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Multiple Case Comparison of the In-Transit Visibility Business Process

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MULTIPLE CASE COMPARISON OF THE
IN-TRANSIT VISIBILITY BUSINESS PROCESS

THESIS

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Abstract

Over the past decade, the Department of Defense has developed an In-transit Visibility capability. Despite significant funding and research in developing this capability, the initial deployment in support of Operation ENDURING FREEDOM (OEF) in 2001 highlighted an ongoing problem to achieve ITV within the U.S. Air Force. Initial results from Headquarters USAF initiated studies point to a need to focus on business processes related ITV management.

This research employed a multiple case study design embedded in a functional benchmarking process to solicit ITV management "best practices" from leaders in the civilian logistics industry and to identify gaps between their practices and those of the Air Force. The data collection method used electronic mail as a portal to conducting subject matter expert interviews. Using the data collected from the benchmarking partners, the research recognized 19 "best practices" and compared the civilian and military environments in 41 areas. This evaluation highlighted gaps between practices used in the civilian industry and those used by the Air Force. These gaps served as areas of opportunity in which the Air Force can evaluate alternative management practices in an effort to improve the ITV process. Using these gaps as a foundation, the research proposed fourteen recommendations for action.

MULTIPLE CASE COMPARISON OF THE IN-TRANSIT VISIBILITY BUSINESS PROCESS

I. Introduction

Background

In-transit visibility (ITV) is the capability to track assets through the logistics pipeline while "in-transit." ITV is one of three subordinate components of "total asset visibility." The other two components are "in-storage" and "in-process." Although all three components are important to total asset visibility, this research effort focuses the achievement of "near-real-time" visibility over in-transit assets.

Applied to the Department of Defense, ITV tracks the identity, status, and location of DoD cargo and passengers through the Defense Transportation Network (DTN) during peace, contingencies, and war. DoD asset visibility initiatives arose from difficulties encountered during Operation Desert Storm/Desert Shield. As documented in several studies since the Gulf War, over 50% of the 40,000 containers shipped into theater had to be opened, inventoried, and resealed because military personnel did not know their contents (DoD Integration Plan, 1995; Libby, 1993; Sherman, 2001; Suders, 2001; US General Accounting Office, 1999). This problem unnecessarily extended the operation by 100 days and cost an additional $650 million dollars in transportation costs (General Accounting Office, 1999; Lynn, 1997). Ultimately, this lesson led the Deputy Under Secretary of Defense to release the Defense In-transit Visibility Integration Plan in

1995. Despite significant spending and research efforts to achieve ITV throughout the 1990s, DoD experienced similar lack of visibility during all operations to date (Secretary of Defense, 2002; Pina, 2000; Butler and Latsko, 1999; Suders, 2001). The deployment in support of Operation Enduring Freedom (OEF) in 2001 highlighted a continuing problem within DoD in achieving ITV (Quinton, 2002).

The current Department of Defense concept for providing ITV establishes service specific automated information systems (AIS), also called "feeder systems," designed to upload logistics data into the Global Transportation Network (GTN). GTN is supposed to provide ITV for the Defense Transportation Network. Before GTN, each defense service maintained service-specific automated systems to track their in-transit inventories. The shortfall of these service-specific designs was the lack of horizontal integration between the services, resulting in a complex array of systems that supported individual service needs but failed to support a joint transportation network (Sciaretta and Trettel, 2000: 11). In an effort to solve the problem, the DoD In-transit Visibility Integration Plan 1995 presented a defense-wide plan that defined ITV requirements, operating concepts, and system implementation. With the establishment of that plan, DoD placed significant emphasis on the successful development and implementation of the ITV feeder systems (DoD ITV Integration Plan, 1995).

Despite the effort on DoD's part, the deployment to OEF highlighted a breakdown in the Air Force "feeder" system. During OEF deployment operations, the Air Force Combat Support Center worked to resolve ITV issues, but was unsuccessful. After the initial deployment, the Air Staff tasked several agencies to investigate ITV issues (Quinton, 2002). In January 2002, the Air Staff tasked the Air Force Inspection Agency (AFIA) to conduct a study into the problems preventing the successful implementation of ITV within the Air Force. Results from this study indicate that a lack of emphasis on policy development and management practices, rather than poor system design, as the major cause of ITV failure.

Problem Statement

Since the problems encountered during the Gulf War with loss of cargo visibility, DoD has placed significant emphasis on ITV. USTRANSCOM developed GTN to serve as a centralized network of systems designed to provide DoD with ITV. ITV within GTN relies on feeder systems providing timely and accurate movement data to GTN. The Air Force developed a network of software applications to manage movement data of materiel and personnel for upload into GTN. Despite all this effort, recent deployments have shown the Air Force system is still unsuccessful in providing ITV.

Initial results from the HQ USAF directed studies indicate a need to focus on business processes related to the management of current Air Force ITV automated systems, such as defining goals and objectives, detailing roles and responsibilities, ensuring adequate training, and developing a method to determine performance effectiveness. Other attempts outside the Air Force to implement automated systems face challenges similar to those encountered by the Air Force. One way for the USAF to overcome its ITV challenges might be to consider adopting management strategies employed by other non-DoD organizations.

Research Question

The focus of this research effort is to answer the question: “What can the Air Force learn from leaders in the logistics industry to improve upon current In-transit Visibility (ITV) business processes?”

Investigative Questions

To answer the high-level research question, this research evaluates the business processes of the Air Force and civilian logistics companies by addressing the following investigative questions:

1. What is the Air Force ITV process?
2. Does the Air Force provide sufficient policy/direction to clearly articulate roles and responsibilities of personnel within the ITV process?
3. Who are the leading civilian companies in using logistics information systems, specifically for ITV?
4. What are the processes employed by the leading logistics companies to achieve ITV?
5. What are the “best practices” that enabled the leading logistics companies to successfully deploy their ITV business process?
6. What similarities and key differences exist between the Air Force and the leading logistics companies’ ITV process?

Research Objective

The primary objective of this research effort is to determine gaps between ITV business practices of leading logistics companies and the Air Force. By identifying gaps in the process, this research will propose possible alternative approaches to successfully manage the Air Force ITV process. At a more general level, this research will increase the body of knowledge on successfully implementing and sustaining a critical automated business process. Through the investigation of current leading companies in the logistics industry, this research will provide valuable information that any logistics company can use to help formulate their management practices.

Scope and Limitations of the Research

This research assumes that a difference exists between how the Air Force and the civilian companies manage their ITV business processes. It further assumes that, due to the nature of "best practices," many processes will not be duplicated between civilian companies. Although duplication between the companies may eventually strengthen a correlation between the practice and success, lack of duplication does not necessarily eliminate a possible correlation.

The focus of this research is on the business practices surrounding the use of the ITV information systems. Although system architecture is an important component to the success of the information system, this research does not intend to draw comparisons between systems designs. Further, the data on civilian practices used in the gap analysis is obtained primarily from structured interviews. Interview data is typically considered secondary in that the data does not come directly from the event. Instead, the data is derived from the informant's knowledge of the event. A method to increase the data reliability is to interview subject matter experts, as they typically have the greatest understanding of the event. The experts interviewed in this research are senior information technologists responsible for the ITV information system.

This research focuses primarily on the Air Force ITV process during unit deployments. ITV can apply at several stages throughout the supply chain for both the Air Force and civilian companies. For the Air Force, the supply chain includes an original purchase order, parts moving between units and a depot repair facility, and equipment involved in a unit deployment. The Air Force uses different processes and information systems for each of these phases, although some may overlap. Problems encountered during recent unit deployments in gaining ITV led to the initiation of this research. Thus, this research focuses on that process.

Previous Air Force investigations of civilian logistics companies concluded that it is difficult to compare specific operational processes across civilian/military boundaries (Abaleto and Lee, 1993). There are also concerns with different levels of visibility (Miller, 1996). Civilian companies are typically concerned with tracking shipment-level detail, while the DoD wants visibility over the actual contents of the shipment. This difference has narrowed in recent years as civilian companies shifted supply chain strategies to more lean logistics focuses. As companies streamline their logistics pipeline, they more frequently require information on what they will receive, not just when they will receive it (Gilmore, 2002). This shift in strategy makes the study of civilian companies more applicable to the Air Force.

Methodology

This research employs a case study design to gather data on the business processes of civilian companies and the Air Force. This research uses a broad scope approach for each company with a more thorough analysis of specific areas of each company. At a minimum, specific areas of study include policy promulgation, management oversight, and performance measurement. The data collected will be compared to determine similarities and gaps between each of the processes. Since this study is of an exploratory nature, this research will not draw correlations between the processes and success. Rather, it will show areas DoD could consider in improving its ITV programs.

To understand the Air Force process in more detail, this research will expand the investigation of the Air Force to include a thorough review of ITV policy and a specific mapping of how the USAF currently attempts to provide ITV.

Summary

This chapter discussed the background, the problem, the research questions, the research objective, and the methodology of this thesis document. The remaining four chapters of this thesis include the Literature Review, Methodology, Findings and Analysis, and Conclusions.

The literature review provides an overview of In-transit Visibility as a pillar of Total Asset Visibility and presents a process view of ITV based on research conducted over the past decade. In addition, this chapter presents a review of Department of Defense and Air Force policies and guidance on ITV, which provides the foundation for answering Investigative Questions One and Two. Finally, chapter two will discuss benchmarking as a method to improve processes and present initial findings on industry leaders in ITV. The information gained from the literature will help refine the scope of the research and lay the groundwork for the thesis methodology.

Chapter three will present the methodology of this research which will be a qualitative approach and discuss the use of case studies to evaluate the business practices of leading logistics companies. A complete description of the research methodology will be presented.

Chapter four will present the findings and analysis related to the research question by addressing each investigative question. Data supporting each answer will be presented. The chapter concludes by discussing the research findings and presents recommendations.

Chapter five discusses research limitations and future research topics. The chapter concludes with an overall summary of the research effort.

II. Literature Review

Introduction

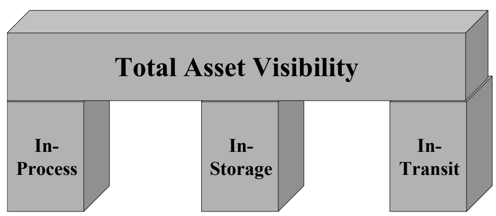
Visibility into the shipment of inventory through the supply chain has shifted from a business competitive advantage to a necessity. With the birth of the World Wide Web in 1992, the last decade has witnessed a surge in the application of information technology to achieve "near-real-time" visibility (Gould, 2001; Moore, 2000; World Wide Web Consortium, 2003). The literature shows a heightened desire to research and develop asset visibility technology over the past decade. Much of this research has focused on the development and optimization of data entry, system architecture, and component interfaces. Researchers have devoted little effort to the overall management of these systems. Process management is crucial to the success of ITV, for the best system design may ultimately fail if not properly managed (Kara, 2002). This chapter lays the groundwork for this research effort by reviewing literature on asset visibility. Since ITV is a component of TAV, the chapter opens with a review of the TAV concept. The chapter will then present ITV as a business "system" and address literature supporting this viewpoint.

Total Asset Visibility

Total asset visibility (TAV) refers to the capability to maintain awareness of inventory throughout the entire supply chain (DoD Dictionary of Military Terms, JV2020). TAV is referred to as total product visibility in the civilian logistics industry (Moore, 2000; "More shippers will… ," 1999). Regardless of the term used, it is a capability that enables a company to exactly know their inventory, what it is, where it is, and how much there is in any location (Moore, 2000). Throughout this document, the term Total Asset Visibility will refer to this capability.

TAV is an umbrella concept that requires visibility during three distinct periods known as the pillars of TAV (see Figure 1 below): in-storage, in-process, and in-transit (Department of Defense, 1995).

Figure 1. Pillars of Total Asset Visibility



In-storage assets are those stored at retail and wholesale inventory sites, awaiting utilization or disposal activities. Warehouse Management Systems enable the automated tracking of inventory during this phase (Forger, 1999)

In-process assets are those on order, but not yet shipped, or in repair at maintenance facilities. Order Management Systems enable the automated tracking of inventory during this phase (Forger, 1999)

In-transit assets are those shipped from origin to destination. Transportation Management Systems enable the automated tracking of inventory during this phase (Forger, 1999)

Focus on the Department of Defense.

"Recent deployments of U.S. forces underscore the importance of gaining control of the logistics pipeline… We cannot begin to support our national military strategy and have control of our resources without Defense Total Asset Visibility" (Department of Defense, 1995). To better understand the need for TAV, consider the economic principle, *Output = Input x Efficiency*, where input could be any of a number of variables including funding, capital, and personnel. This principle establishes that a firm achieves maximum efficiency, at a given level of input, when no additional output can be achieved with existing technology and a reassignment of resources. This principle can be applied to the level of support achieved in an effort to support national military strategy.

Faced with the force downsizing (reduction in personnel) of the 1990s and no increase in other inputs, an increase in efficiency was necessary to maintain the same level of output. "Doing more with less" created the need to increase efficiency in the DoD. Based on the economic principle of efficiency and assuming no prior serious inefficiencies, the only means to achieve this end was to implement new technologies. Under Secretary of Defense Paul Kaminski pointed to TAV as one way to bring "greater efficiency to logistics operations" (Department of Defense, 1995).

During Desert Storm/Shield, the DoD shipped approximately 40,000 containers into theater, but nearly 50 percent of the containers were not available to US forces because of poor control and visibility (DoD Integration Plan, 1995; Inspector General, 2001; Libby, 1993; Sherman, 2001; Suders, 2001; US General Accounting Office, 1999).

In response to these Gulf War logistics problems, the Secretary of Defense planned for the implementation of a Defense-wide total asset visibility solution in the Defense Total Asset Visibility Implementation Plan. The future vision for TAV is described in Joint Vision 2020 (Chairman of the Joint Chiefs of Staff, 2000). Supporting the TAV Implementation Plan, the Defense Materiel Management Regulation (DOD 4140.1R) and the Defense Transportation Regulation (DOD 4500.9R) were modified to include direction for TAV.

The Total Asset Visibility Implementation Plan served as a blueprint for developing a "comprehensive, coherent, and joint approach to supporting our national military strategy and controlling our resources through Total Asset Visibility" (Department of Defense, 1995). It established requirements in the areas of requisition tracking and visibility of assets in-storage (also referred to as on-hand or in-stock assets), in-process (includes in-repair assets), and in-transit (includes due-in assets).

Joint Vision 2020 (JV2020) frames the future direction for the joint forces as envisioned by the Chairman of the Joint Chiefs of Staff. Primary to this vision is "Full Spectrum Dominance" with Focused Logistics as one of four means of achieving this end. Focused Logistics is "the ability to provide the joint force the right personnel, equipment, and supplies in the right place, at the right time, and in the right quantity, across the full range of military operations." This requires the fusion of information, logistics, and transportation technologies to track and shift assets even while en route. By linking the war fighter to the logistician through a common operational picture made possible by total asset visibility, Focused Logistics will provide the full range of logistics support necessary to achieve full spectrum dominance. The vision recognizes that technology superiority is only a part of achieving focused logistics. More importantly, the business processes associated with the technology drive the success of innovation. Development of doctrine, organizations, training and education, leaders, and people that effectively take advantage of the technology enable the attainment of the overarching goal (Chairman of the Joint Chiefs of Staff, 2000).

The Defense Materiel Management Regulation, DOD 4140.1R, directs the total asset visibility program to instill user confidence in the Defense Transportation Network by providing accurate, timely, and cost effective visibility for assets in-storage, in-process, and in-transit (Department of Defense, 1993).

The purpose of the Defense Transportation Regulation (DTR), DOD 4500.9R, is to provide a common framework for all shipments through the Defense Transportation System (DTS). It is very specific in nature to ensure that all shipments comply with necessary and regulatory standards. By following these standards, the DTR, in part, enables total asset visibility. The DTR specifies when and how tracking operations should be conducted, along with providing criteria to evaluate current systems capabilities and identify improvements after analysis of impact, cost, and value-added. The DTR also establishes the Joint Mobility Control Group (JMCG) as the centralized command and control center for movement requirements through the DTS (Department of Defense, 2000). Policies put forth in the DTR regarding in-transit visibility are addressed later.

The Joint Mobility Control Group (JMCG) supports the United States Transportation Command's Strategic Plan by centralizing command and control over the DTS. It is the focal point to coordinate DTS operations in support of the Unified Commanders and other customers. Included among its responsibilities is the ability to provide visibility of all movement requirements. To this end, the JMCG is expected to ensure asset visibility (Department of Defense, 2000).

"TAV relies on integrated information systems to provide seamless connectivity between old and new support systems, which enables efficient and effective resource allocation and command decision making" (United States Air Force, 1999). The operating concept defined in the Defense TAV Implementation Plan identified automated information systems (AIS) for each phase of the supply chain: Logistics Information Processing System (LIPS) for requisition tracking, Inventory Control Point (ICP) AIS for in-storage and in-process visibility, Global Transportation Network (GTN) for in-transit visibility, and Joint Total Asset Visibility (JTAV) for in-theater visibility. Since this research is concerned primarily with in-transit visibility, the following discussion focuses only on those AIS that support ITV.

The Global Transportation Network (GTN) is a web-based Transportation Management System (TMS) that "collects, integrates, and distributes transportation information providing the DoD a seamless, near real-time capability to access and employ that information for peacetime and wartime planning and decision-making" (United States Transportation Command, 2002). Although only a prototype in 1995, GTN was identified as the DoD's composite database for visibility over the DTS

(Department of Defense, 1995). GTN became operational in August of 1997 after several incremental stages of development (Sciaretta and Trettel, 2000).

Prior to GTN's development, each DoD service employed stove-piped automated system for transportation management requiring each customer to track their materiel as it moved from system to system resulting in a lack of coordination amongst the services. Instead of being designed as a data-originating system, GTN became a central repository for information originating from these legacy service-systems, opening the doors for horizontal integration within the DoD (Geis, 1999; Sciaretta and Trettel, 2000).

GTN's development evolved rapidly and by the end of 1997, GTN could post approximately 80 percent of the data received within 5 minutes of receipt and could replicate it within seconds (Martling, 1997). TRANSCOM expanded GTN capabilities in 1998 by developing electronic interchanges with commercial carriers. Today, approximately 90 commercial carriers interface with GTN (GTN website). In October 2002, USTRANSCOM awarded a six-year, $63.8 million contract to Northrop Grumman Corporation's Information Technology Unit for the development of GTN for the 21st Century (GTN-21). This next-generation information system will take advantage of new database design concepts and technology to improve in-transit visibility and to expand command and control decision support capabilities (United States Transportation Command, 2002b, Emery, 2002).

The Joint Total Asset Visibility (JTAV) provides theater commanders with intra-theater ITV. JTAV extracts logistics data from several military departmental and component information systems, including the Global Transportation Network, and presents that information in a concise and useable format for theater commanders. JTAV is an ongoing project managed by the Joint Total Asset Visibility Program Office (Inspector General, 1999a; JTAV Program Office, 1997; "Joint Total Asset Visibility", 2000; Taylor, 2000; DOD TAVIP; Richardson and Pacheco, 2000).

The Defense Transportation Tracking Service (DTTS) is a computer-based system developed to provide visibility over in-transit Arms, Ammunition, and Explosives (AA&E). Developed by the US Navy, DTTS uses Global Positioning System and other technologies to ensure in-transit ordnance and security for the entire DoD. It pushes its database hourly to the GTN to provide ITV to the other services (Department of Defense, 2000).

In-transit Visibility

In-transit Visibility (ITV) is that subset of Total Asset Visibility which focuses on tracking the identity, status, and location of cargo and passengers from origin to destination during peacetime, contingencies, and war (Department of Defense, 1995). Current literature refers to ITV as the end result of a transportation management process (Gould, 2001; Krizner, 2001a). Defining ITV as a process allows for the refinement of management practices and continuous improvement of the business process. To understand ITV, the ITV process must be defined.

Components of ITV.

The DoD's current operating concept divides ITV into two components: cargo and personnel. Each component is further divided into several subcomponents, as follows: Cargo—Unit, Non-unit, Personal Property, and Redeployment and Retrograde;

Personnel—Unit, Non-unit, Medical Patients, and Vessel and Aircraft Scheduling Data (Department of Defense, 1995). This study investigates the cargo portion of ITV, so further discussion focuses on the cargo component.

Unit movement cargo is defined as "all unit equipment, accompanying supplies, Marine Corps Maritime Prepositioned Forces, Army unit equipment aboard prepositioned afloat ships, and prepositioning of Materiel Configured to Unit Sets (POMCUS) stocks." (Department of Defense, 1995). In short, unit movements pertain primarily to deployment or startup supplies.

Non-unit movement cargo is defined as "all sustainment material (except the supplies and equipment accompanying a unit during deployment) in CONUS, pre-positioned overseas, or afloat." (Department of Defense, 1995).

Personal property cargo is defined as "household goods, unaccompanied baggage, privately owned vehicles, mobile homes belonging to military members and civilian employees of the DoD and U.S. Coast Guard." (Department of Defense, 1995).

Redeployment and retrograde cargo is defined as "material leaving a theater location bound for another theater as redeployment cargo and material bound for CONUS" (Department of Defense, 1995).

Critical to Air Force operations is the capability to maintain ITV over all four of these subcomponents. This research, though, originated from problems with the movement of unit cargo during the initial deployment in support of Operation ENDURING FREEDOM. Since the research problem focuses on unit movement cargo, discussion with focus on this subcomponent.

Need for ITV.

Literature over the past decade has established the need for developing and maintaining an ITV capability both in civilian and military logistics environments (Gould, 2001; Krizner, 2001a; Miller, 1996; Wolford, 1996). Whether civilian or military, logistics allows for the "efficient and effective flow of goods from the point of origin to the point of consumption in order to meet customers' requirements" (Gould, 2001). Logistics accommodates customers' requirements by providing the customer with the *right* amount of the *right* product at the *right* time at the *right* place in the *right* condition at the *right* price with the *right* information: the seven *rights* of logistics (Bowersox, Closs, and Cooper, 2002). ITV adds value to logistics by giving the customer real-time information necessary to maintain positive control over in-transit inventory (Gould, 2001; Krizner, 2001a). Positive control over shipments enables time-definite delivery (Bowersox et al., 2002). Reliable time-definite delivery increases customer confidence in the supply chain. Increased confidence leads to a decreased requirement for safety stock that, in turn, decreases inventory costs and reduces excess inventory in the logistics pipeline. A streamlined pipeline allows for faster delivery times further enhancing time-definite and just-in-time delivery (Bowersox et al., 2002; Jones, 1999; Douglas, 2001; Gould, 2001).

