlington's Toledo, Ohio hub was the setting of a June 1993 tour of Burlington's nighttime hub operations. Approximately 22 aircraft arrive and depart Toledo within a four hour window every Monday through Friday night. During this timeframe the Toledo Airport is used only by Burlington; there is no other airport traffic. Burlington uses one building to sort all of the incoming and outgoing cargo. There are ten entry modules into this sort building, so cargo is fed into and out of the facility from a total of ten different locations. Each module is decentralized and personnel within a module unload incoming containers, input cargo into the sorting process, and load sorted cargo in containers. Burlington is currently expanding to accommodate more modules.

The sort facility is new, very clean and well-lit. White walls and a continuous air recycler keep the work environment clean. Many propane forklifts were visible moving into and out of the sort facility. These propane forklifts also helped keep the air clean.

Outside of the sort facility was a large, well-lit aircraft parking ramp on which aircraft were well-spaced for

safety reasons. While there was a lot of activity on and around each aircraft, safety was prevalent.

Cargo Handling Equipment

A majority of the cargo that Burlington receives is moved in fiberglass cargo containers that are contoured to the shape of the type of aircraft on which it will be loaded. These containers have vinyl, tarp-like "door" openings through which cargo is loaded and unloaded. The "door" comprises the entire side of a container. These large openings allow placement of any piece of cargo that can physically fit into a container without wrestling the through a small door opening.

Pallet dollies are used to transport containers to and from aircraft to the sort building. A maximum of four dollies are pulled by tugs. When the dollies with loaded containers reach the sort building, they are pushed by hand from the dollies to a rollerized sub-flooring. Then, the tug takes the dollies out of the building and away from the sort operation. Once a container is on the rollerized flooring, the sort procedure takes place.

For cargo that is too large to fit into a container, forklifts are used to transport it to a large cargo buildup area. As mentioned previously, Burlington uses propane powered forklifts during the observation; however, in an effort to improve the air quality within the sort facility, Burlington was in the process of converting to electric-

powered forklifts. The change over was to be made quickly because Burlington does not own any of the equipment that it operates; they lease everything.

Finally, K-loaders were used to load containers and pallets onto the aircraft. Containers and pallets are pushed from the dollies onto the K-loader which has rollerized flooring. Then, two containers or pallets are raised to the main deck of the aircraft for loading.

Aircraft

Burlington Air Express leases all of its aircraft and the maintenance of its aircraft. They currently have the following number and types of leased aircraft:

2	Convair 580s
7	727s
18	DC-8s

Small Package Sort

Like all other air cargo carriers observed, Burlington sorts its small packages several times. The primary sort is simply removing cargo from an incoming container and sorting it by the region of the country for which it is destined. Eventually, all cargo is sorted by a three letter airport code, then loaded into outgoing containers.

All cargo that is small enough, and has no rough edges that could damage the conveyors, is sent through the sort facility on a conveyor system that runs throughout the building. Cargo that fits into a container, but cannot be

moved on the conveyor, is transported by cart or forklift to the container build-up area.

Large Cargo Handling

Any cargo that is too large or too heavy to be placed on the conveyor belt system is moved by forklift to a pallet build-up area. Aluminum aircraft cargo pallets or "cookie sheets" are used for shipping large pieces of cargo. Single empty pallets are placed on dollies, then cargo is placed on top of the pallet using a forklift. Once a pallet is full or no other cargo is available for the destination of that pallet, it is covered with plastic and nets. The plastic is for temporary protection from the weather since a pallet is only exposed to weather for a few minutes. Once a sheet of plastic is used, it not reused but is recycled.

The nets used are commercial air cargo nets which resemble a thin rope-type net. These nets are placed over the cargo to provide the same restraint that a cargo container would provide for a similar load.

When cargo is extra large and requires more than one pallet to be "married" to another pallet, the pallets are placed on a movable platform that can also be transported by tug. Then the pallets are connected by a coupler and built-up the same way as a single pallet is built. When possible, instead of "marrying" pallets in the pallet build-up area, they are sometimes connected on the aircraft for ease of transporting on the aircraft ramp.

Employees

Like all of the air cargo carriers observed, Burlington's employees who sort and load/unload cargo are part-time workers. Both male and female workers were seen in all areas of the operation.

Intransit Visibility

Each package going through the Toledo hub had a Burlington barcoded label. Also, customers placed their own barcoded labels on packages for their internal use. While each label was visually inspected for the proper regional and three letter airport codes, no scanning of the barcodes was observed. However, Burlington was experimenting with a new label system that allows sort personnel to easily identify overnight cargo. A label with white letters on a black background was used to identify overnight cargo, and a label with black letters on a white background was used for non-overnight packages.

Operations Interface

Personnel loading cargo containers at the end of the modules are also responsible for load planning. A load planner enters the weight of the containers or pallets on a weight and balance worksheet, and when all containers and/or pallets for an aircraft are weighed, the final load plan is accomplished.

Cargo upload teams receive pre-load plans via radio from load planning personnel before all containers have been

weighed. Once a load plan is finalized, load teams receive final load plans via radio, and they also receive a paper copy. Then, the load planner goes out to the aircraft on which the cargo is to be loaded and briefs the outbound aircrew. If there are still more containers to be loaded in that load planner's module, then he/she goes back to the sort facility and continues loading containers.

Fully loaded containers on dollies are positioned next to departing aircraft when a load plan is completed. Any available load team loads any aircraft that has a cargo load positioned next to it. This allows load teams to prioritize early departures, then work on any other loads that are ready early. Also, work teams from each of the ten modules that load cargo into the containers and remove the cargo from the containers for sorting, work on the aircraft ramp at the end of their shift. These employees give the load teams extra help if needed.

Safety

Clothing and protective gear are important parts of an employee safety program. Employees are issued uniforms by Burlington. These uniforms consist of black pants, green T-shirts, steel-toe boots, cargo gloves, and lift belts. Employees working outside on aircraft and on the parking ramp are required to wear reflective gear and hearing protection.

At the beginning of the work shift, teams from each module and load teams do calisthenics to loosen muscles to help prevent injuries. Coupled with the good lighting and the clean air in the sort facility, working conditions observed are very good and safe.

New orange, electric forklifts will help keep the forklifts easily visible. Also, all vehicle drivers observed were very safety conscious even though activities were always fast-paced.

Interview

Title of person(s) interviewed: Manager, Hub Night Operations

1. What type of cargo do you specialize in handling and what other types of cargo do you handle?

Burlington's specialty is in the movement of large, oversized, heavy weight cargo; however, any type or size of cargo is accepted for shipment. Approximately 78 percent of Burlington's cargo weighs less than 70 pounds and the remaining 22 percent is "awkward/heavier freight" that cannot be moved on their conveyor system but is moveable by forklift. This awkward/heavier freight comprises 50 percent of Burlington's total volume.