For the military environment, maintaining an ITV capability provides the theater commander situational awareness by providing real-time information about the deployment status of strategic assets (Krizner, 2001b; USTRANSCOM, 1997). Maintaining positive control over a deployment allows adjustments in a unit's movement in response to changes in the operational situation, and is a key to success for rapid global mobility (USTRANSCOM, 1997). Kross (1997) emphasized the importance of ITV to the DoD when he stated that USTRANSOM does not "want a single aircraft to take off until we've captured and transmitted exactly what's on board and pushed it automatically to GTN."

With modern information technology, these benefits should be easily within grasp. Realizing the benefit, though, requires effective management of the process to eliminate old philosophies and allow the re-engineering of current business processes (Hodge, 2001).

Air Force ITV Policy and Guidance.

Several levels of command guidance regulate Air Force operations. Moving down the chain from DoD to wing-level, policy becomes more specific. For ITV, DoD guidance provides a strategic understanding of Joint requirements. As policy moves down the chain to the Air Force wing, guidance is communicated in a document called the Installation Deployment Plan.

At the Department of Defense level, policy and guidance is broad in scope and provides a basis for joint implementation. The Defense Materiel Management Regulation (DOD 4140.1R), the Defense Transportation Regulation (DOD 4500.9R), and the Defense In-transit Visibility Integration Plan each address ITV.

The Defense Materiel Management Regulation, DOD 4140.1R, states that "timely, accurate in-transit information shall be available to all users and logistics managers in a standard format adequate to satisfy needs." It further mandates near real-time visibility down to the line item detail by standardizing policies, procedures, and electronic transactions throughout all segments of the Defense Transportation System. Transportation data, including arrival, departure, and receipt information, should be captured. To ensure line item visibility and reduce in-processing time, any variety of automated identification technologies (such as bar codes, laser optical cards, memory or smart cards, and RF devices) may be used (Department of Defense, 1993).

The Defense Transportation Regulation, DOD 4500.9R, identifies GTN as the DoD ITV system and establishes criteria to "evaluate current systems capabilities and identify improvements after analysis of impact, cost, and value-added." This criteria ensures continuous improvement of the information system (Department of Defense, 2000).

The Defense In-transit Visibility Integration Plan (ITIVP) was developed by the United States Transportation Command (USTRANSCOM) for the Deputy Under Secretary of Defense for Logistics to provide a joint, high-level statement of operational requirements and system design to achieve ITV. The ITVIP narrows the focus of concepts written in the TAV Implementation Plan. It calls for the GTN database to receive logistics information from originating source systems, point of embarkation and debarkation systems, and joint theater transportation system. Although these "feeder" systems continue to evolve with advancing information technology, the operating concept remains the same. At a minimum, the system should identify the contents of a shipment and monitor its location from origin to destination, track individual requisitions, items, and unit movements, reconstitute shipments, and divert shipments to new locations.

Further, it should be able to track commercial and military shipments by shipment identification number, Transportation Control Number (TCN), Unit Line Number (ULN), Unit Identification Code (UIC). In an effort to enhance tracking capabilities, the ITVIP supports the use of Automated Information Technology (AIT) and Electronic Data Interchange (EDI) whenever possible (Department of Defense, 1997).

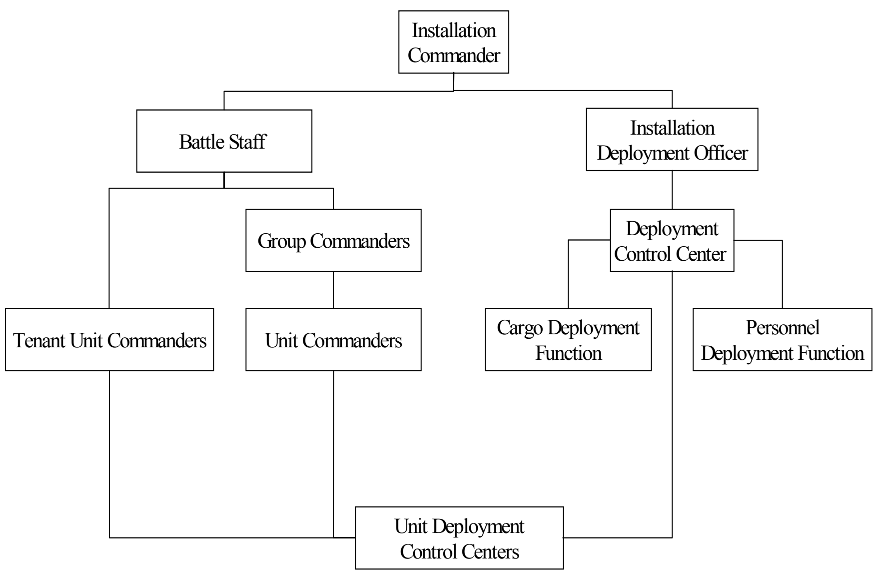
Air Force level policy and guidance operationalizes DOD policy for the Air Force. At the service level, policy and guidance remains broad in application. Air Force guidance applying to ITV includes the Air Force Doctrine Document 2-4 *Combat Support* and Air Force Instruction 10-403 *Deployment Planning and Execution*.

The Air Force Doctrine Document 2-4 (AFDD 2-4), *Combat Support*, lays the doctrinal framework for Combat Support, the foundation of aerospace power. Combat Support includes those people and organizations that plan, program, and sustain the forces, who and what are deployed, and how the arrive and return safely. AFDD 2-4 describes how best to implement Combat Support to ensure the responsiveness, readiness, and sustainability of the Air Force. The Combat Support process involves five underlying principles: responsiveness, survivability, sustainability, time-definite resupply, and information integration. Exploiting ITV information technology enables responsiveness in the supply chain and time-definite delivery. ITV becomes more vital to successful operations as combat support command and control systems evolve. To ensure appropriate levels of ITV, AFDD 2-4 states that personnel at origin, en route locations, and destination should use automated information systems that feed standard joint systems such as the GTN (U.S. Air Force, 1999).

Air Force Instruction (AFI) 10-403, *Deployment Planning and Execution*, provides "the basic requirements for Air Force deployment planning and execution at all levels of command to support contingency operations" (AFI 10-403, 2001). AFI 10-403 establishes the Integrated Deployment Systems (IDS) as the Air Force deployment information system. The IDS is a transportation and personnel management system that serves as the Air Force "feeder" system to GTN. Sub-component systems of IDS include the Logistics Module (LOGMOD), Manpower and Personnel Module (MANPER), Cargo Movement Operations System (CMOS), and Computer Aided Load Manifesting (CALM). CALM and CMOS are Transportation Management Systems, while MANPER is a Personnel Management System. LOGMOD is a Deployment Planning System that spans both transportation and personnel management (AFI 10-403). AFI 10-403 also outlines roles and responsibilities for ITV at all levels of command (Headquarters, Major Command, and Wing), and establishes a clear chain-of-command at the wing level to ensure leadership is fully aware of the deployment situation. Personnel throughout this "chain" (see Figure 2) have specific responsibilities toward maintaining an ITV capability, as follows:

AFI 10-403 identifies two directorates within the Headquarters Air Force, Installations and Logistics (HQ AF/IL) that maintain roles within the ITV process: Directorate of Plans and Integration (HQ USAF/ILX) and Directorate of Transportation (HQ AF/ILT). During the summer of 2002, HQ AF/IL reorganized and consolidated these two directorates into the Directorate of Logistics Readiness (HQ AF/ILG). AF/ILG serves as the office of primary responsibility (OPR) for Air Force deployment and redeployment operations. This responsibility includes development of policy guidance to support Air Force deployment objectives and to integrate automated systems to support deployment operations. ILG also serves as the OPR for the Integrated Deployment Systems (IDS) and its sub-component systems: Logistics Module (LOGMOD)/ LOGMOD Stand Alone, Cargo Movement Operating System (CMOS) and the Computer Aided Load Manifesting (CALM) (AFI 10-403, 2001).

Figure 2. Installation Level Deployment Chain-of-Command



NOTE: The Installation Commander chairs the Battle Staff with representation by the IDO, Group Commanders, Unit Commanders, and Tenant Unit Commanders

At the Major Command and Numbered Air Force level, the logistics plans function serves as focal point for IDS. They ensure technical and procedural guidance, as well as training, for the deployment-related systems (AFI 10-403).

AFI 10-403 identifies eight different positions at the installation level that each have roles in the cargo ITV process: Installation Commander, Installation Deployment Officer, Wing Plans/Operations Plans/or Logistics Support Squadron's Logistics Plans Office, Transportation Squadron Commander, Cargo Deployment Function Officer, Squadron/Unit Commanders, Unit Deployment Managers, and the Deployment Process Working Group.

The installation commander maintains overall responsibility for installation/unit deployments, including meeting all pre-execution, command and control, cargo, and personnel requirements outlined in AFI 10-403. The commander ensures all units have required automated deployment systems and sufficient Local Area Network (LAN) capability and limits non-deployment related LAN usage on the installation during deployment operations to ensure maximum system connectivity for use of the automated deployment systems.

The Installation Deployment Officer (IDO) is appointed by the Installation Commander to direct, control, coordinate and execute installation deployments for the commander. The IDO ensures the installation uses available automated systems (i.e. IDS components) to maintain in-transit visibility and maintains responsibility for maximum operational readiness of all components of IDS. The IDO serves as the focal point for IDS and LOGMOD and provides training on these systems (AFI 10-403).

The Wing Plans, Operations Plans, or Logistics Support Squadron's Logistics Plans Office, depending on the organizational structure of the installation, assists the IDO on providing technical guidance for IDS and LOGMOD. This office serves as the OPR for IDS, the flow of IDS data at the installation, and for LOGMOD (AFI 10-403).

The Transportation Squadron Commander serves as focal point for CMOS and CALM and provides training on these systems. The transportation commander is responsible for ensuring that CMOS can receive unit level deployment data from LOGMOD, process this data, and pass this data to GTN for ITV (AFI 10-403).

The Cargo Deployment Function (CDF) Officer is appointed by the Transportation Squadron Commander to manage the unit cargo deployment process. The CDF Officer ensures the correctness of cargo documentation and data entered into CMOS. This process is critical to ITV success (AFI 10-403).

Unit Commanders hold ultimate responsibility for their unit's deployment readiness. They ensure all unit equipment is properly prepared to move within the Defense Transportation System, including appropriate ITV documentation. Unit commanders appoint a Unit Deployment Manager to manage the unit deployment readiness process, including any IDS/ITV requirements (AFI 10-403).

Unit Deployment Managers (UDM) are appointed by their unit commander to manage all aspects of the unit deployment process. All UDMs must be proficient and experienced in the deployment, process, requirements, and systems. They must also obtain training on the use of LOGMOD and ensure all deployment related data are correct and up-to-date (AFI 10-403).

The Deployment Process Working Group (DPWG) is a governing body that is established at each installation to oversee all deployment related issues, including IDS implementation and sustainment, as well as to address deployment policy and training issues. The IDO chairs the DPWG with, at a minimum, the following representatives: Wing Plans, Logistics Plans, Manpower, Personnel, Supply, Transportation, Communications, Tenant units, and other functional areas as determined by the IDO (AFI 10-403).

AFI 10-403 also requires each installation develop an Installation Deployment Plan to provide specific, tactical guidance for executing deployments at the installation level. The development of an IDP ensures compliance with all regulatory guidance while capturing unique deployment requirements of each Air Force installation. Specifically, the IDP defines local processes, procedures, infrastructure, and resources necessary to safely and effectively deploy forces. The IDP must describe the who, what, when, where, and how the installation meets each basic deployment requirement. As a minimum, the IDP must address the following areas: deployment roles and responsibilities, pre-execution procedures, deployment work-center organization and facilities, unit personnel and equipment assembly areas, cargo marshaling yards, installation-level passenger and cargo processing facilities/locations, execution procedures, weapons and ground safety concerns, deployment training requirements, and deployment process flowcharts. As the deployment process owner, the Installation Commander is the approval authority of the IDP. As the Installation Commander's agent for deployment operations, the Installation Deployment Officer develops and publishes the IDP (AFI 10-403).

ITV as a Process

A process is "a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer (Hammer and Champy, 2001)." In the logistics industry, logisticians often view ITV as a support function to a shipping process. ITV is often not considered a process in itself, but merely the result to the process of transporting materiel from one location to another. Hammer and Champy's definition of a process, particularly the part about adding value to the customer, opens the possibility of considering ITV to be a process in itself. Visibility is the output of the process and has shown to be of great value to the customer, but it requires a collection of activities to convert source data into information valuable to the customer (Bowersox et al., 2002; Gould, 2001; Krizner, 2001a). Figure 3, below, illustrates the concept of the ITV process.

Figure 3. The ITV Process

Defining the "Black Box."

To gain the benefit of viewing ITV as a process, the "black box" must be opened. For the ease of discussion, the researcher defines the primary process stream as identify, collect, transmit, consolidate, and distribute, as illustrated in Figure 4.

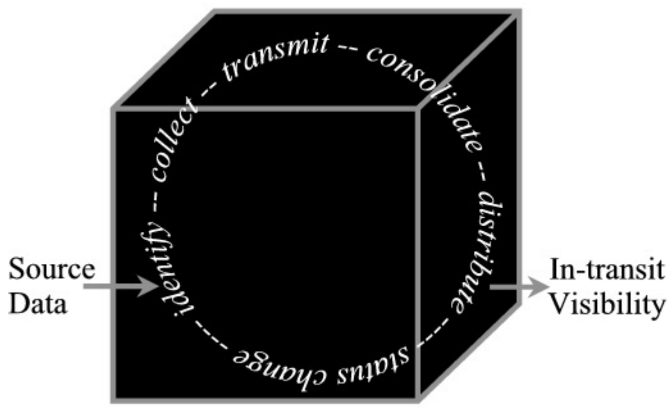


Figure 4. The Cyclical Nature of the ITV Process

For visibility of an item moving through the logistics pipeline to occur, the item must be identified in some fashion and associated with a shipping mode. In the Air Force, items are identified by a Transportation Control Number (TCN) and associated with an aircraft mission number when moving via organic aircraft. However, more than just the identification is needed for an item. Information, such as dimensions and weight, will also be collected. A bill of lading is an example of a method to collect these necessary data. These data are then transmitted to a centralized location where it is consolidated with information on all other items moving through the pipeline. In order to achieve the end result, asset visibility, the information must be distributed to users. Near real-time visibility can be achieved by continuously repeating this process every time there is a change to an item.

Logisticians will inevitably view the automated information systems as the process, rather than tools to be used in the process especially since near real-time ITV is often thought to be impossible without automation. However, automation is not absolutely required to provide ITV but without it, the process is extremely complex, time-consuming, and error-prone. Information technology should be viewed as an enabler to making changes to a process rather than the process itself (Hammer and Champy, 2001). Technology enables organizations to break the boundary of "the way it always has been" to create "the way it can be." In the case of ITV, automation allows for the streamlining of a complex process and can remove much of the error.

Viewed as a process, ITV can be re-engineered. Re-engineering is "the *fundamental* rethinking and *radical* redesign of business *processes* to achieve *dramatic* improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed (Hammer and Champy, 2001)." Properly employed, re-engineering delivers considerable benefits by viewing a business process from its most fundamental level, absent any previous assumptions. By throwing out any formerly developed assumptions and viewing ITV from a re-engineering standpoint, new possibilities open to dramatically improve the process. This "re-engineering" concept has been realized within both military and civilian contexts (Hodge, 2001; Shah, 1993). To better understand the ITV process, it is necessary to further define each component and review research that supports each component.

Social Security Numbers (SSN), Universal Product Codes (UPC), International Standard Book Number (ISBN), Vehicle Identification Number (VIN) are all forms of identification. Identification serves two primary purposes: separation and relation. Consider the example of a person who robs a bank. A witness of the crime sees and records the license plate number of a car leaving the scene of the crime. The license plate number has separated this car from all others. The license plate number is linked to an owner by the SSN on the vehicle registration. Through investigation, the police determine the owner of the vehicle by following this relationship and question this individual about the crime. Applied to a logistics environment, relation and separation occurs on multiple levels. Identification is used to uniquely identify individual units, containers, and vehicles. This same identification is used to establish a relationship that shows the container in which the unit is shipped and the vehicle on which the container is loaded. As long as this relationship is maintained, tracking can occur at any level.

Identifiers are typically captured in data elements that serve as a means to label and format information (Miller, 1996). Standardizing these data elements reduces the need for data cross-referencing and allows for interoperability between automated systems with minimal interface requirements (Krizner, 2001b; Miller, 1996). The Social Security Number (SSN) serves as a simple example of the need for data standardization. In 1936, the Social Security Board issued the first SSN using the same standardized nine-digit format used today: XXX-YY-ZZZZ, where XXX is an area number, YY is a group number, and ZZZZ is a serial number. By standardizing the data elements, SSNs can be used interchangeably between automated information systems. Although SSNs were originally created specifically under the Social Security Act, standardization quickly allowed them to become the primary means of identification for Americans (Social Security Administration, 2002). Although this is a simple example, it shows the importance of data standardization.

In most cases, companies voluntarily comply with data standards. They do so because complying with these standards eases the barriers to communication thereby increasing their chances of global competitiveness (American National Standards Institute, 2002). The actual standard format used to support logistics movements depends upon the technology employed to collect the data. The use of these technologies also expands identification beyond separation and relation. Automated technologies, discussed under collection, allows for the inclusion of detailed information about the container contents. This capability moves the ITV-capability to lower levels of visibility by eliminating the need to open containers to inventory container contents (Miller, 1996).

The Department of Defense (1993; 2000) directs, to the maximum extent possible, the use of the National Stock Number (NSN) and the Transportation Control Number (TCN) to control and manage every shipment moving through the Defense Transportation System. The DOD (1993) further required that each line item be discretely identified, readily available on electronic media, and linked to the TCN to maintain item visibility.

A 13-digit NSN is assigned by the Defense Logistics Services Center to uniquely identify an item of material in the Federal Supply Distribution System. The format of the NSN is a categorical scheme consisting of the Federal Supply Class and the National Item Identification Number (Defense Logistics Agency, 2002).

The TCN is a unique 17-character data element usually assigned by the shipper to identify a shipment unit (container, pallet, bin, etc.). TCN's are never duplicated or reused. Each TCN contains four parts representing the Department of Defense Activity Address Code (DODAAC), Julian date, serial number, and suffix (Department of Defense, 2000).

Data accuracy and timeliness are the key success factors to the ITV process (Suders, 2001; Ferris, 2000). Regardless of system architecture, lack of data accuracy can result in a failed process (Anderson, 2001). Until recently, ITV relied on front line workers to manually input long item control numbers, such as the NSN or TCN, into information systems. Any data entry mistake negatively impacted asset visibility. Automating this process minimizes the tedious and error-prone task of transcribing alphanumeric labels onto a paper form or keying it into a database (Standard Systems Group, 2002). This type of automation facilitates in-transit visibility by expediting the data entry process while minimizing human error (Gonzalez and Hollister, 1999).

One method of automating the ITV process is through integrating of a suite of data capture tools with asset-tracking information systems. This suite of tools, termed automated information technologies (AIT), includes a variety of devices including linear and two-dimensional bar codes, memory cards, radio-frequency identification (RFID), and Global Positioning Systems (Jones, 1999; Gonzalez and Hollister, 1999; Hyland, 2002). By providing added levels of visibility, AIT has become an important component to any asset-tracking system (Gonzalez and Hollister, 1999; Hodge, 2001). AIT greatly increases both the efficiency and effectiveness of the ITV process by rapidly capturing, assembling, and transferring detailed information and interfacing with a variety of automated information systems with minimal human intervention (Hyland, 2002; Hodge, 2001; Miller, 1996; Richardson and Pacheco, 2000). Used improperly, though, AIT is reduced to simply an expensive technology (Krizner, 2001b).

DoD logistics AIT objectives include efficient data collection, improved data accuracy, reduced processing times, and enhanced asset visibility (Krizner, 2001b). Miller (1996) investigated techniques to capture source data within the DOD ITV process. He concluded that employing AIT in the DOD ITV process would support an item-level ITV capability while eliminating the need to perform open-container inventories as was the case during the Gulf War. Following an analysis on data capturing methods, Wolford (1996) concluded that to achieve an ITV capability, the DOD must emphasize the data collection process. Recognizing the importance of AIT, in 1997, the DOD established an AIT Task Force that developed a Logistics Automatic Identification Technology Concept of Operations. This plan provided a Defense-wide plan for adopting AIT technologies (DOD, 1997; Sciaretta and Trettel, 2000). Patterson (1999) found that given proper standardization and training, AIT could be employed at any location, including austere environments, to improve the ITV process. By 2004, the

DOD plans to field AIT technology at all levels and nodes of the supply chain (Baucom, 2000; Hodge, 2001).

For the Air Force, the Assistant Deputy Chief of Staff for Installations and Logistics stated that, by 2004, all logistics information systems "endeavor to capture all data via automated methods" (Orr, 2000). The Air Force "feeder" systems currently have at least partial capability with RFID, Optical Memory Cards, and Two-Dimensional Bar Codes and full capability attained for Linear Bar Codes and Smart Cards (Standard Systems Group, 2002).

After collecting the shipment information into the Transportation Management System (TMS), the information must be distributed to users for shipment visibility. Depending upon the information system architecture, this process may include either or both a transmission and consolidation step (Douglas, 2001b). Transmission refers to the flow of electronic data from one information system to another. Consolidation is required when a centralized repository is used to receive data from several collection sources, whether it is from information systems or simply from collection sources. The following examples illustrate some implementations of these sub-processes, from simple to complex:

Example 1

System Architecture: Single TMS, single data entry location
Sub-processes: Collection → Distribution
Use: A single operating facility where all operators have access to a single information system database via internal LAN or intranet. Operators enter data directly into the database for distribution, with no conversion requirements. Typically does not involve any external interfaces.

Example 2

<u>System Architecture</u>: Single TMS, multiple data entry locations
<u>Process</u>: Collection → Consolidation → Distribution
<u>Use</u>: One operating system, but receives data from multiple operating facilities via an external interface, such as an extranet or the World Wide Web. Interface allows operators to input data into a single database. Does not normally require data conversion.

Example 3

<u>System Architecture</u>: Multiple operating systems, multiple data entry locations
<u>Process</u>: Collection → Transmission → Consolidation → Distribution
<u>Use</u>: Multiple operating system design, may be multiple TMS or a Warehouse Management System (WMS) interfacing with a TMS. Collection inputs data into the first operating system which interfaces with a second operating system. The second information system acts as a central repository to consolidate and distribute the data for visibility. The second information system is typically a TMS and does not originate data. Requires an interface between the two information systems.

As illustrated in the examples above, more complex system designs require data interfaces between the information systems. Data standardization improves the effectiveness of these interfaces by minimizing the need for data reconciliation (Douglas, 2001b). Reconciliation must occur to link two different data sets that refer to the same item. For example, a barcoding AIT may enter data into a WMS using a Unit Product Code (UPC) as its identification. The WMS may track assets in the warehouse by its UPC. However, for a TMS to maintain ITV it may require the use of the National Stock Number. Even though the UPC and NSN refer to the same shipment item, reconciliation is required to link the two identification labels to that piece of equipment. When not properly managed this interfacing issue becomes another source of error.

To increase the efficiency of this reconciliation process, research over the past decade has focused on the development of Electronic Data Interchange (EDI). EDI has become generically known as an electronic exchange of formatted business transactions between information systems (RAND, 2003). Although EDI has become a common practice, failure to properly manage EDI damages the capability of the business process. Today, many kinds of information are exchanged electronically via EDI, to include purchase orders, bills of lading, freight bills, shipment status, proof of delivery, and payments (Department of Defense, 1996; Miller, 1996).

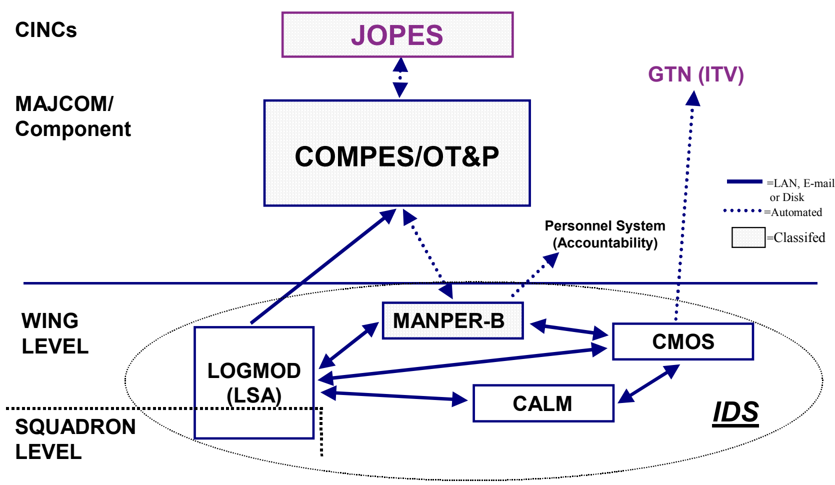
In 1996, USTRANSCOM developed the Defense Transportation Electronic Data Interchange Implementation Plan to outline the requirements and detail operating concepts for the use of EDI in the DOD. This plan improved several DOD transportation processes, including ITV (Department of Defense, 1996). Today, USTRANSCOM manages over 90 interface agreements between GTN and other information systems (USTRANSCOM, 2002).

For the Air Force, the Standard Systems Group (SSG) develops and manages information technology, including the IDS. To ensure effective interfacing between information systems, SSG maintains interface agreements (Standard Systems Group, 2002). These documents are formal agreements that regulate the development and improvement of information systems that must interface. For example, an interface agreement between LOGMOD and CMOS ensures that any future improvement to one system does not affect the interfacing capability of the two systems.

The GTN serves as a centralized data warehouse that consolidates transportation information from "feeder" systems and distributes that information to users via a web interface (Department of Defense, 1997). The Air Force's approach to supporting ITV during deployment operations has relied upon the Integrated Deployment Systems (IDS) to electronically interface with the GTN.

Collectively, IDS is a transportation management system that integrates logistics planning, transportation management, aircraft load planning, and personnel tasking (Jennings, 2001). Since this research focuses on cargo ITV, the following discussion does not address the personnel management system, MANPER. During a planning phase, personnel at the Air Force unit level pre-load transportation information into LOGMOD for all cargo planned for use during deployment operations. The Unit Deployment Manager (UDM) identifies each item by NSN and inputs data on the dimensions, weight, and any necessary special indicator or hazard codes. Each item is assigned to a shipping container (e.g., pallet, bin, and so forth) which will be assigned a TCN during a deployment. During a deployment, equipment identified to deploy is consolidated into a deployment plan and assigned appropriate TCNs. The plan is then passed electronically to CALM for aircraft load planning based on airlift assigned to the mission. Each completed load plan is considered a "chalk" and represents the cargo that will be loaded on each support aircraft. Chalk detail is passed back to LOGMOD for assignment of cargo to the chalks. Because actual load of an aircraft could easily change, transportation information is not pushed to GTN at this point. Only once an aircraft commander accepts the loaded aircraft is data then electronically passed "by chalk" through CMOS and pushed to GTN for ITV (AFI 10-403, 2000; Jennings, 2001; Standard Systems Group, 2002). Figure 5 shows this IDS operating concept.

Figure 5. Air Force Current ITV Operating Concept



Jennings, 2002

The Ongoing Problem

Visibility into the logistics pipeline is an old problem given new birth in the DoD after the Gulf War. The ensuing years following the war witnessed rapid advancements in all phases of the ITV process. Regardless of the effort put forth thus far, ITV continues to be a major challenge for the DOD, specifically for the Air Force.

In 1999 during Operation ALLIED FORCE theater commanders discovered a lack of ITV and exploited commercial parcel carrier systems for partial ITV. However, those commercial systems could not tell commanders all the information required of a military deployment tracking system. They could not ensure unit integrity and did not typically track package contents. Among the explanations for the problems experienced during ALLIED FORCE were user error and a lack of ITV doctrine and supporting policies (Secretary of Defense, 2002).

Similar problems arose again most recently during the deployment in support of Operation ENDURING FREEDOM (OEF). The only successful ITV involved the tracking of aircraft tail numbers. Determining the actual contents of the jet required an airman on the ground at the deployed location to physically inspect the plane once it arrived in theater, the same as was required over a decade earlier during the Gulf War (Quinton, 2002). Of the problems encountered by the Air Force, Hall (2002) reported the root causes were in the areas of firewall/local area network (35%), user error (30%), server (27%), and policy/guidance (8%). Figure 6 graphically shows this breakdown. Of the 38 different problem categories identified, not one error was attributed to ITV system architecture or data interfacing. Sixty-two percent of the issues were related to network problems (firewall/LAN and server) and were addressed by "rapid management intervention" (Hall, 2002). The remaining 38 percent, however, cause alarm. The user error problems occurred because of a lack of training or a conscious decision at the installation level not to use the ITV automated systems. A lack of or confusion with policy and guidance caused the other eight percent (Hall, 2002).

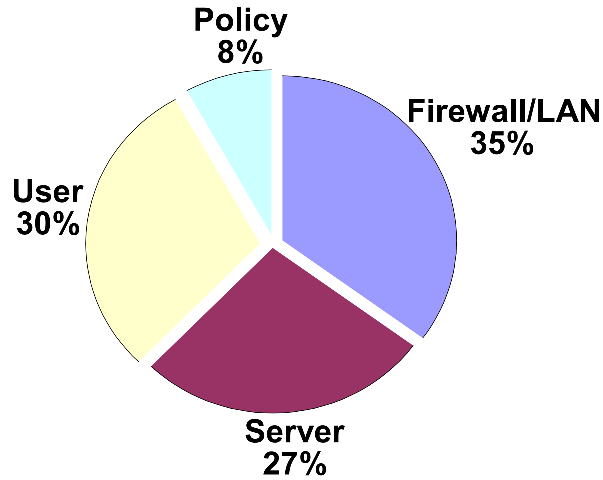


Figure 6. Breakout of ITV Errors Occurring During OEF Deployment

Following the OEF deployment, the Air Force established an investigative team to identify training and other issues to try to prevent the same problems from reoccurring in the future. The team reviewed mobility processes and recommended the following actions (Hall, 2002):

- Extend wing-level deployment focus from "wheels up" to ITV data in GTN
- Ensure ITV support is Inspector General compliance item during inspections
- Include CMOS deployment training in wing quarterly exercises
- Conduct periodic GTN connectivity exercises or tests
- Conduct additional training for Unit Deployment Managers (UDMs)
- Reduce interval between receipt by and uptake into GTN
- Add CMOS deployment training to transportation status reporting

ITV Management Factors

Management is a broad topic and constitutes many factors, any of which may be important to managing a specific process. Most ITV research to date places less emphasis on the management factors than the technical issues. Results of the technical research, though, have alluded to some management factors important to the ITV process.

The General Accounting Office (1999) found that long-standing management issues hindered implementation of the TAV initiative. Specifically, they identified cultural resistance to change, military services parochialism, the lack of outcome-oriented goals and performance measures, and the lack of management accountability.

Suders (2001) and Ferris (2000) both discuss the importance of data quality in using decision-based technology. Effective management oversight is critical to ensuring data quality. To ensure the adequacy, accuracy, and timeliness of data, the Army formed a Data Integrity Work Group (DIWG), consisting of representatives from Headquarters, Department of the Army, the major Army commands, system design centers, and the Army Materiel Command's Logistics Support Activity (LOGSA). The DIWG attempts to improve data quality by identifying and resolving problems.

Joint Vision 2020 identifies the need for an innovative, continuous learning process. This requires “a means of interaction and exchange that evaluates goals, operational lessons, exercises, experiments, and simulations” (Chairman of the Joint Chiefs of Staff, 2000). Air Force Doctrine Document 2-4 identifies the need for effective training of Air Force personnel using the ITV information systems (U.S. Air Force, 1999). AFI 10-403 also addresses training and the development of formal deployment education programs that includes the understanding and use of IDS components. It further mandates that the Installation Deployment Officer, who holds overall responsibility for the training, provide monthly reports to the installation/wing commander on the status of deployment training (AFI 10-403, 2001). Although this instruction emphasizes training and reporting training status, two training issues could decrease the effectiveness of this training. The training on IDS typically focuses on the use of each component and not on the interfacing of the components. Without effective component interface training, the users do not have the experience to resolve between-component issues. When such a problem arises during in the heat of a deployment, the users would revert to a manual process diminishing ITV. Even in an effective training program, much of the ITV training is conducted only at a local level. To date, the Air Force has not conducted a service- or Major Command-wide information exercise that ends in ITV data transmission to GTN. Without an exercise of this magnitude, attainment of ITV is not tested until deployment execution.

The Naval Supply Systems Command found the lack of management oversight of inventory in-transit to depots to be an important factor in failed visibility. They created a "follow up" process that automatically alerted necessary personnel when required shipment milestones were not achieved within established time standards. This web-based tool, launched in May 2001, also has the functionality to escalate issues to higher management, if required (Tinker, 2001). Although the initial results are positive, the DoD has not developed such an automated reporting system for deploying inventory.

Anderson (2001) identified the need for continuous training for automated system specialists as a challenge for adopting an ITV capability. He also identified the need for leader development programs. These programs should make leaders knowledgeable about the ITV process and how to measure the efficiency and effectiveness of their part of the process through the establishment of performance goals and objectives. Finally, Anderson (2001) states the need to update and formalize policy and develop field guides to explain how ITV processes work at the strategic, operational, and tactical levels.

Whyte and Bytheway (1996) identified attributes to use to measure the success of implementing information systems. Some of the attributes they identify include: data accuracy, personnel competence, system complexity, error checking capability, documentation, user friendliness, executive support, system integration, necessity of the system to business processes, system reliability, technical support responsiveness, training, upkeep of the system, and user involvement.

Refinement of Scope

To date, information systems have been developed, tested, and refined. Techniques to automate traditionally human interfaces, such as AIT, have resulted in significant increases in the efficiency of the data entry process. Data standardization and EDI developments have effectively linked automated information systems.

However, despite a decade's research on ITV, problems continue. During the OEF deployment, the Air Force might have eliminated 38 percent of the problems encountered with more effective management practices. A review of the literature on ITV revealed a lesser emphasis has been placed on analyzing management issues related to the ITV business process. Some researchers have proposed management factors that could influence a TAV or ITV process: cultural resistance to change, lack of outcome-oriented goals and performance measures, continuous training, effective management oversight, and lack of accountability. However, many of these factors were proposed upon the conclusion of research focusing on more technical areas of ITV, rather thanafter exhaustive research into these actual factors.

With the lack of research emphasizing ITV management, such research is necessary. This research is intended to fill in the gap in current research by focusing upon management issues key to ITV success. One means to identify these management practices is through a comparative analysis of the USAF to companies that have successfully implemented an ITV capability.

Summary

In-transit Visibility continues to be important to the Department of Defense. Since the Gulf War, the DOD has implemented the Global Transportation Network (GTN) and the Air Force has fielded the Integrated Deployment Systems to feed ITV information to GTN. Both the DOD and Air Force have documented the need for ITV and provided instruction for the application of the information technology. Despite these developments toward an ITV capability, recent deployments to Afghanistan highlighted continuing problems in the ITV process. Results from initial Air Force studies appear to show the problem does not lie in the information technologies themselves, but are more process related. Review of the literature demonstrated a lack of research emphasizing the ITV business process. By benchmarking civilian industry leaders, the Air Force may be able to identify gaps and improve current ITV processes.

III. Methodology

Chapter Overview

This chapter explains the methodology employed to achieve the research objective. The sections discuss the research design, data collection techniques, and the data analysis. Research design is the focus of the first section. It presents justification for using a qualitative design and discusses the reasoning for selecting a combined benchmarking, multiple case study approach. The second section provides details on the techniques used for collecting data. The final section describes how the data will be analyzed to support answers to the research question.

Research Design

The research design is an "action plan for getting from here to there," a blueprint of research that deals with the questions, data, and analysis (Yin, 1994). Within social science, researchers have debated the formulation of research design and compared the uses of quantitative and qualitative research methods as evaluation techniques. Although individual researchers tend to favor one method over others due to past training and familiarity, the decision on which method to use ultimately lies in the appropriateness of conducting the study based on known information and the desired result of the evaluation (Dooley, 2001). Creswell (1994) explains that the qualitative paradigm focuses on forming a complete picture, or confirming a prior theory, by studying a phenomenon in its natural setting in which application statistical analysis is limited. To the contrary, quantitative evaluation applies statistical procedures to test apriori theories, thereby determining the predictive generalizability of the theory.

This research effort focuses on characterizing business practices that could lead to attainment of ITV. Through study of leading civilian logistics companies and comparison of their practices with current Air Force procedures, this research aims to offer alternatives that could lead toward improved ITV. Because of the qualitative nature of the data, a qualitative design serves to best achieve the research objective. Qualitative research is by nature descriptive, inductive and involves fieldwork where the researcher focuses on collecting and analyzing data on processes, rather than on the product (Creswell, 1994). Table 1 demonstrates how this research meets these basic criteria.

Table 1. Basic criteria for qualitative research

Criteria	**Research characteristic that meets criteria**
Process Oriented	Study of the ITV process
Focus on meaning	Focus on what characterizes effective management of the process
Researcher is primary instrument for data collection	Research must analyze content of archival data, conduct subject matter expert interviews, observe ITV operations
Involves fieldwork	At a minimum, observations occur at a company's operational site; interviews may be conducted remotely
Descriptive in nature	Purpose is to characterize successful management practices and determine similarities and gaps with Air Force practices
Inductive	There is no current theory on how companies were able to solve management challenges in implementing an ITV capability

Benchmarking.

Benchmarking is one way to improve a process. Benchmarking is a "continuous and systematic process of evaluating the products, services, and work processes of organizations that are recognized as representing best practices for the purpose of organizational improvement" (Spendolini, 1992). It is a means to improve organizational processes without "re-inventing the wheel."

Benchmarking made its rise in the early 1990s and by 1996, it had become the third most used management tool. Today, benchmarking is a mindset of achieving organizational excellence and an essential ingredient in strategic planning (Camp, 1998). Spendolini (1992) defined three primary methods of benchmarking: internal, competitive, and functional. Table 2 compares these three methods.

Table 2. Comparison of Benchmarking Methods

Type	Definition	Advantages	Disadvantages
Internal	Similar activities in different locations, departments, operating units, country, etc.	- Data often easy to collect - Good results for diversified "excellent" companies	- Limited focus - Internal bias
Competitive	Direct competitors selling to same customer base	- Information relevant to business results - Comparable practices/technologies - History of information gathering	- Data-collection difficulties - Ethical issues - Antagonistic attitudes
Functional	- Organizations recognized as having state-of-the-art products/services/processes	- High potential for discovering innovative practices - Readily transferable technology/practices - Development of professional networks - Access to relevant databases - Stimulating results	- Difficulty transferring practices into different environment - Some information not transferable - Time-consuming

Spendolini, 1992

Benchmarking does present challenges to overcome. Although benchmarking focuses on the "best of the best," it limits solutions to what has already been achieved. If used improperly, benchmarking becomes a tool for catching-up, at best, rather than jumping ahead (Hammer and Champy, 2001). It is also important to keep in mind that no one company is best at every process (Camp, 1998).

With the Air Force facing continuing budget cuts and manning reductions, there is a continued need to improve operational capabilities. The Air Force shares “best practice” information through Inspector General reports and “lessons learned” documents and these techniques are essentially internal benchmarking methods. Air Mobility Command (AMC) attempts to use competitive benchmarking to compare itself against civilian cargo carriers. Finally, the Air Force has also employed functional benchmarking practices by comparing its processes to those in use by functionally similar, leading civilian corporations. Previous studies have identified some concerns over making these comparisons, as differing natures of the military and corporate worlds may make these types of comparisons inappropriate.

A key distinction between civilian industry and the military is each profit motive: civilian industries are profit driven whereas the military is a not-for-profit organization. This distinction drives deeper than the bottom line; it influences business decisions about processes. A fundamental trade-off in business decisions is effectiveness versus efficiency. Effectiveness is a measure of how well a company can achieve its goal whereas efficiency is the cost incurred to achieve that goal (Bowersox et al., 2002). A for-profit civilian company’s goal is to make money now and in the future (Goldratt and Cox, 1984). Understanding basic economic principles, for-profit companies attempt to achieve this goal through minimizing total costs, thereby making themselves more efficient, while achieving a minimum desired level of effectiveness. Contrarily, the military, or another not-for-profit organization, emphasizes effectiveness within the constraints of funding. The overarching goal of the military is to ensure the continued survival of the country. Within funding provided by the U.S. Congress, the military works to achieve maximum effectiveness at achieving this goal. For clarification, consider the following practical example:

A cross-docking facility has an average throughput of 2,500 shipping units per day. The facility owns 50 forklifts that can each move 100 shipping units per day. Currently, the forklifts work at 50% capacity. If emphasizing efficiency, the cross-docking facility will maximize the use of 25 forklifts and sell the other 25. If emphasizing effectiveness, the cross-docking facility might be satisfied to do nothing. They are achieving their current goal, plus they maintain additional capacity in the event there is a need to surge capabilities to meet some added need.

Understanding differences between the civilian and military industries, the major concern in the past about comparing ITV processes between the Air Force and civilian sector was the level of visibility required (Abaleto and Lee, 1993). To avoid the reoccurrence of the Gulf War experiences and provide theater commanders an appropriate level of command and control, the Secretary of Defense instituted a policy of near real-time visibility of shipments down to the unit or item level. In contrast, past civilian ITV efforts provided visibility only to the shipment level, as any additional capability could subtract from the bottom line (Schwartz, 1997).

Two factors suggest why studying civilian ITV may be beneficial. The first being the drive toward streamlined supply chains in recent years has increased the demand for lower levels of visibility, even in the civilian world. In addition to knowing when their shipment will arrive, customers increasingly want to know exactly what will arrive (Gilmore, 2002; Gould, 2001). The second factor is that several ITV management practices appear to apply across civilian and military environments, regardless of the level of visibility. One example is user training on the ITV information system, although operational training will vary from system to system, general training methods could be the same.

The DOD has previously employed case studies with benchmarking techniques to determine “best practices” of functionally similar civilian companies. One such study, conducted by Abalateo and Lee (1993), focused on operations of leading logistics companies in the air cargo industry. Abalateo and Lee’s study evaluated five leading air cargo companies: United Parcel Service, Federal Express, DHL Airways, Emery Air Freight, and Airborne Freight. They focused their study on all aspects of air cargo operations during surge periods, of which in-transit visibility was one area of concern. From their research, they concluded that ITV requirements for the civilian companies differed from that of the Air Force. Although the capabilities to track cargo throughout the entire logistics pipeline were similar, the civilian carriers experienced limited demand to track cargo over long periods of time and most cargo was delivered within one to two days. In comparison, the Air Force may have cargo awaiting airlift for several days before it begins moving, thereby leaving the Air Force with an increased need to track cargo over long periods of time. Abalateo and Lee’s study of ITV focused primarily on the automatic identification technology employed by the companies. Two limitations exist in applying their results to this research. First, although AIT is a key component to ITV, their study did not investigate the management of the ITV information system. Another limiting factor is the age of the research. From the companies investigated, only FedEx and UPS had fully implemented an ITV capability. In the past decade, information technology has evolved dramatically, allowing for the widespread adoption of tracking systems.

Shah (1993) investigated the ITV process at Federal Express and United Parcel Service, finding both companies to be considered leaders in "track and trace" technology. Shah's goal was to "re-engineer" the ITV process to improve service levels, accountability, and productivity. Shah's study focused primarily on the information technology employed by both companies and how each company could better use that technology. Shah (1993) proposed a re-engineered model that affected the organization of the process, job design, and workflow. Shah (1993) recommended "case teams" to perform root cause analysis to isolate and eradicate problems with shipments or tracking of the shipments. He also recommended implementing AIT to reduce human error, to decrease the need for management oversight of the personnel keying in data. Finally, Shah (1993) noted that time stamping and status messages should be fully utilized for internal package tracking.