2. Do you have written procedures in place for surge periods? If so, are these company-wide, regional, or local?

Burlington has company-wide written procedures called "Bump Procedures" which were established for handling overloads (not necessarily surges in workload). "Bumping" cargo refers to rerouting or removing cargo from a scheduled aircraft route. These Bump Procedures are guidelines that show which customers must be serviced in the event of a contingency.

There are three levels of bump procedures that provide alternate cities for routing cargo in the event that a surge in workload causes the cargo to be bumped off the aircraft. The three levels of structure in the Bump Procedures include: 1) using the existing aircraft fleet and route structure to move the cargo to its final destination; 2) using spare aircraft that are always available (if spare aircraft are not available, Burlington will lease more aircraft when necessary); and 3) holding the cargo at the hub for movement by truck to Detroit where it is sent out via commercial aircraft (leased space). Burlington usually knows by 2200 hours whether or not they will have to use their Bump Procedures.

3. How often are your surge plans updated and do you ever test your plans?

Burlington's Bump Procedures are updated as needed; usually, these updates are conducted every other month. The procedures are continually tested as Burlington guarantees delivery to its customers. Customers who want to move cargo weighing 1,000 pounds or more are required to send advanced notice to Burlington. This information is placed on Burlington's LOTUS spreadsheet program and quickly alerts operational managers to any potential hot spots (any requirements to use bump procedures) so they may plan accordingly.

4. What effects do surges have on your cargo handling equipment?

None. Burlington has spare Ground Support Equipment (GSE) for each function. The spare GSE is referred to as "Hot Spares" and includes equipment that is not normally scheduled for use. Also, Burlington's modular hub design allows even distribution of cargo throughout the warehouse and eliminates bottlenecks.

5. If extra equipment is needed, do you obtain it through in-house resources or by contract? Do you go through company-wide, regional, or local channels?

Burlington primarily uses local channels to obtain extra equipment. Any extra equipment, to include specialized equipment for their aircraft,

is leased from vendors located within the Toledo, Ohio area.

Extra equipment required at regional hubs (outside of Toledo) is also obtained within the local area of the regional hub. However, Burlington uses centralized management and requires approval at the main hub in Toledo when extra equipment is leased by the regional hubs .

6. During surge periods, how do your personnel levels change?

Burlington's staffing fluctuates monthly based on projected and actual volume. Burlington has three categories of part-time personnel: 1) regular part-time employees, approximately 440 people, who work every night (Monday through Friday); 2) scheduled casual employees, approximately 70 people, who work every other night; and 3) contingent employees, approximately 100 people, who are on call.

7. Do you go through company-wide, regional, or local channels to get additional personnel? Are they hired as part-time or full-time?

Local channels are used to obtain additional personnel at the Toledo hub. The Human Resources Department is located in the Toledo hub and selects employees from the large employee base within the Toledo area. These additional

employees are hired as part-time employees. Any requirements for managerial or supervisory positions at the Toledo hub are announced nation-wide.

8. How do you train these additional employees and is there a learning curve associated with this training?

All Burlington employees hired for cargo operations receive the same training. The training process is one week long with one supervisor assigned to train four new employees. In order to give a good overview of all areas, Burlington's employees are rotated through various areas (i.e. loading aircraft, building-up of cargo in containers, conveyors, and trucks) and receive classroom and hands-on experience within each area.

9. How do you measure the effectiveness of your day-to-day cargo handling operations?

Burlington uses time standards to measure the effectiveness of their cargo handling operations. All aspects of the sort and aircraft loading operation are timed. For example, time measurements are made of aircraft uploads, aircraft downloads, truck downloads, build-up of containers, weighing of containers, and aircraft start up. These time standards are compared to the amount of volume handled to develop

productivity standards for the entire hub operation. Productivity is measured in pieces per manhour with a heavy emphasis on time due to the sense of urgency to deliver the cargo at the proper time and to the proper place.

10. How do you measure the effectiveness of your cargo handling operations during surges?

Burlington's measurements of effectiveness during surges are the same as their day-to-day cargo handling operation. The only difference is that more people and resources are required to handle the increase in volume--effectiveness is still measured by pieces per manhour.

Appendix J: Dover Air Force Base

Observation

Setting

The 436th Aerial Port Squadron at Dover Air Force Base, Delaware was the setting of a June 1993 tour of daytime operations. Because of the worldwide scope and mission of the Air Force, the number of aircraft handled at the aerial port varies from day to day. Although daytime and nighttime cargo handling operations are essentially similar--they are both subject to change from one day to the next.

Dover has one very large building which houses all of the aerial port's functional cargo areas. The inside of this building is set up like a warehouse with different sections separated by interior walls. The major sections observed were inbound freight, outbound freight, and ramp services. Functions of these areas will be discussed later.

The interior of Dover's cargo facility was like a warehouse, but exterior lighting was not observed since this observation was conducted during the day. The outside of this facility was surrounded by a large aircraft parking ramp on one side and a parking lot on the other side. (The parking lot could also be cleared of vehicles and used to store cargo awaiting airlift). The majority of the aircraft ramp space was occupied by C-5 aircraft, although C-141s and C-130s were also parked on the ramp.

Dover has a separate explosives storage facility which is located several miles from the main cargo facility, on the other side of the runway. This building is new, well-lit, and very clean. It was set up like a warehouse with truck docks and automated dock levelers. The air inside of this facility is continuously recycled. Security is enhanced by using motion detectors connected to an alarm system. However, armed guards are required for some sensitive shipments.

With the changing schedules and varying missions handled by the Air Force, operations at Dover differ from the commercial air cargo carriers. Unlike the air cargo industry leaders, Dover has the responsibility of transporting passengers in addition to cargo. Accommodating passengers with cargo on board military aircraft often changes how cargo is loaded and what type of cargo is loaded.

Cargo Handling Equipment

Forklifts of varying types and sizes are used extensively in Dover's aerial port. Gas, diesel, and propane forklifts capable of handling 4,000 (4K) and 10,000 (10K) pounds were observed in operation both inside and outside of the cargo handling facility. Forklifts were used to move both large pieces of cargo and cargo pallets.

The pallets used by Dover and the rest of the Department of Defense (DOD) are aluminum covered balsa wood.

In comparison to pallets used by the commercial air cargo carriers observed, these pallets are much thicker and sturdier with approximately two inches of depth to each pallet. These pallets, called 463L pallets, can hold up to 10,000 pounds of cargo, and have metal rings to which cargo restraint straps are attached.

Unlike the commercial air cargo carriers, Dover does not receive, sort, and ship out all of the cargo on a daily basis. Depending on the cargo's destination, frequency of flights, and the cargo priority, some cargo may be held at Dover for over a week.

To store pallets of cargo, Dover has an automated system known as the Mechanized Material Handling System (MMHS). The MMHS is a computerized storage and picking system that allows one operator to store or pick (retrieve cargo for shipment) up to 450 pallets. Up to two married pallets (pallets connected together with couplers) can also be stored and picked by this system. The MMHS uses multi-level storage racks with positions marked for each pallet. A movable vehicle capable of holding two pallets is "driven" by an operator on a track which runs the length of the cargo facility. The operator enters the storage location (of the pallet to be picked or stored) into the vehicle's on-board computer. Then, the MMHS takes over and transports the operator and the vehicle to the proper location. From there, a pallet can either be placed in the storage location, or be pulled (picked) from the location.