Camp (1992) identifies three actions the researcher should take prior to embarking on a benchmarking study: assess current operational strengths and weaknesses, identify industry leaders, and incorporate the best to attain superiority. Spendolini (1992) expands Camp's approach with a circular five-stage benchmarking process, as seen in Figure 7. Spendolini argues that the benchmarking process does not end with implementation because the processes being benchmarked are dynamic and change over time. Thus, Spendolini's model is circular to address the need for continuous improvement through periodic re-evaluation of the process.

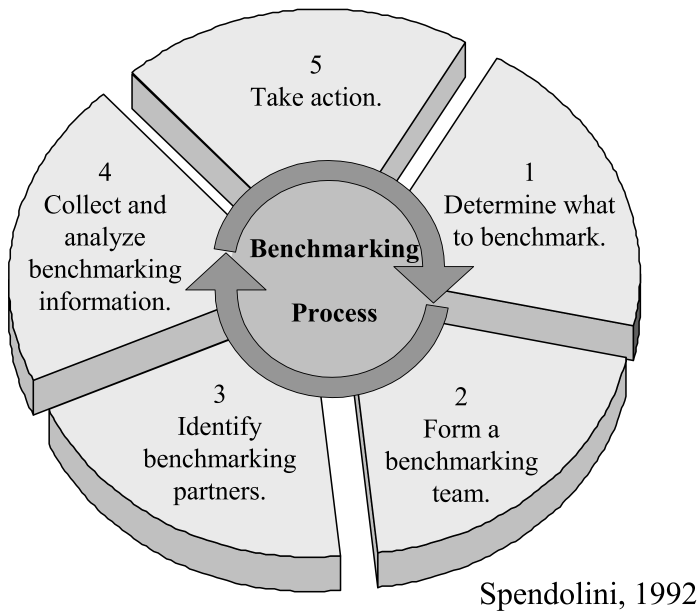


Figure 7. Spendolini's Five-Stage Benchmarking Process

This research employs a functional benchmarking design following a modified five-step process. The modified approach re-incorporates Camp's assessment of operational strengths and weaknesses while removing Spendolini's formation of a formal benchmarking team. Further, since the result of this research is business practices recommended for implementation within the Air Force, step five was modified to "recommend action." Figure 8 shows the modified process.

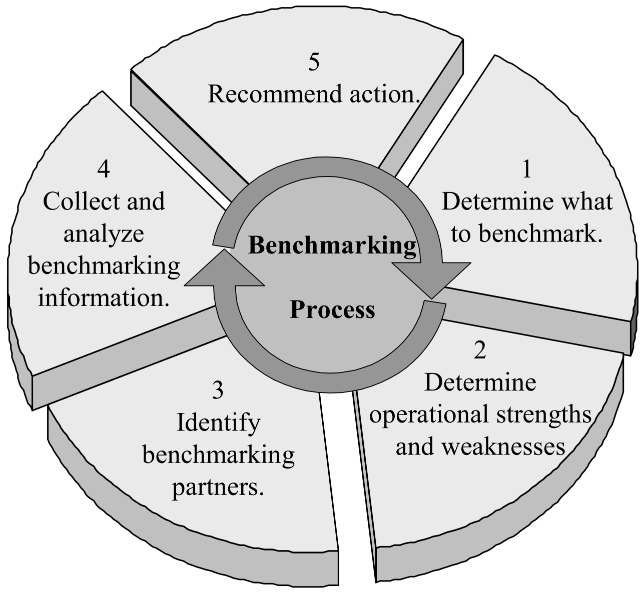


Figure 8. Modified Five-Step Benchmarking Process

Step one of the modified process directs the determination of the focus of the benchmarking study. In this case, the ITV process is the focus of the research. Archival analysis of current literature, presented in Chapter Two, narrowed the focus to ITV business practices. Investigative questions one and two focus on determining the operational strengths and weaknesses of the Air Force ITV process through a review of Air Force policies and guidance on ITV and identification of potential areas of weakness within the process. Step three will provide an answer to investigative question three, identifying the leaders in the civilian logistics industry. By throughly analyzing business and information technology rankings, industry leaders will be determined. Once industry leaders are identified, step four involves collecting data from the benchmarking partners. The data collection method employed for this research will be discussed in detail later in this chapter. Developing recommendations for action from analysis of the data comprises step five. Although this research ends with recommending actions for implementation, the model holds the circular shape recognizing that the Air Force must continue to improve its ITV process through future evaluation.

Comparison of Designs.

Over time, researchers have developed several strategies to collect and analyze empirical data given a wide range of research situations. Each methodology favors specific environments. To determine the most effective strategy for a given situation, it is critical to understand the advantages and disadvantages of each strategy. According to Yin (1994), this comparison should evaluate the types of research questions under investigation, the control the researcher has over actual behavioral events, and the degree of focus on current versus historical events, as highlighted in Table 4.

Table 3. Relevant situations for different research strategies

Strategy	**Form of Research Question**	**Requires control over behavioral events?**	**Focuses on current events?**
Experiment	how, why	Yes	Yes
Survey	who, what, where, how many, how much	No	Yes
Content Analysis	who, what, where, how many, how much	No	Yes/No
History	how, why	No	No
Case Study	how, why	No	Yes

Yin, 1994

Of the methods identified by Yin, the case study is the best fit for this research. A case study can be an exploratory or explanatory approach about a contemporary phenomenon, or a "case," that is bounded by time, location, and activity which cannot be manipulated. The strength of the case study is its ability to deal with a full variety of evidence, including content analysis, direct observation, and systematic interviewing (Creswell, 1994; Yin, 1994). ITV is a contemporary event bounded by an organization's implementation of the process. Data sources can include observing the process, interviewing experts of the process, and or analyzing documentation about the process.

The other four methods listed by Yin (experiment, survey, content analysis, and history) are limited in their application to this research. The experiment is quantitative and typically relies on the study of a control or treatment group to test a theory (Cook and Reichardt, 1979; Yin, 1994). This research will not test a theory. Instead, as an initial investigation into the ITV business practices, this research focuses on characterizing factors important to ITV. The survey is a quantitative design that uses questionnaires or structured interviews for data collection. The intent of the survey is to infer some characteristic, attitude, or behavior about a population from study of a sample (Creswell, 1994; Yin, 1994). Although a survey study of ITV could lead to correlations of success factors, this research is focused on identifying and characterizing success factors. An archival, or content, analysis gathers data from any type of verbal, visual, or behavioral form of communication. This type of study is limited in design in that it does not allow for observing the event or interviewing key participants. A history focuses on exploring only historical events, as the name implies (Yin, 1994). As ITV is a current phenomenon, a historical study of ITV would be limited in scope.

Yin (1994) discusses only two of five commonly used qualitative designs: content analysis and case study. Leedy and Ormrod (2001) present three other qualitative designs; ethnography, phenomenological study, and grounded theory study; and discuss the distinguishing characteristics of each design. Table 5 compares these designs by their purpose and focus.

Table 4. Distinguishing Characteristics of Qualitative Designs

Design	**Purpose**	**Focus**
Case study	To understand one person or event in great depth	One case or a few cases within their natural setting
Ethnography	To understand how behaviors reflect the culture of the group	A specific field site in which a group of people share a common culture
Phenomenological study	To understand an experience from the participants' point of view	A particular phenomenon as it is typically lived and perceived by human beings
Grounded theory Study	To derive a theory from data collected in a natural setting	Human actions and interactions, and how they result from and influence one another
Content analysis	To identify the specific characteristics of a body of material	Any verbal, visual, or behavioral form of communication

(Leedy and Ormrod, 2001)

Ethnographies and phenomenological studies focus on behaviors and experiences of participants. Grounded theory studies begin with the data and construct a theory from them (Leedy and Ormrod, 2001). Understanding the advantages of employing a case study design, this research will employ a combined benchmarking, case study approach. The case study method will be implemented at the fourth step in the benchmarking process to gather data from leading companies in the civilian logistics industry.

Case Study.

For this research, the case study was felt to be the best fit because as a research strategy, the case study is preferred when answering “how” and “why” questions about current events over which the researcher has little control (Yin, 1994). This research effort poses questions in these forms: “<u>How</u> have logistics industry leaders successfully implemented asset-tracking information technology?” and “<u>How</u> can the Air Force use this knowledge to improve its ITV process?” This research will address these questions by investigating the management practices at these leading industries and adapting them for use by the Air Force. The study will occur in the current “real-life” setting of the industry over which the researcher will have no control.

In designing the case study, five components are important: the study’s questions, propositions, unit of analysis, logic linking the data to the propositions, and the criteria for interpreting the findings (Yin, 1994).

“How” and “Why” is the event occurring? As previously discussed, case studies focus on “how” and “why” an event occurs. Development of the questions should clarify the nature of the study in this regard. The questions are a key component to the case study protocol, which will be discussed later in this chapter.

Wherein do the answers lie? The questions focus the researcher what to study, but fail to provide the direction as to where to study. The study’s propositions expand the questions to give the researcher a focus of attention on where to gather the evidence within the scope of the study. They also provide a key to success for the study. Case study’s of an exploratory nature, though, legitimately will not formulate propositions.

Instead, an exploration should state a purpose for the study, along with success criteria. As an exploration, this research discussed the purpose of the study and success criteria in chapters one and two of this document.

What is a "case?" The unit of analysis defines the context of the case study. Similar to defining an individual experiment in scientific research, the unit establishes the scope of the study by defining the single case and the boundaries limiting data collection. The single case could be an individual, event, or entity (decisions, programs, implementation process, organizational change). Boundaries define the beginning and ending of the case, specifically those items, people, location, and time, considered outside the study (Yin, 1994). This research uses the following definitions:

> Unit of analysis: An institution that has attempted to automate the ITV process.
>
> Time boundary: Begins at the institution's implementation of the ITV process and ends with the conclusion of this study.
>
> People/location boundary: People included in the study are those directly involved in the ITV process. The subject matter expert will be a senior ranking information technologist within in the company.

What use is all this data? The final two components of case study research, logic linking data to the propositions and criteria for interpreting the findings, both focus on how to handle collected data. In case study research, there are no precise methodologies established (Yin, 1994). This research will follow a data analysis technique similar to that employed by Abalateo and Lee (1993), who used gap analysis to compare air cargo operations between civilian companies and the Air Force. Actual data analysis will be discussed in detail later in this chapter.

Validity and Reliability.

Questions about validity and reliability of any research method must be addressed. Some common concerns, listed in Table 6, are often levied against qualitative methodologies. Creswell (1994), Dooley (2001), and Yin (1994) all provide recommendations on how to structure a research design to minimize these concerns. Table 6 also shows those recommendations implemented in this research.

Table 5. Recommendations Implemented to Address Research Concerns

Concern, Research:	**Description of concern**	**Recommendations implemented in this research**
Lacks rigor	Sloppiness in data collection and researcher bias influences direction of findings lead to lack of rigor in data collection	- Structured approach using research protocol minimizes bias - Open-ended questions allow respondent, not the researcher, to direct the answers
Exaggerates data to make a point	General confusion of case study *teaching* with case study *research; teaching* may be deliberately alter data to more effectively demonstrate a particular point	- Data are presented in their original form - Analysis results from original date, in unaltered state
Provides little basis for scientific generalization	Focus on a single event or case limits the application of the results to similar events in other environments	- Multiple case study allows for more compelling evidence leading to a more robust analysis - Goal of research is characterization, not generalization
Takes too long and results in massive, unreadable documents	Some case study designs may take a long time to collect the data. The length of data collection depends on each research design.	- Data collection for this research is planned for two months - This document is divided into five chapters to make reading easier.

Creswell, 1994; Dooley, 2001; Yin, 1994

Yin (1994) recommends maximizing the following four design criteria wherever possible: construct validity, internal validity, external validity, and reliability. Table 7 offers several methods to address each of these four design tests and presents the techniques implemented in this research to maximize these tests.

Table 6. Case Study Tactics For Four Design Tests

Tests	**Case study tactic**	**Phase of research in which tactic occurs**	**Recommendations implemented in this research**
Construct validity *Are the operational measures for the concepts being studied correct?*	- Use multiple sources of evidence - Establish a chain of evidence - Have key informants review draft case study report	- Data collection - Data collection - Composition	- Data collected from literature, observations, and interviews - Data analysis and results provided to key informants for review
Internal validity *Is there a "chain of events" between constructs?*	- Do pattern-matching - Do explanation-building - Do time-series analysis	- Data analysis - Data analysis - Data analysis	- Research is exploratory, not construct-based - Identifies patterns across the industry
External validity *How applicable are the study's findings to situations outside those specifically under investigation?*	- Use replication logic in multiple-case studies	- Research design	- Multiple case study design - Includes four logistics industries and an integrated service provider
Reliability *Is the study replicable?*	- Use case study protocol - Develop case study data base	- Data collection - Data collection	- Structured data collection through use of the case study protocol

Yin, 1994

Multiple Case Study.

A multiple case study design increases the external validity of the research. Yin (1994) recommends employing a multiple-case design when the topic under investigation applies in more than a single case. The multiple-case design provides a type of "replication-logic" similar to conducting multiple experiments and provides an avenue for conducting comparative case studies.

This research design implements Yin's recommendations by studying at least one leading company in each of the following logistics industries: air, railroad, trucking, deep sea, and an integrated service provider. Including companies from these four industries will allow for more generalizable results than the previous ITV case studies which focused only on air companies. Results from the studies will be cross-analyzed to highlight similarities in the business practices.

Case Study Protocol.

A properly developed protocol contains an overview of the research, a guide for the case study report, field procedures, and interview questions. The case study protocol is used to improve the reliability of the case study research. It serves as the instrument for conducting the research and guides the researcher in carrying out the case study. The protocol forces the investigator to consider issues ahead of time, allowing an opportunity to anticipate problems (Yin, 1994).

The overview of the research should discuss relevant background information about the research, issues under investigation, and the literature that applies to the subject (Yin, 1994). Chapters one and two provide this overview. The format for writing this thesis document satisfies the recommendation to include a guide to the case study report.

Field procedures of the case study increase the reliability of the data by formalizing the data collection process. Field procedures should highlight the major tasks in collecting data. Yin (1994) recommends including procedures for gaining entry, general sources of information, and procedural reminders. Creswell (1994) also emphasizes the importance of addressing how the researcher gained entry and secured permission to study the case. Initial contact with each company for this study occurred in September 2002 via telephone calls to the respective Chief Information Officers or senior information technologist of each company. A brief discussion introduced the researcher, the research subject and purpose, and requested permission to follow up with an electronic mail (e-mail) message that more thoroughly detailed the research (Appendix A). If a response to the e-mail was not received within two weeks, a follow-up telephone call was made. Of the companies that committed to the research, all responded positively to the initial e-mail message along with a point of contact who would represent the company. The position of each point of contact is listed in the appendix containing the firm's interview response. Structured interviews and observational tours were conducted from October 2002 to January 2003.

At the heart of the case protocol is a set of questions reflecting the full range of concerns from the initial research scope. These questions serve two primary purposes: elicit information from the case and remind the investigator of information necessary to collect (Yin, 1994). Where possible, the questions were posed in an open-ended manner to avoid guiding the informant to a specific answer. Open-ended questions also solicit the greatest amount of information. The questions were sectioned into six "grand tour" questions to focus the interviews on specific ITV business practices, as follows (Creswell, 1994).

> Grand Tour Question 1: How does your organization view the use of information technology, specifically for tracking assets, as a competitive advantage?

a. How does your organization emphasize the tracking of assets through the logistics pipeline?

b. How do you organize “information technology” within your organizational structure?

c. How do information specialists and users integrate into the structure?

Grand Tour Question 2: What guidance has your organization provided to development, implementation, and use of your asset-tracking information systems?

a. What is your stated policy/guidance for users of asset-tracking systems?

b. How do you disseminate policy/guidance to users?

c. How do you ensure personnel follow stated policy/guidance?

d. How do you correct for misuse of the systems?

Grand Tour Question 3: How successful has your organization been at implementing your asset-tracking system?

a. How would you classify the success of your asset-tracking system?

b. What were some major obstacles your organization had to overcome in the implementation stage?

c. What key lessons has your organization learned as a result of implementing your asset-tracking system?

d. Are there any problem areas your organization has yet to resolve?

Grand Tour Question 4: What are the primary success factors that have allowed your organization to successfully implement “real-time” tracking of assets?

a. How do your senior managers remain knowledgeable about the operations of the asset-tracking systems?

b. How do you train users of your information systems?

c. How did you design your asset-tracking information system to ensure successful tracking of assets?

d. How do you provide assistance to users of the asset-tracking system?

Grand Tour Question 5: How do you maintain operability of the asset-tracking systems?

a. How do users and managers know that the systems are working correctly?

b. How do you measure performance of the tracking systems?

c. How do you correct for deficiencies between system performance and measurement standards?

d. How do you adjust your systems for surge operations?

Grand Tour Question 6: What is your asset-tracking process, beginning with identification of the item being shipped through delivery at destination?

a. To what level can you maintain visibility (e.g., vehicle, container, specific item)?

b. What are the primary technologies you use within your process (e.g., barcoding, radio-frequency identification, satellite tracking)?

c. Do you use commercial-off-the-shelf (COTS) software or develop proprietary software?

d. What factors led to your choice to use COTS or develop proprietary software?

e. If using COTS, what software package are you using and who is the developer?

Data Collection

Data collection will be discussed in three sections corresponding to steps two through four of the modified benchmarking process: determine operational strengths and weaknesses, identify benchmarking partners, and collect and analyze benchmarking information.

The second step in the benchmarking process requires the current process to be mapped with strengths and weaknesses identified. Investigative questions one focuses on defining the current Air Force ITV process, while investigative question two focuses on the policy and guidance governing that process. Interviews with Air Force leaders involved in the ITV process and content analysis of current documents available via the Air Force Departmental Publications web site and the home pages of the Air Force Directorate of Installations and Logistics and Standard Systems Group, Logistics Information Systems Program Office will serve as the primary data sources to analyze the Air Force ITV process. From the mapping of the process, the weaknesses, or potential sources of error, will be identified.

Initiating the benchmarking effort requires the identification and selection of the benchmarking partners. Archival analysis of business and information technology rankings, listed in chapter two, identified the leading companies in each of the logistics industries. This data will be further used to select the benchmarking partners. Using the case study protocol, invitations to participate in the research will be offered to the top two companies in each industry.

The multiple case-study design will be employed to collect data for step four of the benchmarking process. For a case study, Yin (1994) discusses three principles of data collection: using multiple sources of evidence, creating a case study database, and maintaining a chain of evidence (Yin, 1994).

A major strength of the case study is the capability to use multiple sources of evidence. Using multiple sources allows for the development of "converging lines of inquiry" (Yin, 1994). Creswell identifies three qualitative data collection techniques, as shown below in Table 8.

Table 7. Strengths and Weaknesses of Sources of Evidence

Type	Options	Advantages	Limitations
Interviews	Face-to-face Telephone Group	Useful when informants cannot be directly observed Informants can provide historical information Allows researcher "control" over the line of questioning	Provides "indirect" information from interviewees viewpoint Provides information in a designated "place" Researcher's presence may bias responses Not all people are equally articulate and perceptive
Observations	Complete participant Observer participant Participant as observer Complete observer	Researcher has firsthand experience with informant Researcher can record information as it occurs Unusual aspects can be noticed during observation Useful in exploring uncomfortable topics	Researcher may be seen as intrusive "Private" information may be observed that cannot be reported Researcher may lack skills Certain informants may present special problems in gaining rapport
Documentation	Public documents Private documents	Enables a researcher to obtain the language and words of the informant Unobtrusive source of information Saves time and expense of transcribing	May be protected information unavailable to public or private access Requires the researcher to search out information in hard-to-find places Materials may be incomplete or not authentic

Creswell, 1994

"The interview is one of the most important sources of evidence for the case study" (Yin, 1994). This research uses a structured interview of ITV subject matter experts as the primary source of data. The interview guide as previously discussed provides the structure to ensure each informant is asked the same set of questions.

Although interview data is a secondary source, senior information technologists should have an in-depth knowledge of the business practices that allowed the company to achieve its leading position. The subject matter expert should also be capable of describing the company's ITV process.

The interview process in this research will use a mode of communication not mentioned by Creswell (1994): e-mail interviewing. Throughout the 1990s, e-mail increasingly became a pervasive form of communication (Selwyn and Robson, 1998; Thach, 1995). Implemented as a research tool for conducting interviews, e-mail has several advantages, as highlighted below in Table 8.

Table 8. E-mail Interviewing, Advantages and Disadvantages

Advantages	Disadvantages
Easy and immediate access to world-wide samples	Limited in application to users of e-mail
Reduce interviewer bias resulting from visual or non-verbal cues	Difficult to ensure respondent anonymity
"Friendly" to respondent	Lacks "tacit" or non-verbal data
Provides already transcribed data, eliminating any errors in transcription	Messages can be deleted with the touch of a button
Favorable response rates	
Saves time and money	

Selwyn and Robson, 1998; Thach, 1995

The primary advantage to e-mail communication is its speed and "friendliness" to respondents (Selwyn and Robson, 1998). The friendliness results from the de-synchronization of the interview process. By conducting the interview via e-mail, respondents can take time to consider the questions and reply at their convenience. The disadvantages of using e-mail are minimized where possible in this study. All companies included in this research use e-mail as a means of communication and only position titles are used to identify the respondent. The use of "read receipts," follow-up e-mails, and telephone calls ensure the respondents receive and respond to the interview questions.

Operational site visits allow for direct observation of non-behavioral, physical processes at the civilian companies. Data collected from observational tours will be used to support or supplement data collected from the interview process, as necessary. Documents and archival records corroborate and augment evidence gathered from other data collection techniques (Yin, 1994). This study utilizes these sources to map the Air Force ITV process and to identify previous studies on civilian ITV processes.

Experience of the Author.

Because qualitative research is interpretative in nature, Creswell (1994) recommends discussing the experience of the researcher that may lead to values, biases, and judgments. The researcher in this study is a specialist in logistics planning for the U.S. Air Force and as a logistics planner was trained in the Air Force ITV process. The researcher managed an installation-level deployment process for three years, two of which were spent as the Installation Deployment Officer. The researcher is knowledgeable about the Air Force ITV information systems and specialized in the integration of those systems, having attended workshops on LOGMOD and conducted training on it and CALM. Based on the researcher's training and work experience, the researcher can be considered a subject-matter expert in the Air Force ITV process.

Analysis and Results

The objective of this research is to identify "best practices" in the ITV process of leading civilian logistics companies for possible implementation by the Air Force. The data gathered through interviews, observation, and document review form the basis of a case study database (Yin, 1994). This database will be used to compare a consolidated perspective of the civilian community with the ITV process used in the Air Force. Gaps between the two processes will identify practices for consideration by the Air Force for adoption. Completing this analysis answers investigative questions five and six as well as step five in the benchmarking process.

Human Subject Information

Human subjects are respondents to the interviews and could be observed during the operational site visits. For the interview respondents, information is provided in the solicitation e-mail about their rights to privacy during the research. Participation in the research is strictly voluntary and by responding to the solicitation e-mail, they consent to being included. Throughout the research report, their responses are referred to by the company name or by their position title. Any subjects involved in analysis of the Air Force ITV systems will be primarily military employees. Approval to use any name or position in the report will be obtained directly from the military participant.

Summary

This chapter presented the research methodology as qualitative and exploratory. It further identified the research design as a combined benchmarking process with a multiple case study comparative analysis. The chapter provided justification for selecting this methodology and explained how the research design accounts for validity and reliability. It maximizes construct validity by collecting data from multiple sources of evidence, including structured interviews, direct observation, and document analysis. The research design considers external validity through a multiple case study design, thereby increasing the generalizability of the results. Finally, the research addresses reliability issues by developing a structured data collection through the use of the case study protocol. A complete description of the methodology was described, to include how the data will be collected and analyzed.

Benchmarking incorporates best practices to become the "best of the best." By benchmarking civilian industry leaders, the Air Force can identify gaps and improve current ITV business processes. The first step to benchmarking is to determine the industry leaders in the desired field of study. The business and information technology rankings allowed for the identification of civilian logistics leaders in air, rail, truck, and sea.

IV. Analysis and Results

Chapter Overview

This chapter presents the analysis and results of the research study. Findings of the literature review, subject-matter expert interviews, and observations are analyzed by examining each investigative question. The chapter concludes by offering recommendations for action by the Air Force, thereby completing the final step in this benchmarking process.

Terminology Differences

During the course of the data gathering for this research, terminology differences between the military and civilian communities became apparent. Before discussing the results from this study, it is necessary to address these differences.

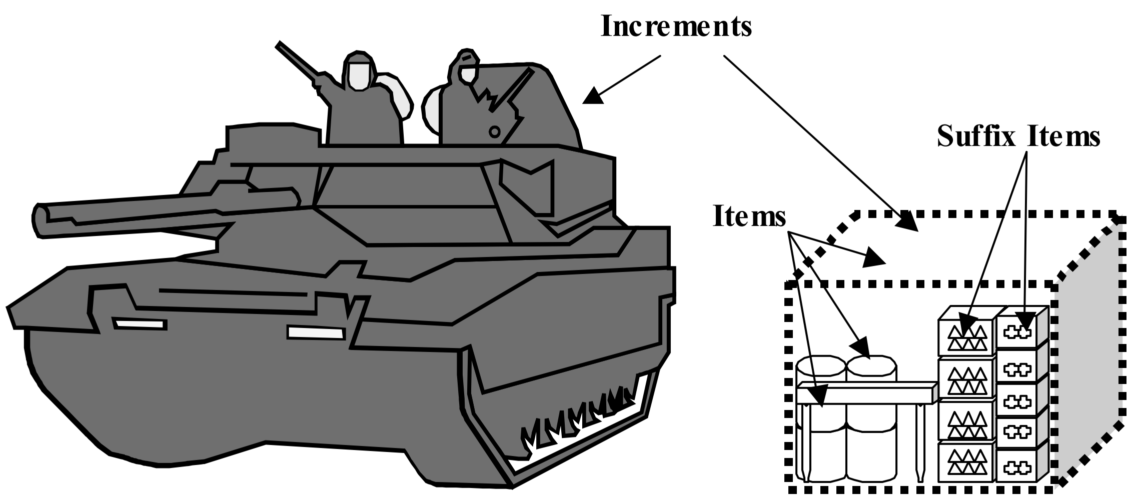
Asset Visibility.

Total Asset Visibility was defined in Chapter 2 as "the capability to maintain a constant awareness of inventory throughout the entire supply chain." Applied to In-transit Visibility, visibility of DOD "assets" refers to the items shipped through the logistics pipeline. Most civilian companies apply "asset" visibility to tracking the location of their transportation vehicles themselves (i.e., rail cars, trailers). They referred to the DOD definition of asset visibility as "total product visibility" and to in-transit visibility as "shipment visibility."

Shipment Levels.

Current industry standards do not define terms associated with various levels of a shipment. For clarification during this discussion, the researcher will define these levels from a DOD perspective and use these terms throughout this document. Figure 9 diagrams the DOD shipment level definitions. The DOD requires ITV over each "item" moving through the Defense Transportation System.

Figure 9. DOD shipment level definitions



An increment is the highest aggregation level of the shipment. It is associated with a handling unit (for example, container or pallet) that is physically loaded onto the transportation vehicle. For very large items that do not require a separate handling unit, such as a vehicle, the increment is the asset itself. Civilian industries may assign a specialized control number to this level of the shipment. Vehicles are identified by their Vehicle Identification Number. In the DOD, the deploying unit assigns a Transportation Control Number to each increment, no matter its shipping "level."

For handling unit increments, such as a box, the next lower level is the item. The item is what goes into or onto the increment. It can be a smaller handling unit or an asset, such as a piece of equipment. Civilian industries identify items by a number of standard methods, such as the Stock Keeping Unit (SKU). The DOD uses the National Stock Number (NSN) to identify items and this is equivalent to SKUs.

For items that are handling units, the next level is the suffix-item, or those things inside the handling unit. Suffix-items use similar identification standards as items.

Investigative Question One

What is the Air Force ITV process?

This research attempted to gather data through interviews with Air Force leaders involved in the ITV process. These leaders were solicited, but due to factors outside the control of this research, no response was provided. Without interview data, this question was answered through a review of Air Force policies and regulations. The ITV process is addressed in three sections: system architecture, operational process, and potential sources of error.

System architecture.

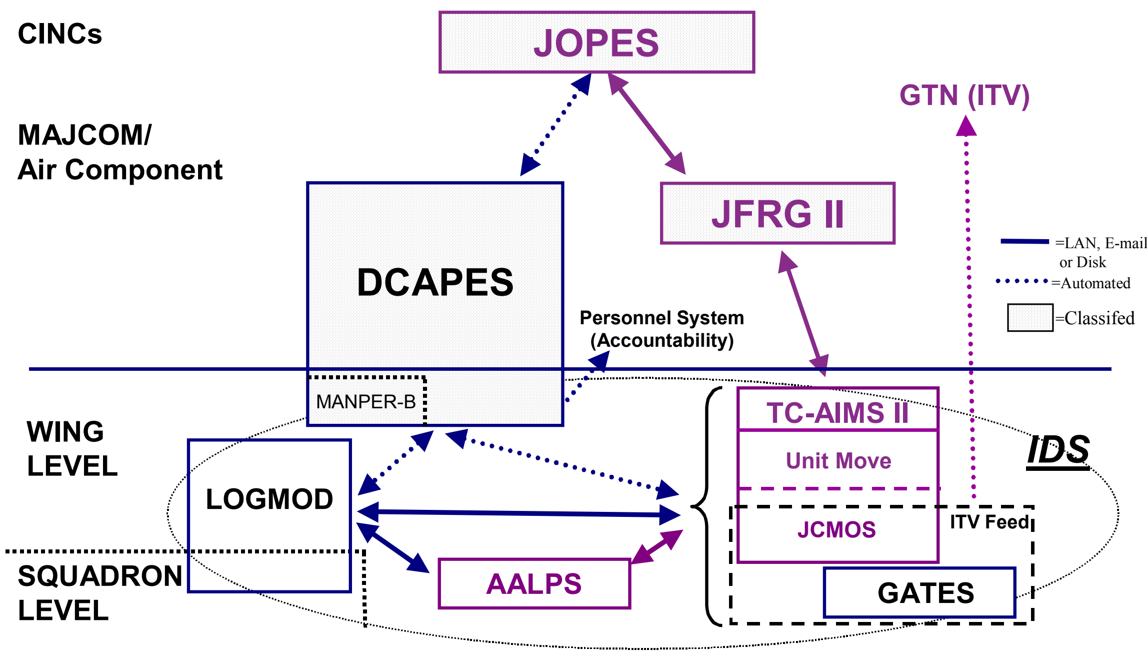
Although the system architecture was not a part of the study of the benchmarking partners, identifying the Air Force system architecture enabled the researcher to identify potential sources of error within the ITV process.

Referring to the architecture definitions found in Chapter Two, the Air Force ITV system most closely resembles a multiple operating systems, multiple data entry locations systems. The Air Force uses a component design under the umbrella system called the Integrated Deployment Systems (IDS). A component of IDS, Cargo Movement Operations System (CMOS), is the Air Force feeder system for ITV. CMOS receives cargo ITV information from LOGMOD and CALM and pushes item-level data to the Global Transportation Network (GTN) to provide ITV. Each Air Force unit uses the Integrated Deployment Systems to plan and execute the deployment of unit cargo.

The Logistics Module, LOGMOD, is the starting point for the transmission of deployment data for ITV. It contains both a deployment planning and execution function. Each Air Force wing maintains a separate LOGMOD database that contains information on their unit cargo. Each unit database is stored at a centralized database located at Maxwell Air Force Base, Gunter Annex in Montgomery, Alabama. Nightly, the Standard Systems Group creates a backup copy of the database. The only current use of this backup is as a failsafe against corruptions or serious mistakes, such as inadvertently deleting an entire plan, occurring while working in LOGMOD. In these cases, a unit can be reverted to the backed up data, which is never any older than one day.

The original IDS design was based on legacy logistics systems. Adapting to evolving technology, the Air Force developed a migration plan for moving to an inter-service deployment architecture. This plan increases deployment effectiveness by providing a common interface and terminology across the services. Three information systems are planned for in the migration plan: Automated Air Load Planning System (AALPS), web-based LOGMOD, and Transportation Coordinators – Automated Information for Movements System II (TC-AIMS II). AALPS is a joint air load planning system that will replace CALM. Web-based LOGMOD is a next-generation, web application that will replace the current, modern client-server system. TC-AIMS II consolidates deployment and transportation functions into a single, interservice system and interfaces with GTN to provide for ITV (Hodge, 2001). Migration to TC-AIMS II complies with DOD mandates under CJCSI 3020.01 to improve service interoperability of ITV systems (Jennings, 2002). Figure 10 demonstrates the future IDS concept.

Figure 10. Air Force future ITV operating concept



Jennings, 2002

Operational Process.

The Air Force ITV process occurs in two distinct phases: planning and execution. AFI 10-403, *Deployment Planning*, provides instruction over both phases.

During the planning phase, an Air Force unit is assigned primary responsibility for a force package, coded by a five-character alphanumeric sequence called a Unit Type Code (UTC) that is designed to achieve a specific wartime mission capability. The unit with primary UTC responsibility, called the pilot unit, identifies all equipment necessary to achieve the specified capability. The pilot unit builds and manually inputs the cargo data, such as weight, dimensions, and identification number, into the centralized LOGMOD database based on the optimum physical arrangement of increments, items, and suffix-items. Once approved by headquarters-level functional experts, this standard UTC package is available in LOGMOD to all Air Force units worldwide that may be assigned to support the capability. USTRANSCOM and Air Mobility Command then use this information to plan airlift support.

Non-pilot units are those units, other than the pilot unit, that are assigned to support a UTC capability. AFI 10-403 requires all non-pilot units to maintain in LOGMOD a local copy of the UTC. A unit is authorized to make minor modifications to the UTC using suitable substitutes, so long that it does not diminish the mission capability. If making a suitable substitute, the unit must change all details necessary to reflect the substituted equipment item, including the description, NSN, dimensions, and so forth. All originating data entry is “by hand.”

Once notified of a deployment tasking, a unit uses IDS for electronic transmission of required deployment information. IDS is used for planning aircraft loads or “chalks,” creating cargo documentation, and transmitting ITV information. The locally maintained UTC equipment packages serve as a basis for these tasks.

A key operational performance measure during a unit deployment is the aircraft take-off time. Within LOGMOD, the Installation Deployment Officer develops a local deployment schedule of events of actions necessary to meet the take-off time. These key milestones provide visibility throughout the installation, including the senior leaders, of the status of the deployment operations. Sequencing of cargo for the schedule of events is based on the aircraft load plans developed in CALM. Once a load plan is complete, a LOGMOD operator manually selects cargo increments, by TCN, for aircraft assignment.

The remainder of the IDS process is electronic, relying upon transfer of files between the component systems.

Potential Sources of Error.

Human intervention within a process is prone to human error. A key to successfully implementing a process is to identify and reduce the occurrence of these errors. Although they may occur as early as initial data entry, many of these errors may not be discovered until ITV fails in GTN. If caught after the transmission to GTN, the problem will appear to be an error in the CMOS-GTN interface. Since the problem may not be between CMOS and GTN, it is necessary to identify and correct the root cause of the problem to prevent a reoccurrence. Once identified, several options are available, as necessary, to improve the process including automation, system error checking, personnel development programs, and management oversight. The following steps appear to be potential sources of error in the Air Force ITV process.

Manually inputting National Stock Numbers (NSN) into LOGMOD. Although manual entry increases the flexibility of the system, manually inputting long strings of alpha-numeric characters is a key source of error. A single digit mistake will result in failed ITV transmission for the specific item. During the evolution of the IDS systems, it was common that a single item could have been assigned several variations of NSNs with possibly only one of which would be the NSN officially assigned by Defense Logistics Information Service.

Manually assigning cargo increments in LOGMOD based on the aircraft load plan. IDS requires a LOGMOD operator to manually assign a cargo increment to an aircraft based on the load plan. When scrolling through possibly hundreds of increments looking at long TCNs, it becomes an easy source of error to select the wrong increment. A good quality inspection can minimize, but cannot eliminate, this problem. An error caught during the physical inspection of cargo usually results in a hand written change, with an update to the system made at a later time. This results in a delayed ITV transmission or wrong transmission if the update is not corrected in the system.

Lack of follow-up by the data-providing unit to ensure data visibility in GTN. The deploying unit has no incentive to provide ITV data. Although they provide the data, they do not use it. It serves as situational awareness data for the theater commander. Because they do not use the ITV data, the providing unit has no incentive to verify ITV data was captured by GTN. Data pushed from CMOS to GTN could fail without the knowledge of the data provider. Under current procedures, the deploying unit does not have an incentive to follow up in GTN to ensure ITV data is captured, because the theater commander uses the information, not the unit.

The airlift crew has no stake in the ITV process. Kross (1997) stated that an aircraft should not take off until ITV data has been captured and transmitted to GTN. Despite this comment, aircrew members may view ITV data as outside their area of responsibility. Instead, they remain primarily concerned with what the documentation says is on the plane, that those same items are loaded on the plane, and that the load complies with all safety requirements.

Investigative Question Two

Does the Air Force provide sufficient policy/direction to clearly articulate roles and responsibilities of personnel within the ITV process?

Chapter two presented a thorough review of the Department of Defense and US Air Force policy and guidance regarding TAV and ITV. These documents provide strategic, operational, and tactical frameworks that clearly identify the roles and responsibilities of personnel within the ITV process. Strategic guidance provides a corporate-level framework of the focus of the company. It typically lacks any specific instruction on how to carry out specific activities. Operational guidance focuses more on specific issues and may provide some direction on how to execute the policy. The lowest form of guidance is at the tactical level. Tactical guidance, as the name implies, specifically describes the tactics (or instructions) on how to execute a specific action. For a policy to be effective throughout the corporation, guidance should be provided in all three forms. Table 9 compares the documents in terms of the level of guidance they provide and shows that the DOD and USAF has addressed ITV at the strategic, operational, and tactical levels.

AFI 10-403, *Deployment Planning and Execution*, is the primary Air Force operational document that details the planning and execution of deployment operations. As listed in Chapter 2, AFI 10-403 clearly identifies ITV roles and responsibilities of Air Force offices at all major levels of command. It, combined with the Installation Deployment Plan (IDP), provide both operational and tactical guidance for achieving ITV.

Table 9. Comparison of DOD and USAF ITV policies and guidance

Document	**Primary Focus of Document**	**ITV Guidance**
Joint Vision 2020	Defines future direction of Joint Forces	Strategic
AF Doctrine Document 2-4	Provides Air Force doctrinal framework for Combat Support	Strategic
TAV Implementation Plan	DOD blueprint for TAV	Operational
ITV Integration Plan	Defines high-level operational requirements and system design to achieve ITV	Operational
DOD Materiel Management	Provides common policies for materiel management in the DOD	Operational
DOD Transportation Management	Provides common framework for shipments through the DTS	Operational
AFI 10-403, Deployment Planning and Execution	AF Instruction on the planning and execution of deployment operations	Operational
Installation Deployment Plan	Defines specific procedures for planning and executing wing-level deployment operations	Tactical
IDS Component Manuals and Help Files	Gives specific directions on how to use the specific IDS component	Tactical

Although AFI 10-403 identifies the roles and responsibilities for ITV, it does not clearly indicate who is responsible for actually achieving and verifying visibility over deploying cargo. In fact, in all of the guidance and regulations reviewed, the only organization assigned direct responsibility for ensuring ITV occurs was USTRANSCOM.

AFI 10-403 implies that if all of the necessary conditions are in place for an ITV capability, a unit will achieve ITV. Examples of necessary conditions include IDS functionality and in-place training program. Table 10 illustrates how statements contained within AFI 10-403 only imply ITV responsibility.

Table 10. Example of AFI 10-403 statements implying ITV responsibility

AFI 10-403 Statement	How it implies ITV Responsibility
Installation Commander is responsible for the overall deployment process.	Implies ITV responsibility as being part of the deployment process. ITV responsibility requires verification in GTN of a successful data transfer. AFI 10-403 does not require follow-up to ensure ITV.
Installation Deployment Officer (IDO) works for the installation commander to ensure a successful deployment operation. The IDO must ensure that the wing maintains operational readiness of IDS components and uses IDS for ITV capability.	Implies ITV responsibility as being part of the deployment process. Specifies the IDO ensure IDS functionality. Implies that functionality of IDS will always result in ITV. AFI 10-403 does not require follow-up to ensure ITV.
Transportation Commander is responsible for ensuring that CMOS can receive wing/unit level deployment data from LOGMOD, process this data, and pass this data to GTN for ITV.	Requires the functionality of CMOS. Implies that a functioning CMOS will successfully transmit data to GTN every time. Does not require follow up to ensure ITV.
Wing Plans/Logistics Plans will consolidate deploying cargo information in LOGMOD and pass electronically to CMOS to provide ITV information to GTN.	Only requires the transmission of information through IDS components to "provide for ITV."

Attachment four of AFI 10-403 contains a series of checklists that serves as an example of tactical deployment execution instructions that may be included in the Installation Deployment Plan (IDP). The following recommended action was found within the checklist for the Installation Deployment Officer (IDO), "Has ITV data created in IDS been transmitted to GTN?" If included in the IDP, this statement would require the IDO to follow up to ensure data was transmitted, but it falls short of ensuring that GTN successfully received the data. Unfortunately, as the header to the attachment points out, the checklists are "recommendations only and may be modified or deleted if not required." Not stating this action as a mandatory responsibility, specifically under the roles and responsibilities section, allows each installation to determine the importance of verifying ITV transmissions in turn leading to omission of the action.

Omitting specific responsibility for ITV in the originating organization causes an ITV death spiral. The primary value of ITV is to the consignee. The shipper originates and transmits the ITV data, but holds little real value in the visibility of the product once it leaves the organization. Viewed as being low value, the shipper may not follow up to ensure their data successfully transmitted. Instead, they may wait until a problem arises and then manage by exception. This problem spirals because the shipper may not be notified of the problem, although the root cause could be as simple as a data entry mistake. Unchecked, the problem will re-cycle. To illustrate this point, consider the following example.

A customer orders a part needed for a car engine repair. The company receiving the order processes the request, transmits shipment data to an ITV system, and sends the customer a tracking number to use for shipment tracking. The customer holds value in the tracking information in that he wants to know when his part will arrive. Other than satisfying the customer, the company holds little value in the tracking information. In many cases, they will not verify the data unless the customer reports a problem. If the customer does not report the problem and the company does not follow up to ensure they successfully transmitted the data, the company may experience the same problem in the future.

To illustrate how this same problem applies to the military, consider the following example. A U.S. Air Force fighter wing is tasked to deploy one of its three squadrons of F-15s. The support aircraft depart which transfers responsibility of the deploying cargo from the fighter wing to the theater commander. The fighter wing transmits data from IDS to GTN. The fighter wing believes the deployment was successful because the cargo deployed on time and there were no problem reported with the data transmission. Other than personal concern about their comrades, the fighter wing holds little value in any additional information about the deployed squadron while it is in-transit. They do not verify the attainment of ITV and only know of a problem if it is reported to them. Following up would have provided the opportunity to identify the problem and seek the root cause, which could have been a simple mistake in the entry of the NSN. Unchecked, the problem may reoccur next time the data is transmitted.

Procedures to correct this issue could be included in an installation's deployment plan. Each IDP is unique though, which leads to different levels of direction and interpretations of the implied responsibilities. Compounding this problem is the existence of career field manning shortages where the author of the IDP may be new to Air Force deployment operations. Without a formal review process above the installation level, there is no guarantee that the IDP will accurately capture ITV responsibilities.

Investigative Question Three

Who are the leading civilian companies in using logistics information systems, specifically for ITV?