Automated rollers on the vehicle and in the storage locations are used to transfer pallets to and from the vehicle and storage location.

Military K-loaders (different from civilian K-loaders) are used to transport cargo from the MMHS to the aircraft. Most operations use two types of K-loaders to load and offload both military and some civilian aircraft. The 25K-loader has rollerized flooring and is capable of holding up to three pallets or 25,000 pounds. The 40K-loader also has rollerized flooring and can hold up to five pallets or 40,000 pounds.

Pallets are placed on the loader with forklifts or are pushed off of rollerized storage docks onto the K-loader. (When cargo is moved from the MMHS to be uploaded on an aircraft, it is first moved by forklift from the end of the MMHS to the docks, which have rollers, so that pallets can be pushed easily by hand or automatically by drive wheels). Once a K-loader is full and is driven to an aircraft, the entire K-loader is raised to the level of the aircraft loading ramp. Then, cargo is pushed off of the K-loader(s) and onto the aircraft.

Since military K-loaders cannot reach the top (main) decks of large commercial aircraft, Dover uses commercial-type loaders, called TA-40s, to work those aircraft. Loading operations require using the military K-loaders or forklifts to transport the cargo to and from the aircraft. Then, the TA-40 is used to move up to two pallets from the

level of the K-loader to the top deck of the aircraft. Finally, the cargo is pushed onto a K-loader. This process is reversed when off-loading the commercial aircraft.

Dover was to receive a 60K-loader shortly after the observation took place. The 60K-loader holds up to six pallets or 60,000 pounds and reaches the top deck of a DC-10 or B-747--capabilities that the 25 and 40K-loaders do not possess.

Aircraft

The Air Force has a fleet of C-130, C-141, and C-5 aircraft that transport a majority of the DOD's airlift cargo. There are C-5 aircraft stationed at Dover AFB, but they also have C-141s and C-130s transiting the base. Because worldwide situations change daily, the number and type of aircraft at a particular location change daily. For example, Dover may be required to load/unload KC-10, KC-135, or any type of aircraft that transits the base. This includes commercial aircraft such as DC-10s and B-747s that are contracted to move DOD cargo.

The C-5s that are stationed (home-based) at Dover are maintained on the base, except for major maintenance which is consolidated at depot repair facilities. Any military aircraft that transit Dover can receive minor, enroute maintenance, but the majority of maintenance work is accomplished at an aircraft's home base. Any civilian aircraft that transit Dover are maintained by the contracted

air carrier or their representative. Military maintenance personnel do not service commercial aircraft.

Small Package Sort/Large Cargo Handling

Because all cargo is handled in essentially the same manner, these two areas are combined. Dover moves everything from letters or documents to M1A2 tanks, yet the process is the same. If cargo can fit onto a single pallet or married pallets (up to five pallets hooked together by couplers), it is palletized. Some small vehicles, such as sedans or pickup trucks, can also be palletized, but these types of vehicles are normally driven directly onto the aircraft. (Note: vehicle loading was not observed during this visit).

When cargo first arrives at the aerial port, it is either taken out of trucks or off of inbound pallets and segregated by location. Cargo for varying locations is stored in cargo "bays" which are separate areas inside of the freight facility. Cargo arriving by truck is put in the outbound (export) section of the facility, and cargo arriving by aircraft is put in the inbound (import/retrograde) section of the facility. The cargo bays were not marked by destination due to the constantly changing needs of the DOD. For example, before the Gulf War, there was very little cargo destined for Saudi Arabia. During this observation period, there were separate bay locations for several cities and military installations in

Saudi Arabia. Even though these bays were not marked, all personnel observed were familiar with the locations.

When there is enough cargo in a "bay" location to fill one pallet or when there is an aircraft mission planned, all of the cargo in that bay is palletized. When cargo is palletized, the empty military cargo pallet (a 463L pallet) is placed on three pieces of wooden dunnage. The dunnage is required so that a forklift can easily pick up a built-up pallet (a pallet loaded with cargo) and to prevent a pallet from being warped by the weight of the cargo. Then, cargo is placed on the pallet until there is no other cargo for that pallet's destination, until the pallet is full (contoured to the shape of the aircraft on which it is to be loaded), or until the pallet weighs 10,000 pounds.

After a pallet is filled with cargo, a thick plastic bag is placed over the cargo. Plastic is used to protect the cargo from inclement weather since pallets are sometimes stored outside for several days or even weeks. Then, military cargo nets with hooks are placed on the pallet to secure the cargo. Nets come in a set which consists of two side nets and one top net. In comparison to the commercial cargo carriers, these nets are made of strong nylon straps which hook together and attach (hook) onto metal rings along the bottom edge of the pallet.

Once pallets are built they are weighed. Then, information about the pallet, such as the pallet identification and weight, are entered into a computer.

This computer also contains a manifest of all cargo placed on that pallet. Then, pallets are stored by using the MMHS or by placing pallets in a marked grid yard if there is no space in the MMHS.

Employees

Both military and civilian, male and female personnel work at Dover's aerial port. There are more military personnel than civilians, and all personnel are full-time employees. During this observation, all cargo (air freight) personnel in the aerial port were working eight hour shifts; however, this was changed just prior to the observation. For the past two and a half years, the military personnel were working 12 hour shifts.

During the observation, Dover's manpower increased due to an annual exercise, PATRIOT PARTNER, with Air Force Reserve personnel. PATRIOT PARTNER provides training for the Reserves by allowing them to work in all areas of the aerial port squadron.

Intransit Visibility

The Air Force uses several computer systems to track DOD air cargo shipments. Until recently, two separate procedures were used to track peacetime and wartime air cargo shipments. Now the same procedure is used for all shipments.

Once cargo arrives at the aerial port, either by truck or aircraft, cargo tracking information is input into a

computer. When this cargo is put on a pallet, the computer is updated to reflect that the cargo is palletized. Also, when this palletized cargo is loaded on an aircraft, the computer is again updated. Finally, when the aircraft departs, the computer is updated a final time. All of these computer updates are made by either cargo processing personnel or by a load planner. Any aerial port in the Air Force has the capability to trace any piece of cargo once it enters the airlift system.

Operations Interface

The load planning function was not observed at Dover, but it is essentially the same as that of other aerial ports in which the observers have worked. Once pallets are built, the personnel building the pallets update the computer system to show that a pallet is ready for airlift. Then, load planners use the computer to decide which pallets will be loaded on an aircraft. This decision is based on the cargo's priority and space available on the aircraft. Before completing the final weight and balance of an aircraft's load, the load planners are required to physically look at each cargo pallet to ensure it is built properly.