Step three in the benchmarking process was to identify the industry leaders. However, it was not likely that a ranking existed in the literature over which logistics companies have the best ITV capability. FedEx and UPS were identified as pioneers in a web-based tracking capability; Abaleto and Lee (1993) found these two companies to have the best capability for the air cargo companies they studied. Their research, though, was in the early 1990s and focused only on the air cargo industry. By 2000, rapid advancements in information technology led even the late adopters to develop web-based shipment tracking systems.

With the lack of a specific ITV ranking, an assumption was made that the overall leading companies in each logistics industry got there at least in part because of their capability to adopt new technologies and to develop and maintain superior management practices. Therefore, ranking data was sought from archival records ranking companies by their overall performance. The literature search revealed two separate rankings: one evaluating business performance by gross sales, the other by their overall use of information technology. Business rankings were recorded from Ward's Business Directory of U.S. Private and Public Companies, 2000; the information technology ranking came from Information Week's Top 500 Companies, 2002. Comparing the business rankings and the information technology rankings validated the assumption that leading companies make the best use of information technology. Those companies that ranked high by sales also ranked within the top 500 companies in the United States by use of information technology. However, a high ranking in information technology does not necessarily imply the company was a leader in the use of logistics information systems or for ITV. Because of a lack of correlation, an interview question was developed to evaluate the perceived level of performance. Table 11 shows the top companies in each logistics industry.

Table 11. Leading civilian logistics companies

Air

Company	Business Ranking	IT Ranking
United Parcel Services	1	69
Federal Express Corp	2	35
DHL Airways Inc	3	137

Railroad

Company	Business Ranking	IT Ranking
Union Pacific Corp	1	229
CSX Corporation	2	409
Burlington Northern Santa Fe Corp	3	343

Deep Sea

Company	Business Ranking	IT Ranking
Stolt-Nielsen Inc	1	460
American Presidents Line	2	72
Sea-Land Service Inc	3	---

Trucking

Company	Business Ranking	IT Ranking
CNF Transportation Inc	1	94
Roadway Express Inc	2	134
Schneider National	3	55

Unless otherwise indicated below, this research selected the top two companies from each logistics industry as benchmarking partners. Studying a cross-section of the logistics industry provided additional generalizability to the findings. Further, a cross-sectional analysis allowed for the early stages of correlation.

In total, seven companies participated in the research, listed in Table 12. Studying seven companies provided a sufficient sample size to increase reliability of the results. The large sample also yielded a variety of practices from which to evaluate.

Table 12. Benchmarking partners

Industry	Company
Air	United Parcel Service DHL Airways
Railroad	Union Pacific Corp Burlington Northern Santa Fe Corp
Deep Sea	Stolt-Nielsen Inc
Trucking	Roadway Express
Third-Party Logistics	Vector Supply Chain Management

United Parcel Service was a recognized leader in the air industry as a package-handling specialist. They are also well known for their web-based ITV application. They ranked number one in the business rankings and in the top 100 of the information technology rankings. DHL Airways was an airfreight specialist. Although FedEx ranked higher than DHL, selecting DHL as a benchmarking partner allowed for the inclusion of both package handling and airfreight specialists.

Union Pacific was the leader in the railroad industry in both business and information technology rankings. Given their status as the leading company, Union Pacific was selected as a benchmarking partner. Because of they ranked higher in information technology than CSX, Burlington Northern Santa Fe (BNSF) was selected as the second rail company.

In Deep Sea, Stolt-Nielsen was the leading company. They were selected as the only benchmarking partner from the Deep Sea industry. The second highest ranking company, American Presidents Line, was a passenger travel company and the third company did not rank in the top 500 in information technology.

The top two companies in the trucking industry were CNF Transportation and Roadway Express. CNF Transportation accepted the researcher's invitation, but forwarded the information on to their integrated logistics company, Vector Supply Chain Management. To increase the validity of the data, the selection of benchmarking partners was expanded to include Vector SCM. As the second highest ranking company, Roadway Express was selected as a benchmarking partner.

The following information provides a basis of understanding of each company that were included in this research as benchmarking partners.

United Parcel Service.

United Parcel Service began in 1907 at Seattle, Washington as a bicycle messenger service called the American Messenger Company. Today with headquarters in Atlanta, Georgia, UPS continues to develop the frontiers of logistics as the largest express carrier and largest package carrier in the world. Founder, Jim Casey, established the principles which guide UPS today: customer courtesy, reliability, round-the-clock service, and low rates.

In 1988, UPS became an airline, UPS Airline in addition to a trucking company. UPS Airline became the fastest-growing airline in Federal Aviation Administration history and today, was among the ten largest airlines in the U.S. They operate more than 1,800 flight segments per day in more than 700 domestic and international airports.

Based on an increase in customer requests for logistics expertise, UPS created the UPS Supply Chain Solutions Group in 2002. This group specializes in global distribution, transportation management, shipment processing, and inventory management.

Technology at UPS spans an incredible range, from specially designed package delivery vehicles to global computer and communications systems. In 1994, UPS's award-winning Web site made its debut and for the first time in UPS history, on December 22, 1998, online tracking requests for a single day exceeded one million. Today, UPS delivers 13.6 million packages and documents per day for 7.9 million customers and averages more than 6 million on-line tracking requests per day on its Web site.

Every year, UPS proves to be the best in the industry by receiving several awards. The following awards are examples of those won in 2002:

- Web Best 50 (CIO magazine)
- Top 100 e-businesses (InternetWeek magazine)
- Top 100 information technology companies (InfoWorld magazine)
- Top 500 most innovative users of information technology (InformationWeek magazine)

DHL Worldwide Express.

In 1969 in California, Adrian **D**alsey, Larry **H**illblom and Robert **L**ynn (D, H, and L) founded DHL Worldwide Express as a service shuttling bills of lading between San Francisco (the location of their headquarters) and Honolulu. Today, DHL is the global market leader of the international air express industry, accounting for 37.5% of the market share. They offer their customers fast, responsive, and cost-effective, express deliveries in addition to e-commerce fulfillment and logistics solutions to over one million customers around the globe.

DHL maintains a network of over 4000 offices at more than 120,000 destinations in 220 countries across the globe. They handle over 160 million shipments per year. DHL employs 71,000 people and runs a fleet of more than 250 aircraft, operating over 700 flights per day, with another 2,335 flights contracted to carry DHL packages on other carriers aircraft.

Throughout DHL's history, they have led the way with investments in information technology that enable the company to ship and track documents and packages quickly and efficiently. Like UPS, they developed a convenient web-based application called DHL Worldwide Package Tracking that enables customers to track any package shipped by DHL at any time, day or night, from any location on the World Wide Web.

Union Pacific Corporation.

Union Pacific Corporation was one of America's leading transportation companies. Its principal operating company, Union Pacific Railroad, was the largest railroad in North America. It covers 23 states across two-thirds of the United States and operates key north/south corridors into Mexico and Canada.

Union Pacific headquarters are located in Chicago, Illinois. They employ over 48,000 workers and own nearly 7,000 locomotives and 97,000 freight cars. They average over 33,000 route miles per year. Union Pacific maintains one of the most diversified commodity mixes in the industry. Their fastest-growing business area is hauling coal, where it moves more than 238 million tons annually. Although Union Pacific Railroad's primary role is transporting freight, it also runs a substantial commuter train operation in Chicago.

Union Pacific has also offered web-based applications to allow customers to manage their rail shipments. The shipment-tracking portion of their e-commerce solution is the Secured Equipment Trace which traces any railcar, regardless of railroad line, as long as Union Pacific is included in the routing.

Union Pacific has won several awards for excellence in the railroad industry with the most recent being a number one ranking by Fortune magazine as "America's Most Admired Companies." It was their third straight year they ranked the top railroad.

Burlington Northern Santa Fe Corporation.

Headquartered in Fort Worth, Texas, Burlington Northern Santa Fe Corporation (BNSF) was created in September 1995, from the merger of Burlington Northern Incorporated and Santa Fe Pacific Corporation. BNSF employs about 38,000 people and operates one of the largest railroad networks in North America, with 33,000 route miles covering 28 states and 2 Canadian provinces.

BNSF moves more intermodal traffic than any other rail system in the world, was America's largest grain-hauling railroad, and hauls enough coal to generate more than ten percent of the electricity produced in the United States.

BNSF provides its customers with a convenient, web-based transportation management system called iPower. iPower is an integrated set of tools organized around the shipping process that help keep customer shipments moving from beginning to end. Through iPower, customers can plan and ship freight, trace the movement of freight, and pay bills electronically. The iTrace component of iPower allows customers to trace up to 300 pieces of equipment by identification number.

In addition to being listed by InformationWeek as one of the top 500 most innovative users of information technology, BNSF has also identified by The Data Warehouse Institute for a Best Practices award for data warehousing in two categories: Business Performance Management and Real-time Analytics.

Stolt-Nielsen, S.A.

Stolt-Nielsen was founded in 1959 as Parcel Tankers, Incorporated, with a one time-chartered ship called the *Stolt Advance*. Headquartered in Greenwich, Connecticut, the company has grown to become a three-billion dollar publicly traded international transportation company focusing primarily upon ocean-going transportation.

In 1999, Stolt-Nielsen Transportation Group Limited (SNTG) was established to consolidate all of Stolt-Nielsen's transportation businesses. SNTG was the world's leading provider of integrated transportation services for bulk liquid chemicals, edible oils, acids and other specialty liquids. SNTG maintains a combined capacity of approximately four million barrels of liquid storage.

In 2000, Stolt-Nielsen expanded its logistics services by standing up a third-party logistics company, Optimum Logistics. Optimum Logistics provides an internet-based platform, called TransLink, for international logistics management. TransLink was developed over six years ago as one of the first web-based track-and-trace applications for international logistics.

Roadway Express.

Roadway Express is a subsidiary of Roadway Corporation, headquartered in Akron, Ohio. They were founded in 1930 as a less-than-truckload transporter of industrial, commercial, and retail goods in the two- to five-day regional and long-haul markets. Roadway provides service between all 50 states, Canada, Mexico, and Puerto Rico with international freight services for 140 countries.

Roadway employs over 26,000 people and operates 379 terminals, 34,500 trailers, and 10,700 tractors. On average, they deliver over 50,000 shipments per working day. In 2001, they delivered over 7 million tons over a total of 500 million miles. Roadway manages the most comprehensive time-definite services in North America and are the only carrier to pinpoint deliveries within one-hour windows to multiple locations throughout North America.

Roadway maintains a broad range of online transaction and document exchange capabilities, including web-based services for supply chain management, in-transit shipment visibility, and other technologies for managing freight transportation. They maintain over two terabytes of shipment data stored online and their information systems process over 99 million transactions each day.

Roadway has won several awards as a leading technology innovator, including the following from 2002:

- Top 100 companies in information technology (CIO magazine)

- Top 100 best places to work in information technology (ComputerWorld magazine)

- Top 500 most innovative users of information technology (InformationWeek magazine)

- Top 100 e-businesses (InternetWeek magazine)

Vector Supply Chain Management.

In December 2000, CNF Incorporated entered into a joint venture with General Motors (GM) Corporation to form Vector SCM (Supply Chain Management). Headquartered in Novi, Michigan, the company is nearing the end of a three-year transition plan and currently manages more than $1.7 billion in logistics spending for GM.

The company acts as a global fourth-party logistics (4PL) company. A 4PL provider is a distinctive business model combines the best capabilities and technologies from logistics companies and other service organizations to deliver value throughout the entire supply chain. 4PLs excel at providing intra-/inter-company process management, engineering redesign, and ongoing performance management and continuous improvement through management of the entire supply chain.

Through the integration of technology and physical infrastructure, Vector SCM provides global logistics and supply chain management services to enable end-to-end visibility for material and finished products as they move through the supply chain. They design, build, execute, and manage logistics supply chains worldwide.

Investigative Question Four

What are the processes employed by the leading logistics companies to achieve ITV?

Data obtained from subject matter expert interviews with senior information technology managers from each company provided the basis for the answer to investigative question four. The interviews consisted of six grand tour questions that each contained between three to five subquestions. The specific answers provided by each manager are contained in appendices C through I. The researcher also conducted site visits of two companies, Roadway Express and UPS. Observations during these visits enhanced and added to the answers provided from the interview and in some cases solidified the data analysis phase of the research.

Before answering this question, the nature of the data must be considered. Interview data is secondary data based on the knowledge of the interviewee. The researcher structured the interview questions in an open-ended format aimed to solicit a wide range of responses. Each respondent was asked the same set of questions to increase data reliability. Because the questions were open-ended, their response was influenced by respondents' interpretation of the question. Since a Delphi analysis was not conducted in this research, conclusions cannot be drawn that a company does not use a specific practice that another company states that it uses. Rather, it merely means that the respondent did not state the use of that practice. Given this limitation, this research effort does not collect sufficient evidence to correlate management practices to ITV success, although drawing correlations was not within the original scope of the research.

Investigative question four will be answered through the following categorical factors that appear to have an impact on successfully implementing and maintaining a business process: company organization, policy and guidance, success criteria, operational process, management, and technology.

Company Organization.

Company organization forms the foundation for success of any business process. Although the physical structure of the organization was important, two other key factors are vital to success: process development and organizational emphasis on the process.

All of the companies studied are for-profit organizations. As such, their primary business goal is to make money now and in the future. When asked about the importance of information technology to achieving this goal, six of the seven companies recognized that a high priority on the development of new technology was a key to their success. One aspect of technology adoption mentioned was the capability to track shipments through their supply chains. The only company that did not indicate that shipment tracking as being a mission critical function was Stolt-Nielsen, who stated that their customer's do not hold a high value in automated shipment tracking. Stolt-Nielsen operates about 500 voyages per year with little variability in voyage length. They believe that this low variability in port-to-port transit times provides their customers with an accurate knowledge of the location of the vessel which decreases the customer's concern over shipment visibility. This variability increases significantly, up to several days, for the time between when the ship arrives at port and when it is authorized to discharge its cargo. With the high variability is offloading cargo, providing their customers with a time-of-arrival at port can be somewhat controversial. Instead, the company works with its customers to keep them unofficially apprised of the current situation and notifies them via a Notice of Readiness that the cargo is ready for discharge.

With a high priority placed on information technology, all seven companies have adopted the Chief Information Officer (CIO) position as the senior ranking information technologist. In all cases, the CIO is a member of senior management and reports directly to the President and Chief Executive Officer. In adopting this structure, each company attempts to ensure information technology concerns are addressed at the highest levels of management.

Under the CIO, each company has established a centralized organization to address information technology concerns company wide. These organizations range in size from just over 100 employees at Vector SCM to over 5000 at UPS. The difference in size is not indicative of the emphasis placed on information technology, more the size of the company.

Two of the companies studied formed separate organizations to manage specific shipping accounts. Vector SCM, a public integrated logistics provider, was founded as a subsidiary to CNF Transportation to manage the distribution of General Motors vehicles. Although GM was still their primary customer, they offer logistics services to any company. In an agreement with DaimlerChrysler, Union Pacific formed a private integrated logistics company, Insight Network Logistics, to over see the vehicle distribution. Included in Insight Network Logistics contract with DaimlerChrysler was the “real-time” tracking of vehicles by Vehicle Identification Number.

All seven companies studied have developed formally defined processes for governing the development of information technology. In designing, developing, and implementing information systems, all use an integrated team of cross-functional experts including program managers, information technologists, and users. This enhances system design, while ensuring user needs are met. UPS formalized a committee of 15 senior managers of functional managers throughout the company, called the Information and Technology Strategy Committee, whose sole charter was “studying the impacts and application of new technologies and setting near term technology direction.”

Policy and Guidance.

In order to successfully implement a process, the process must be articulated to all levels of management and workers. Once implemented, the company must enforce the policies and enact corrective measures to ensure compliance with the defined process.

All companies studied integrate corporate policies for for use of information technology within a Code of Conduct. Each of these documents provides a strategic level perspective on the expected use of all information technology applications within the respective companies. Within their corporate policy, all companies, with the exception of Stolt-Nielsen, include a statement about the importance of information technology, including the tracking of shipments, to the future growth of their companies. As an International Standards Organization (ISO) certified company, Roadway reported using ISO 9002 standards as a basis for the development of their policy and guidance principals. The companies provide operational level perspectives by integrating instructions into core business rules for a business area. Tactical level instructions are provided in the respective operations and technical manuals to give specific instructions on the use of each information system.

Once a company develops policies, it was critical to have a means to rapidly promulgate that policy throughout the company. Every company studied discussed multiple methods used to distribute policy information, both initially and on a recurring basis. Examples of these methods include the following:

- Include policy dissemination in the governance process and in core business rules

- Cascade information through the business process area managers

- Integrate it into daily job information

- Use automated technology including blast voice mail and mass e-mail distributions

- Locate all policy documents at a centralized location on the Internet or company intranet

- Include in field training and operational workshops on the application

- Discuss in daily briefing sessions

Each company relies upon the business process area managers to ensure compliance with all corporate policies. DHL creates operational management incentives based on data quality specifically for complying with ITV policies. Roadway and Vector SCM links data transmissions to pay as an incentive. If they fail to provide data necessary to ensure the capture of ITV information, the driver or company does not get paid. Other enforcement procedures reported to ensure an ITV capability include monitoring data quality through auto-generated reports, and performing internal audits. Both Union Pacific and UPS reported that they rely upon the hiring of quality employees for compliance to all policies. UPS is majority owned by its employees, so it is counter to its employees' best interest to not attempt everything possible to maintain ITV, which UPS calls its core business.

Despite all enforcement procedures, problems can still arise. For these cases, a corrective action plan could help. All companies reported that the first corrective action step taken was to conduct some type of root cause analysis to determine where the problem lies. For human related discrepancies, each company reported the use of disciplinary actions up to and including termination, if needed. Union Pacific attempts to prevent human related errors from occurring in what they call "proactive management." Proactive management, in Union Pacific terms, means routinely monitoring the process to identify, prepare for, and take action on any potential problem area. In attempting to resolve potential problem areas, Union Pacific can minimize the effect of a problem. Three of the companies reported that their primary corrective action was remedial training. In their training, Vector SCM includes emphasizing the importance of the information systems.

Success Criteria.

Up to this point, there has been an assumption that each company has successfully implemented their shipment tracking information system. The assumption followed that since each company was a leader in their respective industry and they provided high customer service through shipment visibility, their business processes were worthy of study as a "best practice." To validate this assumption and to provide validity to the research results, each company was asked a series of questions regarding their perceived success at implementing ITV technology. UPS believed they have the best on-line tracking system in the world, which takes an average of 66.4 million hits per day. Roadway pointed to their very survival as a testimonial to the success of their tracking capabilities. They are one of only four survivors from among the largest 50 LTL carriers in existence in prior to deregulation in 1979. BNSF stated that they are the premier provider of shipment location information compared to their rail peers. DHL, Union Pacific, and Vector SCM also all claimed their tracking systems to be highly successful. Of the companies studied, only Stolt-Nielsen did not report a high level of success, primarily due to their perspective that shipment tracking was a low priority to their customers. Stolt-Nielsen stated that they do emphasize the use of information technology, though not necessarily for shipment tracking.

Table 13. Obstacles, Lessons Learned, and Problems Areas of Implementing ITV

Obstacles	Lessons Learned	Problem Areas
Cost and logistics of implementing the system	Cannot train too much	Keeping up with evolving business requirements
Correctly Sizing database to support anticipated volume	Integrate the system with business decision systems	Timeliness and accuracy of data from external partners
Getting complete, accurate, and timely data	Make the people closest to the data responsible	Staying ahead by continuing to evolve technology
Integrating with other business systems	Start with the business problem, not the technology	Maintaining a secure global network
Adjusting to evolving technology	Recognize change management issues	
	Create fail-over databases to ensure redundancy of data	
	Quality of relationship with data provider reflects the quality of data	
	Involve all affected business areas early in the design process	

Given the level of success perceived by each company, each company was asked to provide a list of obstacles encountered, lessons learned from their experience, and if there were problem areas the company had yet to resolve. Table 13, above, summarizes these answers.

Operational Process.

The ITV process employed by each company was unique and focused to meet the needs of the respective company. The goal of this research was not to duplicate the process of any of the companies, but to identify practices that could improve the efforts of the Air Force. To do so it is still important to review operational aspects of some of the civilian ITV processes to identify areas the Air Force could exploit.

In designing their information system, the companies cited several reasons for why their shipment tracking system had proven successful. BNSF and DHL used of a cross-functional team of business professionals to ensure the design met all user requirements. BNSF also developed their system in components to add flexibility to the design. This modular design allowed DHL to modify components of the system as volume grew and business needs evolved. Roadway and UPS automated their processes in an attempt to remove aspects of human error. Roadway, as well as Union Pacific and Vector SCM, believed that it was necessary to integrate the shipment tracking system with other business systems to expand the capability from simply tracking shipments to providing decision support.

Each company has formally defined procedures for both initial and refresher training. During the early implementation stages, BNSF sent a training team into the field to provide a train-the-trainer training. Through this process, a supervisor becomes qualified on the system to train subordinates. Like BNSF, DHL used a train-the-trainer program. Roadway took a larger scale approach to training. They did not provide training on the shipment tracking system, instead they integrated training on specific functionality into the overall job function training. This could include Computer Based Training, training manuals, or hands-on training using real data. UPS and Vector SCM also used real data transmission during training sessions.

All six companies that reported a high priority for shipment tracking also cited technical support as a high priority. Providing technical support to users of the tracking system was important to ensuring uninterrupted operations. All six companies provided support to "any user, any question, any data, any time," as Union Pacific put it. They also all maintained a technical support staff 24 hours per day, 7 days per week. In the design of their information system, they imbedded context sensitive help functions for quick access to the user.

The companies studied prepare for surges in operations as part of maintaining a functioning system. UPS experiences a significant surge in traffic every holiday season, Thanksgiving through Christmas. During that time, UPS.com receives over 300 million tracking requests, ten times the normal daily rate. UPS plans for this surge months in advance by conducting operational analyses on their system designs. If necessary, they take actions such as reconfiguring their systems or purchasing new hardware. Roadway developed their database to handle similar extreme increases in use, although they plan for unpredicted surges through continuous tuning of their system. Roadway and Vector

SCM have working plans to de-activate non-mission critical systems during times when they require additional capacity. Like UPS, Union Pacific uses operational simulators to identify trouble spots ahead of time.

Management Practices.

This section focuses on the management of the ITV process. Management practices could include the flow of information both up to senior managers and down to the front line supervisors, as well as the measurement of performance of the business process.

The most common practice mentioned to keep senior managers informed of the ITV business practice was a daily flow of information through some format. Types of formats listed as examples included mass e-mail distributions, "blast voice" transmissions or a "Morning Call," automated feeding of reports generated from within the information system. UPS stated that the tracking system is so much a part of the day-to-day business that it was a topic of daily conversation. Two companies reported using automated alerts built within the system to page a manager if a trouble spot arises.

Roadway uses auto-generated reports not only to keep senior managers informed but also to inform the front-line workers of their performance. Roadway managers receive an error report which has been carefully scrutinized by an auditing team. This error report provides a list of all transactions input by worker as well as the data entry error rate. On a technical level of managing the information system, DHL and UPS both report the use of global "fail-over" networks. A fail-over is a network that backs-up data from the primary network. In the event that the primary network crashes, the system can switch over to the backup network to continue system operations.

To measure the system effectiveness, the six companies emphasizing shipment tracking tie system performance to business measures, such as on-time delivery, number of items in the supply chain, or customer service levels. Union Pacific also measures their system use, number of transactions per user, and speed of response to inquiries. Vector SCM uses their trip plan timing as criteria to measure their information flow. Although Roadway uses similar system measures as Union Pacific, they take a more fatalistic view stating "If the system is running, the process is working."

All of the companies reported a low occurrence of deficiencies between their measures of performance and the standard level of performance established for the system. However, if a deficiency does exist, all use a root cause analysis to identify and eradicate the problem. BNSF takes a proactive approach through a regimented change control process. They schedule a 40-minute routine network outage every Sunday morning to allow for system changes, updates, and any other necessary corrective action. Planning this outage was advantageous in that all employees know it and can plan their schedules around it, plus the outage does not impact operations since it is scheduled during a low peak time. BNSF maintains a 99-plus per cent system availability.

Technology.

From discussions with the civilian companies, each looked at the potential return-on-investment (ROI) before adopting a new technology or enhancing a technology already in use. If new technology has the potential of a high ROI and their customers value the technology, they might consider developing or adopting the technology. In this sense, they can use technology as a leverage point to earn market share. Stolt-Nielsen served as an example of the ROI driving technology adoption. As previously discussed, Stolt-Nielsen did not place a high priority on real-time shipment tracking because they perceive their customer to not place a high priority on it. For Stolt-Nielsen, there was not a sufficient ROI to invest heavily in developing technology to support a real-time cargo tracking system.

Similar to Stolt-Nielsen, the other six companies attempted to respond to their customer requirements. At a minimum, all six companies could track at the shipment, or increment, level. Table 14 shows a comparison of the level of tracking each company provides.

Table 14. Comparison of tracking levels

Company	Tracking level	"By association"
BNSF	Rail car/VIN	Increment
DHL	Increment	Item
Roadway	Increment	Item
Stolt-Nielsen	Ship	
Union Pacific	Rail car	Item
UPS	Item	
Vector SCM	Increment	Item

The table lists two different methods to track shipments: tracking level and "by association" tracking level. Tracking level indicates that the level to which the ITV process actually tracks a specific control number. "By association" indicates that the information system links a lower-level control number to one at a higher level, creating a hierarchy of control numbers. The ITV process tracks the higher-level control number, but by maintaining the hierarchy, the system provides visibility at the lower level. If there is any deviation in the association, such as a re-palletization of cargo, the company adjusts the hierarchy in the system. As long as the system accurately links all changes back to originating control numbers, “by association” can create a more efficient system as the process actually tracks a significantly fewer control numbers.

Chapter Two presented the concepts Automated Information Technology (AIT) and Electronic Data Interchange (EDI) as two primary factors has driven automation in the ITV process. AIT is components used to electronically collect data and EDI is the formatting connection of information systems through a common interface. The six companies that emphasized ITV all use some degree of automation. Union Pacific reported their process as being 94-97 per cent automated through direct data feeds via EDI and AIT such as trackside railcar readers and global positioning systems to track car locations. Through associations with the rail cars, their system updates the location of the shipments. BNSF reported using a similar process as Union Pacific. Roadway located linear barcode equipment at each dock in their cross-docking facilities. As a trailer is loaded or unloaded, they use the barcoding equipment to maintain accurate records of the shipment. DHL and UPS use a similar process for their operations, locating AIT at entry point for each aircraft and or truck. As cargo is unloaded, the highest level of the shipment is scanned which updates the system. Through association, all lower level shipment items are updated. UPS reported employing the widest range of technology: barcoding, radio frequency identification, Bluetooth, acoustical radio, optical data transmissions, and, their commonly recognized handheld device, Delivery Information

Access Device (DIAD), which every UPS delivery agent uses to automatically transmit pickup and delivery information. The DIAD forms the basis of UPS's tracking system.

Of the companies interviewed, all six that emphasized shipment visibility used proprietary software, although Vector SCM reported using both proprietary and commercially available software. The commercial software package used by Vector SCM is described under Post Hoc Analysis. Although some of the companies say they would have used commercial-off-the-shelf (COTS) software, others viewed the development of logistics software as a core competency of their business. UPS was a pioneer in the development of tracking systems and gained a competitive advantage through their system. Roadway believed they could develop and maintain logistics software better and faster than if relying on COTS. Union Pacific developed the first rail car scheduling system and later evolved that system into their tracking system. BNSF developed their own system and then later sold rights to use the software to German and Canadian railroad companies.

Investigative Question Five

What are the "best practices" that enabled the leading logistics companies to successfully deploy their ITV business process?

"Best practices" are business practices that enable a company to achieve higher standards than its competitors. They usually begin internal to the company as an original concept, but spread throughout the industry as companies attempt to emulate the practice. The companies chosen as benchmarking partners are typically leaders in their respective industry. This research assumed that the companies achieved this highest level through the creation and implementation of “best practices,” or through the adoption and optimization of other companies’ “best practices.” Following this assumption, this research viewed all practices identified in answer to Investigative Question Four from a “best practice” standpoint, or at least as practices worthy of strong consideration for adoption. To specifically answer this question, though, this research will highlight those practices that appeared to possibly have an impact on ITV success. Since the nature of the data collection did not provide the respondent a follow-on opportunity to respond to the use of specific practices, as would be the case in a Delphi analysis, this research cannot draw correlations between these “best practices” and successful ITV processes. Table 15 lists the identified practice and which company or companies responded.

Table 15. Identified "best practices"

#	"Best Practice"	BNSF	DHL	Roadway	S-N	UP	UPS	VSCM
1	Emphasizes ITV in relation to core business, not just the result of a process	X	X	X		X	X	X
2	Integrates logistics experts with IT professionals in developing the tracking system	X	X	X		X	X	X
3	Creates a separate organization, a third-party logistics provider, to manage specific logistics accounts					X	X	X
4	Locates all company policies and guidance on a centralized repository for easy access by all employees			X				
5	Bases data quality, or information requirements, on operational incentives, or other personal incentives like pay		X	X				X
6	Emphasizes the data entry process as the first key to success			X				
7	Uses reports automatically generated within the system to monitor data quality	X	X	X		X	X	X
8	Performs root cause analysis to identify the underlying problem of a situation	X	X	X		X	X	X
9	Develops the tracking system in a component, or modular, design to allow for high reuse and easy update	X						
10	Integrates tracking system with business decision making systems to ensure importance of tracking			X		X		X
11	Uses mock runs of the system for training employees			X			X	X
12	Designates technical support as high priority; offers technical support to "any user, any question, any data, any time"	X	X	X		X	X	X
13	Develops plans to deactivate non-mission critical systems to ensure sufficient capacity to handle surge operations			X				X
14	Uses operational simulators to identify trouble spots in system					X	X	
15	Notifies managers of pending problems using automated alerts built within the system						X	
16	Develops system tools to measure real user experience		X					
17	Implements a regimented change control process to ensure high probability of system availability	X						
18	Deploys trackside readers to monitor location of transportation vehicles	X				X		
19	Develops system with the highest levels of automation to virtually eliminate all human error					X	X	

Investigative Question Six

What similarities and key differences exist between the Air Force and the leading logistics companies' ITV process?

Investigative Question Six forms the foundation for answering the overarching research question: "What can the Air Force learn from leaders in the logistics industry to improve upon current In-transit Visibility (ITV) business processes?" This research answers this question through a comparison, or gap analysis, between Air Force practices and the civilian practices identified in answer to Investigative Questions Four and Five.

In the same manner that this research cannot draw correlative conclusions, the methodology employed limits the ability to perform a gap analysis between the civilian companies. Further, the focus of the research is not to compare the civilian companies with each other. The purpose is to solicit a wide range of practices for consideration by the Air Force. With this focus, questions were formulated based upon responses given by the civilian firms. A question listed indicates its use by at least one of the civilian company. Thus, "yes" answered indicates a similarity between the Air Force and conglomerated civilian industry and "no" indicates a gap. Table 16 lists the questions and answers from the Air Force perspective.

Table 16. Analysis of gaps between civilian and USAF ITV processes

#	Gap Analysis Area	Yes	No
	Company Organization		
1	Does the Air Force place a high priority on the development of information technology?	X	
2	Does the Air Force highly emphasize ITV at all levels of command?		X*
3	Does the Air Force have a senior ranking manager to represent information technology concerns at the highest levels of command?	X	
4	Has the Air Force established a centralized organization to address all information technology concerns?	X	
5	Has the Air Force formally defined processes governing the development of information technology?	X	
6	Does the Air Force integrate logistics experts with information technology professionals when planning, developing, and implementing tracking systems?	X	
	Policy and Guidance		
7	Does the Air Force provide strategic level guidance regarding the use of information technology applications?	X	
8	Does the Air Force provide operational level guidance regarding the use of information technology applications?	X	
9	Does the Air Force provide tactical level guidance regarding the use of information technology applications?	X	
10	Does the Air Force use multiple methods of disseminating policy and guidance, as appropriate	X	
11	Are policies regarding the use of tracking systems included in the applicable business process areas' information?	X	
12	Does the Air Force locate all corporate shipment tracking policies and guidance on a central repository accessible by all employees?	X	
13	Does the Air Force rely upon business process area representatives to ensure strict compliance with policies regarding shipment tracking?		X*
14	Does the Air Force tie operational incentives to ITV data quality?		X*
15	Does the Air Force perform internal audits on the ITV process?	X	
16	Does the Air Force employ root cause analysis to determine the underlying problem with the ITV process?	X	
17	Does the Air Force use disciplinary actions for human error incidents involving the ITV process?		X*
	Success Criteria		
18	Does the Air Force emphasize training on the ITV process?	X	
19	Has the Air Force integrated IDS with business decision systems?	X	
20	Does the Air Force make the people closest to the data responsible for the data?	X*	
21	Does the Air Force start with the business problem, instead of the ITV technology?	X	
22	Does the Air Force recognize change management issues when fielding new ITV systems or releasing updates to current systems?	X	
23	Has the Air Force created fail-over databases to ensure redundancy of ITV data?	X	
24	Does the Air Force involve all affected business areas in the design process?	X	

* Items marked with an asterisk are discussed in depth.

Table 17 (continued). Analysis of gaps between civilian and USAF ITV processes

#	**Gap Analysis Area**	**Yes**	**No**
Operational Process			
25	Did the Air Force develop a flexible ITV system?	X	
26	Did the Air Force integrate the ITV system with other business decision systems?	X	
27	Does the Air Force use "mock run" exercises for user experience on the system?		X*
28	Does the Air Force have twenty-four hour technical support accessible for ITV needs?	X	
29	Did the Air Force embed context sensitive help functions into the ITV system?	X	
30	Does the Air Force maintain the capability to handle surge operations?	X	
31	Does the Air Force have working plans to de-activate non-mission critical systems, if necessary?	X*	
32	Does the Air Force employ operational simulators to identify trouble spots in the process?	X	
Management Practices			
33	Does the Air Force use sufficient means to inform management of the status of the ITV process?		X*
34	Does the Air Force use automated alerts to notify managers of pending problem areas within the ITV process?		X*
35	Does the Air Force use reports automatically generated within the system to manage the ITV process?	X	
36	Does the Air Force use "fail-over" systems to ensure the continuous operability of the ITV process?	X	
37	Does the Air Force tie performance measurement of the ITV process to business measures of success?		X*
Technology			
38	Does the Air Force use a "hierarchy of control numbers" to maintain visibility at the lowest levels?		X*
39	Has the Air Force addressed automated information technology concerns within the ITV process?	X	
40	Has the Air Force fully utilized automation within the ITV process?		X*
41	Does the Air Force use commercial-off-the-shelf software if available and meets all needs of the process?	X	

* Items marked with an asterisk are discussed in depth.

Does the Air Force emphasize ITV at all levels of command? Kross (1997) emphasized the importance of ITV at the highest levels of command in the DoD and in the Air Force. Despite Kross's statement that aircraft should not take off until ITV is achieved, the highest priority of an installation during a deployment is to get "wheels up" on time. Regardless of the ITV status, a deployment is successful when this occurs. The installation emphasizes the information trail that is required for a deployment only to the extent that it supports the main "wheels up" goal. The installation typically does not emphasize ITV. It is not an enforced Air Force-wide practice to expand the success criteria to include unit cargo data appearing in GTN.

Does the Air Force rely upon business process area representatives to ensure strict compliance with policies regarding shipment tracking? For the Air Force, the business process area (BPA) representatives could be any number of officers at various levels of command. However, the user error reported during the deployment to OEF originated at the installation level. This result reflects that user error in the ITV process often occurs at the data originating organization or the front end of the process. At the installation level, the BPA representatives for unit deployments are the installation senior commanders, unit commanders, and the Installation Deployment Officer. Referring to question two, if the installation level managers do not emphasize ITV, then they will not necessarily ensure strict compliance. The Air Force is not standardized in this area.

Does the Air Force tie operational incentives to ITV data quality? The primary operational incentives available to the Air Force are awards and decorations, performance appraisals, and job positions. It is not currently possible to tie data quality to more personal incentives, such as pay. Performance appraisals, or awards, for unit movements typically involve speed and efficiency that allowed for the success of "wheels up," but not ITV data quality.

Does the Air Force use disciplinary actions for human error incidents involving the ITV process? Disciplinary action would only result during the ITV process where it affects the "wheels up" goal. An error in transmission that has no impact on the immediate installation goal is not viewed as grounds for disciplinary action. In fact, an innovative change away from the current ITV process would be considered positive if it allowed the installation to achieve the "wheels up" goal.

Does the Air Force make the people closest to the data responsible for the data? The USAF does do this. The people closest to the data in the Air Force ITV process are the installation's Unit Deployment Managers (UDM). The UDMs are responsible for the data but only to a degree. They are required to input the data and are expect to correctly and accurately maintain the data in a ready state. The Installation Deployment Officer can run an error report to determine if errors exist. However, the IDO has to rely upon the unit commander for enforcement. If the unit commander views the ITV process as a low priority, then the UDM will not be held responsible for the data.

Does the Air Force use "mock run" exercises for user experience on the system? The Air Force currently does not employ "mock runs" of information transmission as an exercise practice. This practice is occasionally used at the installation level but it is not a standard practice Air Force-wide.

Does the Air Force have working plans to de-activate non-mission critical systems, if necessary? AFI 10-403 defines a procedure to de-activate non-mission critical information systems to provide for maximum system capability. However, implementing this plan requires full support from installation commanders and the network operations group. Since there are no specific guidelines for when to actually deactivate the non-mission critical systems, support for this action is not standardized across Air Force installations.

Does the Air Force use sufficient means to inform management of the status of the ITV process? The deployment process establishes a clear chain-of-command to inform the installation commanders and higher headquarters commanders of the status of deployment operations. The installation commander chairs the group of commanders called the Battle Staff, on which the Installation Deployment Officer is a member. The IDO communicates critical information during the Battle Staff meetings. The installation commander then reports to higher headquarters through a message called the situation report. Although the opportunity exists to review the status of ITV transactions, information transfer into GTN is not typically viewed as a priority at the Battle Staff. Since it is not discussed at the Battle Staff, ITV status is not generally addressed in the situation report. Before automating the ITV process, the Air Force used a written message format, called a departure message, to maintain awareness of unit cargo movements. The message contained all increments, listed by TCN, associated to a departing aircraft, listed by mission number. By tracking the aircraft, through association, the Air Force maintained an awareness of the cargo. Once the Air Force automated the ITV process, they decreased the importance of this message. However, the problems experienced during the Enduring Freedom deployment led the Air Staff to nearly reactivate these messages in an attempt to provide at least a minimal level of visibility into the deployment.

Does the Air Force use automated alerts to notify managers of pending problem areas within the ITV process? Currently the systems used by the Air Force do not have the functionality to automatically notify anyone of a pending problem, be it system or information related.

Does the Air Force tie performance measurement of the ITV process to business measures of success? Currently, the Air Force does not measure the ITV process. The primary "business" measure during a unit deployment is "on-time takeoff." From the takeoff time, the installation may develop timing criteria for information transfer through IDS and possibly even the for the CMOS-GTN transmission. However, the only measure typically used for measuring success is the takeoff time. Once in transit, the Air Force uses established aircraft "trip plans" to route the aircraft to destination. These plans include estimated times of arrival at intermediate stops. However, ITV transactions are not currently tied to these times.

Does the Air Force use a "hierarchy of control numbers" to maintain visibility at the lowest levels? Currently, ITV information systems attempt to track cargo at both the increment and item level, instead of creating associations between these shipment levels. By tracking at multiple levels, the system is required to actually track significantly more data. Through association, the "hierarchy of control numbers" would aggregate lower level shipment identifications, requiring the system to track only at the aggregate level. The current process does not establish these "associations."

Has the Air Force fully utilized automation within the ITV process? The Standard Systems Group has included AIT capabilities in the system design. LOGMOD produces shipping placards for increment labeling that includes a linear bar code. However, bar code readers are not standard purchase items throughout the Air Force. Further, the Air Force does not use automated means to record aircraft data prior to upload or download of cargo.

Post Hoc Analysis

During this research, the researcher noted four points that fell outside the original scope of this study. Three of these resulted from the site visits to Roadway and UPS. Since these observations were not originally addressed, they are identified as post hoc analyses.

The Air Force is not a package handling company.

Since UPS spurred the package handling business and implemented their highly successful tracking system, the Air Force appears to want "to be like UPS." The UPS World Port facility in Louisville, Kentucky is an impressive example of the efficient exchange of cargo to forward on to its destination. UPS uses a system of conveyors and infrared barcode readers to sort the packages automatically. The only human intervention occurs if there is a problem to the extent that the information system does not clearly read the barcode. In these cases, the package drops into another conveyor monitored by workers. If needed, the worker prints and affixes another label to the package. As the information system determines, packages destined for a specific location drop into a basket for loading into an airworthy shipping container. Once the container is filled, the worker transports the container to the appropriate aircraft for loading. This highly automated system supports UPS capability to maintain accurate ITV at the package, or item, level. However, the Air Force is not a package handling company. Two reasons why UPS can use this automated facility are because of the maximum shipment weight and the routine nature of UPS operations. UPS will not ship a package size in excess of 150 pounds because it exceeds the maximum weight allowance they can move on their automated conveyor system. The cargo pallets alone used by the Air Force weigh nearly as much as the maximum UPS shipment. The second reason is that UPS ships packages through established routes. This allows the company to structure its processes to best respond to the demand. The market for the Air Force, on the other hand, is constantly changing as they must respond to crises at any time of the day, any day of the year, at any location around the globe, with little to no notice. Until the Air Force becomes a package handling company or the demand becomes static, they should not compare themselves to the UPS's of the world.

UPS Air Cargo more closely matches Air Force operations.

During the site visit of the UPS World Port facility, the researcher also toured the UPS Air Cargo area. Within the last decade, UPS started a freight transport division of their company. In part, this capability was developed to take advantage of empty return flights from Hawaii. UPS contracted with Dole Pineapple to transport their products to the continental United States. UPS Air Cargo is working toward a more automated process, but the current process is predominantly manual not automated. They use a different tracking system than the package side, although the system is structured the same. They maintain visibility at the shipment level and use manual data entry. If they rebuilt freight, they record changes by hand and manually input these changes into the

ITV system. The process used by UPS Air Cargo resembles the Air Force cargo operations process.

Air Force aerial port operations are similar to less than-truckload cross docking operations.

During the site visit to Roadway Express, the researcher toured the major cross-docking facility just outside Akron, Ohio. This facility was very similar to the Travis Air Force Base aerial port. Compared to scale, heavy airlift capacity versus truck capacity, the two are similar operations. Both operations minimize the logistics footprint by moving freight from vehicle to vehicle based on destination and through capacity maximization of the transportation vehicle. Both operations maintain an efficient download and upload process that attempts to maximize efficiency in relation to time and motion. For example, Roadway uses time and motion studies to diagram the docking plan at their facility.

Commercially available logistics software solutions could be employed to satisfy ITV requirements.

Vector SCM reported using commercially available software, G-Log, for shipment tracking. G-Log is a company, headquartered in Shelton, Connecticut, that "provides global transportation and logistics software enabling enterprises and logistics services providers (LSPs) to move goods through the supply chain, across all modes and geographies, as a single, integrated, collaborative process." Their primary product is the Global Command and Control Center (GC3). GC3 is a web-native solution that provides a single, integrated technology platform for planning, executing, and managing the supply chain. GC3 supports ITV by "providing complete visibility to all in-transit freight, initiating proactive alerts on all problematic moves, and recommending routing changes to alleviate problems before it's too late" (G-Log, 2003).

Research Findings

Current ITV process contains many potential sources of error.

Review of the literature, coupled with the researcher's experience, allowed the researcher to map the ITV process. In mapping out the process, the researcher noted several potential sources for error. If an error goes unchecked at any step in this process, the result could be failed ITV. The following are the potential sources of error, as previously discussed:

1. Manual entry of National Stock Numbers (NSN) into the ITV system.
2. Manual selection of cargo increments in the ITV system.
3. Lack of follow-up by the data-providing unit to ensure data visibility in GTN.
4. Little incentive for the airlift crew to ensure ITV.