Once a load plan is complete, (including the sequence of the pallets, weight, and balance), load planning contacts the outbound (export) freight section. At Dover, outbound freight personnel are then responsible for sequencing the

pallets as specified in the load plan. (At other aerial ports, ramp services accomplishes this). If the pallets are stored in the MMHS, then the MMHS is used to "pick" the pallets and place them at the end of the freight facility. Then a forklift is used to place these pallets on hi-line (or finger) docks. These docks have rollers so that pallets can be pushed easily by hand or automatically by drive wheels. If pallets are stored in a grid yard, they are also moved by forklifts to hi-line docks.

When a load is sequenced in the proper upload order, it is considered "pulled". Then, the outbound freight personnel notify Ramp Services (load teams) that the cargo is pulled and ready for upload. (All load teams carry hand-held radios tuned to the aerial port frequency). The load teams then push the pallets from the hi-line docks onto K-loaders, and the K-loaders are driven to the aircraft.

Ramp Services' load teams can load some aircraft without any assistance from aircrew members (called Phase II uploads), but all C-5 aircraft and some complicated loads on C-141s and C-130s require an aircrew member, known as the loadmaster, to be present. The loadmasters do not work for the aerial port, but they do assist in the upload and download of cargo. (The researchers noted that none of the observed commercial air cargo carriers have a comparable loadmaster function).

Dover's Air Terminal Operations Center (ATOC) is used to coordinate all of the aerial port's functions. The ATOC

also interfaces with the Dover Air Force Base Command Post. The Command Post has representatives from aircraft operations, aircraft maintenance, and the aerial port. Changes in aircraft uploads/downloads, maintenance problems, the request for loadmasters, etc. are coordinated through the Command Post and to the aerial port.

Safety

Clothing and protective gear are important aspects of an employee safety program. All military personnel are required to wear the Battle Dress Uniform (BDU), while civilians are not required to wear uniforms. All cargo personnel are required to wear, and are issued, steel-toed boots and leather cargo gloves. Also, everyone is required to wear hearing protection while on aircraft or on the outside aircraft ramps. Reflective gear is required during hours of darkness. Lifting belts are optional, but are available to everyone. All personnel at Dover were observed wearing the required protective gear.

Lighting, another important safety aspect, was poor inside of the inbound and outbound cargo sections. This poor lighting was identified by management and a workorder for new lighting does exist. Neither outside lighting nor nighttime operations were observed.

Vehicle safety both inside and on the aircraft parking ramps was observed. All vehicles were moving very slow and seemed to be observing speed limits. Horns, lights, and

hand signals were used by all drivers on observed vehicles. Even though there were no visible drive/walk lines on the inside or outside of the facility, everyone was extremely cautious and safety-minded.

Interview

Title of person(s) interviewed: Squadron Operations Officer
436th Aerial Port Squadron

Note: Throughout this interview, *Dover* refers to the 436th APS at Dover AFB DE.

1. What type of cargo do you specialize in handling and what other types of cargo do you handle?

Dover handles any size, shape, dimension, or weight of cargo. Basically, Dover will move any type of cargo that the shipper (customer) requests. Unlike the commercial air cargo carriers, Dover will not specify the size, shape, and weight for the customer. A lot of the cargo moved by Dover is heavy cargo which is referred to as "ugly cargo". This includes outsized cargo (that will not fit within the confines of a normal 463L pallet), pallet trains, vehicles, tanks, explosives, hazardous materials, etc. Any cargo that is air eligible can be moved by Dover.

2. Do you have written procedures in place for surge periods? If so, are these company-wide, regional, or local?

The *aerial port* does not have written procedures on how to operate during surges from an

aerial port perspective; however, there *are* plans developed from the *base level* plans and programs perspective on how the *entire* wing at Dover AFB will function during a surge period. For example, the plan specifies use of one of the bay locations at the aerial port during surge periods--this area was explicitly built during Operation DESERT SHIELD/STORM to handle the heavy workload experienced at Dover AFB.

In addition, Dover has portable ramps (rollerized hi-line docks), War Reserve Material (WRM), etc. to handle any added volume typically associated with a surge period. These, and other specific capabilities, are available during surge periods; however, the specifics on operational use of these surge capabilities are not in writing. Instead, these surge capabilities are known as operational requirements that are continually *maintained* rather than written.

The aerial port has local written agreements in place with specific Air Force Reserve units who support aerial port operations during surge periods. Although these written agreements include specific reserve units stationed at Dover AFB, Headquarters Air Mobility Command

(HQ AMC) "sources" the reservists for Dover AFB; thus, Dover must go through HQ AMC and the reserve counterparts to acquire reserve personnel.

The Air Force has recently reduced the amount of regulatory guidance for operations. The concept of "empowerment" has led to more general guidance that gives more latitude to operational managers. Instead of the commands (e.g. AMC) specifying *exactly* how to operate, there is an emphasis to manage the operation using the best means possible. For example, AFR 28-4, *USAF Mobility Planning*, is being phased out and superseded by Appendix G of the DOD regulatory guidance--which states that anything that enters the defense transportation system will be moved in the appropriate manner.

3. How often are your surge plans updated and do you ever test your plans?

Local written agreements with the reserve aerial ports are updated annually. Testing of the written agreements includes training with the reserves throughout the year. Currently, there is a large reserve aerial port unit at Dover AFB for their two-week annual tour in support of PATRIOT PARTNER. This exercise is conducted with the reserves and allows them to train as if they were to "take-over" aerial port operations from the

active duty personnel. This is only one example of training with the reserves--training with reserve personnel is an on-going process (weekly).

In addition, the aerial port's ability to operate in a surge period has continually been tested during real-world events such as Operation DESERT SHIELD/STORM and, recently, Operation RESTORE HOPE.

4. What effects do surges have on your cargo handling equipment?

Most of the material handling equipment (MHE) or cargo handling equipment used at Dover is very *old* and surge periods reduce the time allowed for preventative maintenance (decreases the reliability of the equipment). In conjunction with the age of the equipment, additional use of the equipment during these surges in workload also increases the likelihood of breakage of the vehicles (out-of-commission). Thus, all of the MHE is affected by a surge in workload--the more the equipment is used, the more potential there is for breakage.

The Air Force is currently upgrading some of the MHE to reduce the potential of breakage. Unlike a civilian company, the Air Force will not buy an entire integrated system--instead, the systems will continually be upgraded and some

systems are integrated with different systems. For example, Dover had a number of pallet dollies (similar to those used by the commercial carriers) that required a heavy use of manpower to integrate this system. The use of pallet dollies was not practical for Dover since this system was manpower intensive when integrated with the current MHE system (military K-loaders). The pallets had to be turned with forklifts and loaded on the K-loaders with forklifts. In addition, only a certain number of pallet dollies could be towed at one time which required a lot of manpower and time to move the cargo to and from the aircraft. The physical distance to and from the aircraft (large amount of ramp space) also made it a lengthy process to shuttle the cargo with pallet dollies.

Since the systems are brought on-line by the Air Force in intervals, some aspects of the MHE systems do not always match up well with other systems. One example is that there may be new K-loaders, but the forklifts used in conjunction with the K-loaders are old.

Most of the 25K and 40K-loaders at Dover are very old. Due to the type of aircraft stationed at Dover (C-5's with 36 pallet positions), the 40K-loader, more so than the 25K-loader, is the primary vehicle used to load and off-load cargo.

Since more 25K-loaders (with 3 pallet positions per vehicle) are required to service a C-5 aircraft, Dover relies heavily on the 40K-loader (with a capacity of 5 pallet positions per vehicle). However, Dover received new 25K-loaders that are being used to load and off-load aircraft. There have been some adjustment problems with the new 25K-loaders (i.e. the operator's cab of the vehicle was not in the right place and the rails were blocking capability to tie-down the pallets to the vehicle); but, the newer models received have been adjusted to alleviate these problems.

Dover is scheduled to be the test-site for the new 60K-loader (6 pallet and 60,000 pound capability). This vehicle was scheduled to arrive in August 1993 and is viewed as a tremendous enhancement to Dover's capability to move cargo due to the size of aircraft based at Dover.

5. If extra equipment is needed, do you obtain it through in-house resources or by contract? Do you go through Air Force-wide, regional, or local channels?

Dover uses both in-house (Air Force) and contract resources to obtain extra equipment. All requests for extra equipment first go through the base transportation squadron (Vehicle Operations), and any requirements for additional equipment that are not available at Dover are justified to

HQ AMC. HQ AMC, in turn, determines if resources from other bases can be used to fulfill Dover's requirement for extra vehicles during a surge period. If necessary, the vehicles are sourced from local contracts (leased) by the base contracting office (and through Vehicle Operations) with HQ AMC approval. Short term requirements (less than three months) to lease extra equipment are approved at HQ AMC. Long term lease requirements (over three months) are sent through HQ AMC and then approved by the Air Staff at US Air Force headquarters. However, the vehicle authorization process used by the Air Force requires justification for any long-term requirements. If approved, the "authorization" (versus the actual vehicle) to acquire the vehicle is given to the unit. Thus, if there is a long-term need for a vehicle, this requirement should be identified in order to establish a permanent authorization that eventually results in a "vehicle buy" (procurement of the vehicle).

Dover has, in the past, resorted to leasing extra equipment to support surges in workload. For example, during Operation DESERT SHIELD/STORM, Dover was heavily tasked to ship cargo (in addition to deploying personnel) to the Persian Gulf. In addition to acquiring equipment from other Air Force bases, Dover had to establish emergency contracts to lease some equipment

(propane forklifts and latrine servicing trucks--LSTs--that are used to clean the aircraft).

Currently, Dover is a test base for propane forklifts. These 10K propane forklifts (10,000 pound capacity) are leased on a long-term basis from a local contractor, with HQ AMC and Air Staff approval, in an effort to improve the quality of air within the cargo handling facility. In comparison to the diesel forklifts used within the warehouse, the propane forklifts have cleaner burning fuel when serviced properly. However, when, and if, the long-term lease of propane forklifts becomes a vehicle buy, there is still a requirement for diesel forklifts (propane forklifts are *not* deployable to off-base locations).

In addition to the long-term lease of propane forklifts, Dover also has commercial TA-40's which are vehicles used to load and off-load cargo on commercial aircraft (these vehicles are similar to the K-loaders used by commercial air cargo carriers). The TA-40s are leased on a long-term basis by HQ AMC and are required because the military 25K and 40K-loaders cannot reach the upper deck on B-747 aircraft (and other commercial widebody aircraft).

6. During surge periods, how do your personnel levels change?

In order to accommodate the increase in workload during surge periods, Dover readjusts its manning to 12 hour shifts. However, Dover only recently reverted back to eight hour shifts that were in-place prior to Operation DESERT SHIELD/STORM. There are still some areas of the aerial port that are still on 12 hour shifts. If 12 hour shifts are necessary, the current goal is to have personnel work four days on and three days off with overlapping shifts (e.g. overlap shifts of personnel working grave and day shifts). Of course, there were several instances during Operation DESERT SHIELD/STORM where personnel worked six days on and one day off; however, this was over a short period of time. People are willing to do whatever is necessary to overcome the events in a surge period. When working long shifts, there is a concern for safety and, if people are not given a break, productivity will decrease in proportion to the number of days spent working the long shifts on a continual basis. It is important to balance safety and productivity issues with the number of personnel working.

Due to the increased workload that Dover has experienced (cargo moved to support operations in

Europe, the Middle East, and Somalia), along with the reduction in manning due to Air Force-wide cutbacks such as Variable Separation Incentives/Special Separation Bonuses (VSI/SSB), the aerial port remained on 12 hour shifts after the Gulf War. Several instances occurred where justification was made for added reserve personnel to work in the aerial port. In order for these reserves to work in the aerial port squadron during a surge period, there must be a *need* or requirement for added personnel during a surge period. Justification for added personnel (reserves) includes the tonnage of cargo anticipated and why added personnel are needed to handle this tonnage, the backlog of cargo in the aerial port, current manpower, and how many hours (man-days) the reserves are required to work during the surge. For example, Dover requested "reserve augmentation" from specific reserve units during Operation RESTORE HOPE (humanitarian airlift of cargo to Somalia). Many of the reservists were members of the 72nd APS, 96th APS, and the 46th APS--reserve aerial port squadrons based at Dover AFB.

Dover trains personnel from reserve units stationed not only at Dover AFB, but throughout the United States, all year long--it is an on-going

process. In addition, Dover trains Army personnel (most of whom work mail duties) on the formal processes of the aerial port.

7. Do you go through Air Force-wide, regional, or local channels to get additional personnel? Are they hired as part-time or full-time?

In order to acquire additional *military* personnel, Dover must go through Air Force channels for approval (military personnel are acquired on a full-time basis). Additional *civilian* personnel are sourced through the local civilian personnel office at Dover AFB. Depending on the requirement, some civilians "overhires" are hired as part-time employees.

The amount of additional military and civilian personnel requested is directly related to current worldwide events and the mission taskings for Dover AFB. The requirements for personnel may fluctuate immensely (weekly or day-by-day) depending on real-world events. There is a minimum level of personnel required to handle operations below which manning cannot drop. In some situations there may be no need to fill a few short-term vacated positions on a one-for-one basis; but, in other cases where the surge results in losing a significant number of people, there may be a requirement to request for additional

personnel. For example, next week there could be a tasking to send 60 personnel to Mogadishu, Somalia. This would probably result in a request for additional personnel (reserves) to handle the workload if active-duty personnel depart for Somalia.

8. How do you train these additional employees and is there a learning curve associated with this training?

Additional personnel required to work during surge periods are given complete training in order to perform their duties. Each individual is required to complete *all* training associated with his or her position and there is a learning curve associated with training additional personnel. For example, personnel will receive operator training and government licensing on applicable MHE, safety, flightline driving, self-aid/buddy care, etc. The level of specialized training given to an individual depends on the position he or she will work (i.e. handling explosives or hazardous material, operating K-loaders or forklifts to move cargo, building cargo pallets, load planning, etc.) and the currency of that individual. During Operation DESERT SHIELD/STORM additional training requirements for reserve personnel deploying to the Middle East included chemical warfare training. Thus, the training

conducted in a strategic aerial port, such as Dover, is directly related to the taskings and dangers to which personnel are inherently exposed.

In regards to civilian personnel, fortunately, there are a number of qualified civilians in the local area with prior military or civilian experience in aerial port operations. These additional civilians are checked for currency and provided all of the necessary upgrade training to complete their respective duties. This is a benefit for Dover as these individuals do not take as long to train and the learning curve is not as steep in-comparison to someone who has no prior experience.

9. How do you measure the effectiveness of your day-to-day (peacetime) cargo handling operations?

There are several methods for measuring effectiveness. One specific measurement is the Port Processing Time (PPT)--the amount of time it takes to process a piece of cargo through the aerial port. Port Hold Time (PHT)--the amount of time the cargo is physically in the port--is a measurement of interest and directly impacts Dover's operation and the backlog of cargo; however, this metric is controlled by the Tanker Airlift Control Center (TACC) at HQ AMC. In addition to PPT, there are several daily reports

that are monitored. Some of these reports include: 1) frustrated cargo--cargo that is held at the port due to some type of discrepancy; 2) cargo backlog--cargo awaiting movement to certain destinations (this report is reviewed in conjunction with the aircraft missions forecasted in the Air Terminal Operations Center (ATOC) to ensure there is appropriate airlift to move the cargo and that the TACC is aware of cargo at Dover that is awaiting airlift); and 3) 999/MICAP status reports--high priority cargo and any cargo for special projects or missions.

Aircraft delays are monitored but not used as a management tool at Dover. There may be a variety of situations when delay of the aircraft is unavoidable and the interviewee believes that focusing on aircraft delays is counterproductive. For example, in cases where there are two load crews working aircraft and two tail-swaps (due to required maintenance of the aircraft), along with an unexpected aircraft arrival, it may be impossible to get all aircraft out on-time. Thus, the aircraft delay does not provide an accurate measurement of effectiveness of the two load teams. In some cases, delay codes can serve a purpose by identifying areas that require improvement. However, *all* areas must be evaluated

and effectiveness is measured by whether or not the cargo was loaded on the right aircraft, to the right destination, at the right time.

10. How do you measure the effectiveness of your cargo handling operations during surges (contingencies/war)?

Since the aerial port is a processing point for cargo, the effectiveness of the cargo handling operation during a surge period is measured by the ability of the port to process the cargo and have it ready for airlift. The goal at Dover is to have this process completed within 24 hours--the HQ AMC standard is 48 hours.

During contingencies, a dilemma occurs when there is more cargo than airlift capability. It is extremely difficult to satisfy all service components (i.e. Air Force, Army, Navy, Marines) or shipping agencies. Each component believes they are the most important, and they all compete for the limited number of airframes available. In this situation, the Joint Chiefs of Staff, represented by a Joint Task Force (JTF) is responsible for assigning priorities to all cargo scheduled for airlift in support of the contingency. Unless re-prioritized by some higher agency, the 999 cargo is prioritized on a first come first serve basis (FIFO). For example, during Operation RESTORE HOPE a specific

individual was appointed to coordinate with the JTF to reconcile any differences in the prioritization of cargo. This was necessary because what is important to the Air Force and what is important to the Marines may be considerably different.

Bibliography

1. Air Force Logistics Command. *Benchmarking*. Headquarters Quality Council Work Group, 15 August 1990.

2. "Airborne Cuts Rates to Lure Small Shippers," *The Journal of Commerce*, 31 July 1992, sec. A: 1 , 3.

3. Altany, David. "Copycats," *Quality Digest*, 3: 53-59 (March 1991).

4. Auguston, Karen. "How Jaguar Ships Orders On Time, Every Time," *Modern Materials Handling*, 46: 74-75 (February 1991).

5. Bard, Jonathan F. and Stephen F. Sousk. "A Tradeoff Analysis for Rough Terrain Cargo Handlers Using the AHP: An Example of Group Decision Making," *IEEE Transactions on Engineering Management*, 37: 222-227 (August 1990).

6. Bemowski, Karen. "Quality in Flight," *Quality Progress*, 25: 27-32 (July 1992).

7. "Benchmarking, The IBM-Rochester Way," *Quality Digest*, 11: 57-67 (December 1991).

8. Biesada, Alexandra. "Benchmarking," *Financial World*, 160: 28-32 (17 September 1991).

9. -----. "Truck Soup," *Financial World*, 161: 22-23 (4 August 1992).

10. Bradley, Peter. "Good Things Come in Small Packages," *Purchasing*, 107: 58-64 (9 November 1989).

11. -----. "Headwinds for Air Freight," *Purchasing*, 110: 64-66 (7 March 1991).

12. -----. "Package Express: A Study in How Free Markets Work," *Purchasing*, 108: 68-76 (27 September 1990).

13. Brocka, Bruce and M. Suzanne Brocka. *Quality Management - Implementing the Best Ideas of the Masters*. Homewood IL: Business One Irwin, 1992.

14. Camp, Robert C. *Benchmarking: The Search for Industry Best Practices That Lead to Superior Performance*. Milwaukee WI: Quality Press, 1989.

15. -----. "Benchmarking: The Search for Best Practices That Lead to Superior Performance, Part I," *Quality Progress*, 22: 62-68 (January 1989).

16. -----. Benchmarking: The Search for Best Practices That Lead to Superior Performance, Part II," *Quality Progress*, 22: 70-75 (February 1989).

17. -----. Benchmarking: The Search for Best Practices That Lead to Superior Performance, Part III," *Quality Progress*, 22: 76-82 (March 1989).

18. Cavinato, Joseph. "How to Benchmark Logistics Operations," *Distribution*, 87: 93-94 (August 1988).

19. Cheney, Dick. *Defense Strategy for the 1990s: The Regional Defense Strategy*. Washington DC: GPO, 1993.

20. Clancy, David A. "Savings Are Priority with Deferred Air," *Transportation and Distribution*, 30: 26-27 (May 1989).

21. Cooke, James A. "How the Integrated Carriers Changed an Industry," *Traffic Management*, 30: 37-42 (August 1991).

22. Coyle, John J. and others. *Transportation* (Third Edition). St. Paul MN: West Publishing Company, 1990.

23. "Demand Rockets, Delta Automates Air Cargo Ops," *Modern Materials Handling*, 47: 12-13 (April 1992).

24. Department of Defense. *Dictionary of Military and Associated Terms*. JCS Pub 1. Washington DC: GPO, 1 June 1987.

25. "Desert Storm: Unleashing the Might of Materials Handling," *Modern Materials Handling*, 46: 50-67 (July 1991).

26. Drozdowski, Ted E. "GTE Uses Benchmarking to Measure Purchasing," *Purchasing*, 6: 21-22 (31 March 1991).

27. *Dun's Business Rankings 1992*. New Jersey: Dun & Bradstreet, Inc., 1992.

28. Eisenhardt, Kathleen M. "Building Theories from Case Study Research," *Academy of Management Review*, 14: 532-550 (1989).

29. "Emery Worldwide is Getting it Right," *Global Trade*, 110: 51-52 (May 1990).

30. Emory, C. William and Donald R. Cooper. *Business Research Methods*. Boston: Irwin, 1991.

31. "Fad or Fundamental?," *Financial World*, 6: 34-35 (17 September 1991).

32. Filipowski, Diane. "How Federal Express Makes Your Package Its Most Important," *Personnel Journal*, 71: 40-46 (February 1992).

33. "First Find Your Bench," *The Economist*, 319: 72 (11 May 1991).

34. Forger, Gary. "Top Gun Materials Handling at Tinker Air Force Base," *Modern Materials Handling*, 45: 44-47 (June 1990).

35. Foster, Thomas A. "Airline Interest in Airfreight Rises," *Distribution (Part I)*, 89: 70-74 (July 1990).

36. -----. "Searching for the Best," *Distribution*, 91: 31-36 (March 1992).

37. Frankfort-Nachmias, Chava and David Nachmias. *Research Methods in the Social Sciences*. New York: St. Martin's Press, 1992.

38. Gibson, James L. and others. *Organizations: Behavior, Structure, Processes* (Seventh Edition). Homewood IL: Irwin, 1991.

39. Gordon, Jay. "Air Express Market Stays Hot," *Distribution (Part I)*, 89: 76-80 (July 1990).

40. Gould, Les. "Two Secrets from Japan: Appropriate Technology, Continual Improvement," *Modern Materials Handling*, 45: 56-57 (December 1990).

41. Gourdin, Kent N. and Richard L. Clarke. "Winning Transportation Partnerships: Learning from the Desert Storm Experience", *Transportation Journal*, 32: 30-37 (Fall 1992).

42. Harmon, Marion. "Benchmarking," *Quality Digest*, 12: 20-31 (July 1992).

43. Harvey, Philip D. "Charities need a Bottom Line Too," *The Harvard Business Review*, 65: 14-22 (Jan-Feb 1987).

44. Hawkins, Chuck. "FedEx: Europe Nearly Killed the Messenger," *Business Week*, Industrial/Technology Edition: 124, 126 (25 May 1992).

45. "It's Back to Basics for Carrier Quality," *Distribution*, 90: 57, 60 (August 1991).

46. Jedd, Marcia. "Integrators Race for Globalization," *Global Trade*, 112: 25-27 (July 1992).

47. King, Julia and Janet Mason. "Transportation - High Flying Airborne Express Keeps Feet on the Ground," *Computerworld, Premier 100 Supplement*, 30 September 1991: 70-72.

48. Kitfield, James. "Aspin's Option," *Government Executive*, 25: 42-45 (March 1993).

49. Kleinschrod, Walter A. "Overnight Couriers Provide Price and Performance Options," *Today's Office*, 25: 58-71 (March 1991).

50. Lincoln, Yvonne S. and Egon G. Guba. *Naturalistic Inquiry*. Beverly Hills: Sage Publications, 1985.

51. Luk, Maria. "Hong Kong Air Cargo Terminals to Work in Synch Because of Simulation Applications," *Industrial Engineering*, 22: 42-45 (November 1990).

52. Lyon, Mark W. "Cargo Net Debate Splits Industry," *The Journal of Commerce Magazine Supplement on Air Cargo*, 27 July 1992: 4, 16.

53. -----. "Freight Has Chance to Talk Back," *The Journal of Commerce Magazine Supplement on Air Cargo*, 27 July 1992: 6.

54. Mecham, Michael. "DHL International Extends World Network," *Aviation Week and Space Technology*, 78: 32 (31 August 1992).

55. *Million Dollar Directory - America's Leading Public and Private Company, Series 1991*. Parsippany NJ: Dun and Bradstreet, 1991.

56. Muller, E.J. and Robert Bowman. "The State of Quality in Logistics - Airborne Express," *Distribution*, 91: 97 (August 1992).

57. Muller, E.J. "Trends Bode Well for Air," *Distribution*, 91: 30-36 (July 1992).

58. -----. "Warehouses on Wings," *Distribution*, 88: 48-54 (October 1989).

59. *National Military Strategy Document, FY 1994-1999, (NMSD), Annex H (Logistics)*. Washington DC: GPO, 1993.

60. *National Security Strategy of the United States.* Washington DC: GPO, 1993.

61. Ott, James. "Federal Express Develops C^{3}I-based Information System," *Aviation Week and Space Technology*, 134: 57, 60 (23 November 1992).

62. Page, Paul. "Airborne Joins Higher Price Parade, Says Costs Market Merit 5 Percent," *Traffic World*, 233: 35 (25 January 1993).

63. -----. "Deferred Deliveries Defer Profits for Express Carriers Hit by Recession," *Traffic World*, 230: 21 (13 April 1992).

64. -----. "Embattled Airborne Fares Hurdles in Move to Recoup Losses to Federal," *Traffic World*, 231: 18-19 (24 August 1992).

65. -----. "Emery Cuts Loss to $16.7 Million, Hopes for Some Upturn This Year," *Traffic World*, 230: 43 (27 April 1992).

66. -----. "Emery Finally Battles Back Into the Black, Sees Momentum Building," *Traffic World*, 233: 7-8 (1 February 1993).

67. -----. "Federal Aims at 2nd Day Market With Discounted Surface Service," *Traffic World*, 230: 28-29 (25 May 1992).

68. -----. "Federal Targets European Express, Will Hub Paris in Shifting Operations," *Traffic World*, 233: 34 (25 January 1993).

69. Patton, Michael Q. *Qualitative Evaluation Methods.* London: Sage Publications, 1980.

70. Porter, Michael E. *Competitive Strategy.* New York: The Free Press, 1980.

71. Powell, Colin L. *Chairman of the Joint Chiefs of Staff Report on the Roles, Missions, and Functions of the Armed Forces of the United States.* Washington DC: GPO, 1993.

72. -----. *The National Military Strategy 1992.* Washington DC: GPO, 1992.

73. "Proper Planning Makes Most Equipment Modular," *Modern Materials Handling*, 44: 51-54 (June 1989).

74. Pryor, Lawrence S. "Benchmarking: A Self-Improvement Strategy," *The Journal of Business Strategy*, 10: 28-32 (November-December 1989).

75. "Quest for Quality," *Distribution*, 90: 52, 54 (August 1991).

76. Reboulet, Mark S. and Capt Phillip L. Robinson. *A Study of Theoretical Models for Managing Technology Change and a Comparison to a Radio Frequency Identification Implementation*. MS Thesis, AFIT/GLM/LA93S-36. School of Logistics and Acquisition Management, Air Force Institute of Technology, Wright-Patterson AFB OH, September 1993.

77. Richardson, Helen L. "Improve Service Without Raising Costs," *Transportation and Distribution*, 32: 30-31 (January 1991).

78. -----. "Small Shipments Reach Further with Technology," *Transportation and Distribution*, 31: 14-18 (April 1990).

79. Rosenthal, Thomas M. "Are You Seamless; A Seamless Partnership," *Global Trade*, 110: 20-23 (April 1990).

80. Shishoff Lt Col, John W. *The Nonlinear Nature of Internal Auditing: Ethnographic Perspectives of ynamic Structuring*. Unpublished PhD dissertation proposal. The Pennsylvania State University, State College PA, 1988.

81. Spendolini, Michael J. *The Benchmarking Book*. New York: AMACON, 1992.

82. *Standard & Poor's Industry Surveys*. New York: Standard & Poor, 1991.

83. Strugatch, Warren. "Reliability is the Buzzword," *Global Trade*, 110: 48-51 (April 1990).

84. Tabor, Mary B.W. "When Santa's Reindeer Just Aren't Fast Enough," *New York Times*, 25 December 1992, sec. A: 21.

85. Tomas, Sam. "Stealing Shamelessly," *APICS A&D SIG Digest*, 6: 23-25 (April 1992).

86. Tucker, Frances G. and others. "How to Measure Yourself Against the Best," *Harvard Business Review*, 65: 8-10 (January-February 1987).

87. Tucker, Frances G. and Seymour M. Zivan. "A Xerox Cost Center Imitates a Profit Center," *Harvard Business Review*, 163: 168-169, 174 (May-June 1985).

88. *Ward's Business Directory of U.S. Private and Public Companies, Volume 5: Ranked by Sales*. Foster City CA: Gale Research Inc., 1992.

89. *Webster's New Collegiate Dictionary*. Springfield MA: G. & C. Merriam Company, 1981.

90. "What Do Air Shippers Want?," *Traffic Management*, 31: 65, 67 (7 July 1992).

91. "What's Ahead in Materials Handling," *Modern Materials Handling*, 7: 52-58 (January 1992).

92. Yin, Robert K. *Case Study Research Design and Methods*. Beverly Hills: Sage Publications, 1984.

Vita

Captain Mila D. Abalateo was born on 2 July 1963 in Modesto, California. She graduated from Wagner High School at Clark Air Base, Philippines and attended the University of California at Davis, graduating with a Bachelor of Science in Agricultural and Managerial Economics in June 1986. After graduation, she received a commission in the USAF and attended Transportation Officers' School at Sheppard AFB, Texas. She served her first tour of duty at Aviano Air Base, Italy where she worked as the Vehicle Operations Officer in the 40th Transportation Squadron. In February 1989, she was reassigned to the 63rd Aerial Port Squadron at Norton AFB, California and worked in the Air Terminal Operations Center as a Squadron Duty Officer for eight months and, subsequently, as the Air Freight Officer. She completed Squadron Officer School in residence in October 1990. Captain Abalateo entered to the School of Systems and Logistics, Air Force Institute of Technology in May of 1992. Following graduation, she will be assigned to the 60th Aerial Port Squadron at Travis AFB, California.

Permanent Address:

7720 Carriage Circle
Cupertino, CA 95014

Vita

Captain Joni R. Lee was born on 10 August 1964 in Baton Rouge, Louisiana. She graduated from St. John the Evangelist High School in Plaquemine, Louisiana in 1982 and attended Louisiana State University, graduating with a Bachelor of Arts in Political Science (specialty: International Relations) in August 1986. Upon graduation, she received a commission in the USAF and attended Transportation Officers' School at Sheppard AFB, Texas. She served her first tour of duty at Hanscom AFB, Massachusetts where she worked as Vehicle Maintenance Officer, Vehicle Operations Officer, Traffic Manager, and Assistant Chief of Transportation in the 3245th Logistics Squadron. In March of 1989 she was assigned to Rhein-Main AB, Germany where she worked as a Squadron Duty Officer and Air Freight Officer in the 435th Aerial Port Squadron. In March of 1992 she was chosen to attend Squadron Officer School while enroute to the School of Systems and Logistics, Air Force Institute of Technology. Upon graduation, she will be assigned to Air Force Materiel Command headquarters at Wright-Patterson AFB, Ohio.

Permanent Address:

24010 Marshall St.
Plaquemine, LA 70764

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	September 1993	Master's Thesis

4. TITLE AND SUBTITLE
BENCHMARKING PRACTICES OF AIR CARGO CARRIERS: A CASE STUDY APPROACH

5. FUNDING NUMBERS

6. AUTHOR(S)
Mila D. Abalateo, Captain, USAF
Joni R. Lee, Captain, USAF

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Force Institute of Technology,
WPAFB OH 45433-6583

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GLM/LAL/93S-1

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
HQ AMC/XON
402 Scott Drive Unit 3A1
Scott AFB, Illinois 62225-5302

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release;
distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This research effort used the benchmarking process and a case study methodology to determine what the Air Force can learn from commercial air cargo carriers. A literature search showed that the U.S. air cargo industry leaders are United Parcel Service, Federal Express, Emery Air Freight, Airborne Freight, DHL Airways, and Burlington Air Express. In addition, the 436th Aerial Port Squadron at Dover AFB, Delaware was chosen as the Air Force representative in the benchmarking study. Observations of air cargo operations and interviews with operational managers or applicable experts familiar with air cargo operations were conducted at each carrier's hub and at Dover AFB. Observations identified that the Air Force can learn from the commercial air cargo carriers in four areas: cargo handling equipment, intransit visibility, operations interface, and safety. Observations and responses to interviews revealed major disparities between the mission of the Air Force and the goals of the industry leaders. Therefore, industry leader practices during surge periods cannot be applied to the Air Force.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Transportation (Air), Case Studies, Commercial Aircraft, Cargo Handling, Military Transportation, Air Logistics Support	208
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

AFIT Control Number AFIT/GLM/LAL/93S-1

AFIT RESEARCH ASSESSMENT

The purpose of this questionnaire is to determine the potential for current and future applications of AFIT thesis research. Please return completed questionnaires to: DEPARTMENT OF THE AIR FORCE, AIR FORCE INSTITUTE OF TECHNOLOGY/LAC, 2950 P STREET, WRIGHT PATTERSON AFB OH 45433-7765

1. Did this research contribute to a current research project?

a. Yes b. No

2. Do you believe this research topic is significant enough that it would have been researched (or contracted) by your organization or another agency if AFIT had not researched it?

a. Yes b. No

3. The benefits of AFIT research can often be expressed by the equivalent value that your agency received by virtue of AFIT performing the research. Please estimate what this research would have cost in terms of manpower and/or dollars if it had been accomplished under contract or if it had been done in-house.

Man Years _____ $ _____

4. Often it is not possible to attach equivalent dollar values to research, although the results of the research may, in fact, be important. Whether or not you were able to establish an equivalent value for this research (3, above) what is your estimate of its significance?

a. Highly Significant b. Significant c. Slightly Significant d. Of No Significance

5. Comments

_____ _____

Name and Grade Organization

_____ _____

Position or Title Address