The Air Force does not identify a responsible agent for ITV.

Air Force policy does not identify a single responsible agent in the ITV process. The Air Force has developed policy and guidance at the strategic, operational, and tactical levels as communicated in AFI 10-403, *Deployment Planning and Execution.* This document clearly delineates roles and responsibilities of offices and personnel at all levels of command within the ITV process. However, the documents stop short of assigning responsibility of ITV. AFI 10-403 implies responsibility for other organizations for ITV by assigning specific procedures. However, if the procedures do not work properly, the assumption that the process will achieve ITV cannot be supported and visibility is not provided.

The Air Force can learn from leaders in the logistics industry that could assist in the success of the ITV process.

Interviews of the benchmarking partners provided a foundation for determining gaps between practices employed by the civilian industry at large and those of the Air Force. Gaps represent areas of consideration for adoption by the Air Force. The research identified the following gaps, which serve as the basis for recommendations:

System Architecture

1. The Air Force currently tracks shipments at the item level, instead of through a "hierarchy of control numbers."

2. Although some use of technology has occurred (AIT) in general the Air Force has not fully utilized automation within the ITV process.

3. The Air Force currently does not use automated alerts to notify managers of pending problem areas within the ITV process.

Operational Process

1. The Air Force currently does not conduct "mock run" information transmission exercises as a means of training and system optimization.

2. The Air Force does not emphasize ITV at all levels of command, instead focuses on the physical process.

3. Air Force business process area representatives do not enforce strict compliance with policies regarding shipment tracking

4. The Air Force does not use disciplinary actions for human error incidents involving the ITV process.

5. Although the Air Force makes the people closest to the data responsible for the data, the true emphasis on this responsibility is determined by the emphasis placed on it by the unit commander.

6. The Air Force does not tie operational incentives or performance evaluation to ITV data quality.

7. The Air Force does not currently tie performance measurement of the ITV process to overall measures of success.

8. Although the Air Force has structured formats for informing management about the status of deployment operations (e.g. Battle Staff, Situation Reports), status of ITV is typically not discussed.

Policy and Guidance

The Air Force has working plans to de-activate non-mission critical systems, if necessary. However, there are no specific guidelines for when execute this plan. As a standard across the Air Force, the installation level is not conducive to executing this plan.

The Air Force needs to stop comparing itself to package handling companies.

Package handling companies move items weighing less than 150 pounds. By placing a maximum weight requirement, UPS was able to maximize the automation in their ITV process. They use an automated conveyor system that is computer controlled with barcode readers. Once a package is unloaded from the transportation vehicle, it is scanned and placed on the conveyor. Through barcode identification, the computer controls the movement of the package through the sorting facility to its next loading point where it is loaded on another transport vehicle. These changes are automatically updated in the ITV system, allowing for the efficient tracking of the packages. The Air Force routinely transports large freight. The standard air handling unit, a 463L pallet, alone weighs over 150 pounds. Developing an automated conveyor system similar to what UPS uses would be impractical. Second, to ensure the security of the nation, the Air Force must respond to a wide range of contingencies throughout the world often with little to no notice making it difficult to establish shipping lanes. UPS can better approximate their demand which allows the company to use standard shipping lanes. A lost sale to UPS results in lost revenue, whereas a lost sale to the Air Force could greatly impact the security of the nation.

Significance of Findings

Following the initial deployment in support of Operation ENDURING FREEDOM, the Air Force placed a high priority on resolving ITV problems experienced. "Human error" accounted for thirty-eight per cent of the problems attributed to the Air Force. These errors ranged from a lack of knowledge in operating the Integrated Deployment Systems to a refusal to use the automated systems. The results discussed in this chapter identify management practices that could serve as a positive step toward correcting these "human errors." These results form the foundation for recommendations for action.

Recommendations for Action

Based on the results from this research, the researcher presents the following recommendations as opportunities to improve the Air Force ITV process.

System Architecture.

1. Design an interface in LOGMOD to link to the Defense Logistics Information Service (DLIS) official supply database to provide an Air Force-wide standard database for identifying equipment items. DLIS catalogs over 7.5 million national stock numbered items and other items of supply used or managed by the Department of Defense, its customers and partners including NATO and other allied nations. As part of their service, DLIS performs electronic data dissemination functions to customers who need it at every level of the supply system.

2. Include an interface from CALM to LOGMOD that automatically assigns increments to an airlift mission based the aircraft load plan. This will eliminate the tedious and error prone task of manually selecting cargo increments.

3. Develop the capability for the ITV information system to send automated alerts to notify leadership of pending problem areas within the ITV process.

4. Investigate the trade-offs in tracking cargo based on a "hierarchy of control numbers." If found to be more effective and efficient, modify the process to track cargo by aircraft, using "association" to track at a lower level.

Operational Process.

1. Conduct Air Force and Major Command-wide exercise specifically targeted on the ITV process. Establish the planning documents required for a deployment and execute only the information transactions of the "deployment." Include these

exercises as part of the annual exercise schedule and require all installations to participate.

2. Emphasize the importance of the data entry position within the Air Force ITV process by elevating the importance of the Unit Deployment Manager. This should be accomplished by additionally holding the unit commander responsible for ITV data quality.

3. If a "human error" prevents ITV, the person causing the error should be held accountable. If necessary, disciplinary actions should follow.

4. Enforce the statement made by Kross (1997) that no aircraft will take off until ITV is confirmed. Use the aircrew as a final check for ITV.

5. Maximize the use of Automated Information Technology in the ITV process. Investigate using aircraft identification as a means to attain ITV. An example would be adding a bar code on to the hatch of an aircraft cargo ramp. Upon arrival or prior to departure of an aircraft, ramp coordinators scan the aircraft. This process will automatically mark the aircraft at the location. If an association is established within the ITV system, scanning the aircraft will update the system to reflect the current location. Prior to offloading or onloading cargo, the ramp coordinators again scan the aircraft to indicate the activity. Both of these automated processes will aid in ITV.

6. Require use of established deployment reporting procedures to notify leadership of ITV status. For unit movements, require ITV status to be included in Battle Staff meetings and in the Situation Report.

7. Develop standard Air Force performance measurements for ITV success. Extend the "wheels up" measure to include visibility in GTN. Establish a maximum authorized time to verify ITV following take off. Report ITV success

as a part of the deployment reporting procedures. For en route cargo, use the aircraft trip plan timing as criteria for this measurement.

Policy and Guidance.

1. Identify, in AFI 10-403, an Air Force organization, or position, at each level of command as specifically being responsible for ITV. AF/ILG should be responsible for ITV at a strategic level. At the tactical level, for unit movements, each installation commander should be held accountable for his/her installation's ITV information. As an extension of the deployment process, the Installation Deployment Officer should be required to verify visibility of unit cargo information in GTN.

2. Establish specific Air Force guidelines for de-activating non-mission critical systems during deployment operations. Include these requirements in both AFI 10-403 and in the appropriate Air Force communications and information instructions (33-series).

3. Include a Major Command review as part of the Installation Deployment Plan approval process. The review will ensure each installation addresses specific minimum requirements, including ITV procedures. This review will also increase the standardization across the Air Force, while allowing for the flexibility required by each installation.

Summary

The purpose of this chapter was to answer the research question by answering each investigative question posed in Chapter 1. The benchmarking process was followed including case studies of leading civilian logistics companies. From review of Air Force literature, this chapter presented a map of the Air Force ITV process and noted potential sources of error within that process. Next, the chapter identified the leading civilian logistics companies, selected the benchmarking partners, and discussed the ITV processes of those companies. Using the results from the case studies, the chapter presented results from gap analysis between these processes and those in use by the Air Force. The chapter concluded with a list of recommendations for action that may lead to an improved ITV processes within the Air Force.

V. Conclusions

Chapter Overview

This chapter summarizes this research effort. It begins with a discussion on factors that limit this research then proposes future research efforts that may prove beneficial for the ITV process. The chapter concludes by summarizing the research.

Limitations

Chapter two presented previous research efforts into ITV. Although the research discussed is noteworthy, much of it focuses on the system design, little effort focused on categorizing ITV success factors. Interview questions were developed based on factors that appeared to have an impact on other business processes. Researcher bias, because of the researcher's experiences, could have narrowed the focus of the interview questions though this is not believed to be a serious flaw in the research design.

Two other possible limitations became apparent when analyzing the responses to the interview questions. The interviews focused on one representative of the firm and the responses relied upon the respondents' interpretation of the questions. Senior ranking information technologists were chosen as subject matter experts. Although the respondents possessed vast amounts of experience and knowledge of their companies operations, managers at the highest levels of the company may not necessarily have some of the intimate knowledge front line supervisors might possess. Further, front line supervisors might typically have a different perspective of the operations. Adding responses of front line supervisors to the data set could add valuable insight into performance at the tactical level of operations.

As a research strategy, the researcher used an open-ended format for the interview questions. Although this type of question solicits the widest range of responses, the general nature of the questions also allows more opportunity for misinterpretation of the questions. The researcher attempted to overcome this limitation by providing an avenue for clarification of the question. However, if the respondent responded without asking for clarification, the researcher did not provide it. This could serve to limit researcher influence on the subject.

Recommendations for Future Research

During this study, the researcher noted several opportunities for future research that apply to ITV, as follows.

A future research effort could advance this research by conducting a correlation case study focused on determining the factors most likely to result in an effective ITV process. This research could employ a Delphi method and a factor analysis to isolate the critical factors. The research result would postulate that specific factors are necessary for ITV success.

A statistical analysis could be conducted on management practices that have affected the implementation of ITV systems at the Air Force installation level. By reviewing historical error reports on ITV problems and by trial runs on ITV transmissions, the research would first identify units that are successful and unsuccessful at implementing ITV. Once determined, the research would survey all positions within the ITV process at each of these units to identify management practices. Surveying all installations within the Air Force would provide sufficient data to determine statistical patterns on management practices that have worked well versus those that have failed.

Training has been shown to be an important factor toward successful implementation of information systems, although little effort has targeted specific training techniques to implementation success. This effort would focus on determining the optimum training method for learning new information systems through correlating training techniques to previous implementation success. Currently, the Air Force does not have a standard training method for teaching new information systems. The civilian companies studied in this research use a wide range of formats, from computer-based training to hands-on workshops. This research would identify successful training programs by developing correlations between training methods and successful system implementations.

Joint Vision 2020 defines the future of logistics as Focused Logistics. Part of that concept requires streamlining and integrating logistics information systems, including ITV systems. AIT achieves this end by automating the error-prone data entry process. Standard Systems Group developed the capability to include AIT into the process, but this capability has not been fully exploited. This research seeks to provide Air Force leaders with an evaluation of current and past AIT efforts and provide a path to attaining Focused Logistics through maximum automation of the ITV process.

With the advancement of logistics information system applications, a future research effort could evaluate and compare commercially available software to determine if that software can achieve the capabilities required of the ITV process. Six of the seven benchmarking partners studied in this research indicated using proprietary systems for their ITV process. Most of these companies indicated the lack of availability of commercial solutions, at the time of their implementation, to meet their specific needs. The past decade witnessed the rapid development of logistics information systems, like G-Log, which include shipment visibility. During this same time, DOD acquisition strategy evolved from development of proprietary software to the use of commercial off-the-shelf (COTS) software, when available and appropriate. This research would provide a fully scoped evaluation of commercially available logistics software packages to determine their effectiveness toward achieving ITV.

Research Summary

In-transit Visibility (ITV) refers to the capability to track, in real-time, assets moving through the supply chain from origin to destination. For the Department of Defense, ITV supports Focused Logistics and adds the advantage situational awareness to the theater commander during deployment operations. The need for ITV in the DOD became apparent during the Gulf War when over 50% of the 40,000 containers shipped into theater had to be opened, inventoried, and resealed. This led to the implementation of the Defense In-transit Visibility Integration Plan in 1995. A decade after the Gulf War, the DoD continued to experience similar lack of visibility, as was highlighted during the initial deployment in support of Operation Enduring Freedom (OEF) in 2001. Headquarters USAF initiated studies from which the initial results pointed to a need to focus on business processes related ITV management. One such study identified the problems as firewall/local area network (35%), user error (30%), policy/guidance (8%), and server (27%). During the deployment, the Standard Systems Group was able to resolve most of the technical issues (firewall/local area network and server). However, the other 38 percent continued to cause alarm.

A review of literature on ITV research showed a gap in the study of management practices important to implementing critical business processes, such as ITV. Most of the literature point to ITV as the result of the transportation process. Viewing ITV in this manner limits the capability to improve the ITV process. The only true means to improve ITV is to identify the "information" transportation separate from the physical process. Once separated, re-engineering efforts could be applied to the information business process. Through the literature review, this research proposed an initial view of the ITV process as a cycle of identification, collection, transmission, consolidation, and distribution. Further, the review of literature demonstrated that previous research has focused on each stage in this process. Despite the in-depth analyses previously conducted on the ITV process, little effort focused on the overall management of the process.

The research question, "What can the Air Force learn from leaders in the logistics industry to improve upon current In-transit Visibility (ITV) business processes?" served as the foundation for the primary objective of this effort. That objective was to solicit ITV management "best practices" from leaders in the civilian logistics industry and to identify gaps between their practices and those of the Air Force.

This research employed a multiple case study design embedded in a functional benchmarking process to achieve the research objective. Incorporating Camp's original benchmarking design with Spendolini's five-step benchmarking process, this research followed a modified five-step benchmarking design. The background and literature review completed step one by determining the focus of the study to be ITV management practices. Step two required the identification of operational strengths and weaknesses of the Air Force ITV process. Answering investigative questions one and two accomplished this step. Potential sources of error in the Air Force process were identified from review of Air Force policies and guidance. Steps three and four required the identification of the leaders in the industry and the selection of the benchmarking partners. This research selected to study leading companies from four logistics industries--air, rail, trucking, and sea--and an integrated logistics service provider. The benchmarking partners included Burlington Northern Santa Fe, DHL Airways, Roadway Express, Stolt-Nielsen, Union Pacific, United Parcel Service, and Vector Supply Chain Management.

A case study design allowed for the collection of data from the benchmarking partners. The data collection method used electronic mail as a portal to conducting subject matter expert interviews. These interviews served as the basis for selecting management practices that appeared to have some impact on the critical business process. Two observational tours helped to corroborate and supplement the interview data. These site visits were conducted at Roadway Express and United Parcel Service. Using the data collected from the benchmarking partners, the research recognized 19 "best practices" and compared the civilian and military environments in 41 areas. This evaluation highlighted gaps between practices used in the civilian industry and those used by the Air Force. These gaps serve as areas of opportunity in which the Air Force can evaluate alternative management practices in an effort to improve the ITV process. Using these gaps as a foundation, the research proposed recommendations for action.

Fourteen recommendations for action were proposed as a result of this research, of which two were previously mentioned by Hall (2002). The convergence of these two recommendations emphasizes the importance of the action, especially since the two studies investigated separate aspects of ITV. Hall (2002) focused on the technical aspects of ITV, whereas this research investigated the management of ITV. The first recommendation is the roles and responsibilities of the installation should be extended to ensure ITV data is captured by GTN. The installation commander should ensure this action with the Installation Deployment Officer operationally responsible. Extending the role of the installation during a deployment should shift the installation's focus from "wheels up" to attain ITV. Second, the Air Force should conduct exercises specifically targeting the ITV process. These exercises should be written in an annual training plan and each installation should participate at least once annually.

The other twelve recommendations offer opportunities to improve the ITV process in system architecture, operational process, and policy and guidance.

System architecture.

Within system architecture, four areas were identified that could improve the ITV process, all of which focus automating the process. Beginning with the manual entry requirement, develop an interface with the Defense Logistics Information Service (DLIS) official supply database to reduce the requirement to enter National Stock Numbers. By interfacing with the official DLIS listing, data entry specialists would simply point and click the appropriate NSN. In turn, this will support item-level visibility in GTN. Second, develop an interface between CALM and LOGMOD that will automatically assign increments to an airlift mission based the aircraft load plan. Developing this interface could eliminate the tedious and error prone task of manually selecting cargo increments. In an effort to keep senior managers informed of the status of the ITV process, develop auto-generated alerts within the IDS systems that will send notifications of pending problems. Finally, investigate the trade-offs in tracking cargo based on a "hierarchy of control numbers." If found to be more effective and efficient, modify the process to track cargo by aircraft, using "association" to track at a lower level.

Operational Process.

The research noted six recommendations in the operational process that could lead to an improved ITV process. First, emphasize the importance of the ITV data entry position by elevating the importance of the Unit Deployment Manager. Further, hold this and any other appropriate position accountable for a failed ITV process. Depending upon the position that makes the mistake, it may also be appropriate to hold the unit commander responsible for the data quality. In considering positions that should be held accountable for ITV, enforce the statement made by General Kross (1997) that an aircraft should not take off until ITV data has been captured and transmitted to GTN. The aircrew could serve as a final check for ITV success.

Another step toward an automated process is to use aircraft identification to automatically transmit and update ITV information, using automated information technology. For example, adding a bar code to a convenient location on an aircraft would allow the scanning of aircraft upon arrival and departure from an airfield. Through association, the location of all cargo on board is updated.

The operational process of a deployment already has reporting procedures established to maintain an open line of communication at the installation and between levels of command. These lines of communication should be fully exploited to report status of ITV transmissions. At a minimum, ITV status should be included in Battle Staff meetings and in the Situation Report. Part of this reporting process could include a performance measurement based on established timelines. An operational performance measure already in use is the take-off time. Extend this measure to include visibility in GTN, which will be based on a maximum authorized time to verify ITV following take off. For en route cargo, the aircraft trip plan can be used as timing criteria for this measurement.

Policy and Guidance.

Beyond specifically identifying ITV responsibility, Air Force policy and guidance should be modified to include two other recommendations. The requirement in AFI 10-403 to de-activate non-mission critical systems should be expanded to provide guidelines for executing this procedure. These guidelines should also be included in the appropriate Air Force communications and information instructions (33-series). Adding these guidelines will standardize the procedure throughout the Air Force. Finally, the approval process for publishing an Installation Deployment Plan should be expanded to include a review by the corresponding Major Command. This effort should focus on ensuring each installation addresses specific minimum requirements, including ITV procedures.

Appendix A. Initial Contact to Gain Entry

A two-step process was used to gain entry into each civilian logistics company. First, contact was made with the Chief Information Officer or senior information technologist of each company via telephone or e-mail to introduce the research and request permission to send an e-mail more thoroughly describing the research. This telephone call was followed up with an e-mail to the same person detailing the research, including the problem, background, approach, and disclosure terms. As the interview served as the primary data source, the follow-up e-mail also included a request to answer questions contained in an interview guide. The interview guide was attached to the e-mail. The following text was included in the follow-up e-mail:

> PROBLEM: Before proceeding any further, I want to assure you that this research investigates a real requirement that plagues the U.S. Air Force even after a decade of development in in-transit visibility (ITV). The problem that we continue to encounter, which was highlighted in our deployment in support of the War on Terrorism, is choked supply chains due to lack of visibility. It is critical to Air Force operations and our continued support to the country that we solve this problem.
>
> BACKGROUND: In the mid-1990s, the Air Force implemented a system to upload data into the Global Transportation Network (GTN), the Department of Defense's ITV system. Despite the efforts to get the AF system operational, the Air Force still experiences problems. An Air Force study conducted earlier this year found over 50% of the problems experienced was related to business practices (user training, policy, etc). So, how do you handle the situation where the information systems work, but the overall process fails? That is the focus of this research.

APPROACH: Benchmarking business processes of the top civilian logistics companies will enable the Air Force to resolve these critical business issues. By answering the attached questions, this research should be able to formulate recommendations to Air Force leaders for implementation. The approach is to capture the processes of the best logistics companies in the four major transportation modes (air, truck, rail, and marine) as well as from Third Party Logistics providers. For your convenience, a written interview guide is attached that serves as a first step toward fulfilling this research. Please answer these questions at your convenience.

DISCLOSURE TERMS: Your company's participation in this research is voluntary. At any time, you may withdraw your participation from the research without any advanced notice. If you wish to work under the terms of a non-disclosure statement, that can be arranged. Unless otherwise stated in such an agreement, all information will be treated as for public release. Regardless of any lack of formal agreement, any proprietary information will be safeguarded as confidential information.

Appendix B. Interview Questions

<u>Grand Tour Question 1</u>: How does your organization view the use of information technology, specifically for tracking assets, as a competitive advantage?

a. How does your organization emphasize the tracking of assets through the logistics pipeline?

b. How do you organize "information technology" within your organizational structure?

c. How do information specialists and users integrate into the structure?

<u>Grand Tour Question 2</u>: What guidance has your organization provided to development, implementation, and use of your asset-tracking information systems?

a. What is your stated policy/guidance for users of asset-tracking systems?

b. How do you disseminate policy/guidance to users?

c. How do you ensure personnel follow stated policy/guidance?

d. How do you correct for misuse of the systems?

<u>Grand Tour Question 3</u>: How successful has your organization been at implementing your asset-tracking system?

a. How would you classify the success of your asset-tracking system?

b. What were some major obstacles your organization had to overcome in the implementation stage?

c. What key lessons has your organization learned as a result of implementing your asset-tracking system?

d. Are there any problem areas your organization has yet to resolve?

Grand Tour Question 4: What are the primary success factors that have allowed your organization to successfully implement "real-time" tracking of assets?

a. How do your senior managers remain knowledgeable about the operations of the asset-tracking systems?

b. How do you train users of your information systems?

c. How did you design your asset-tracking information system to ensure successful tracking of assets?

d. How do you provide assistance to users of the asset-tracking system?

Grand Tour Question 5: How do you maintain operability of the asset-tracking systems?

a. How do users and managers know that the systems are working correctly?

b. How do you measure performance of the tracking systems?

c. How do you correct for deficiencies between system performance and measurement standards?

d. How do you adjust your systems for surge operations?

Grand Tour Question 6: What is your asset-tracking process, beginning with identification of the item being shipped through delivery at destination?

a. To what level can you maintain visibility (e.g., vehicle, container, specific item)?

b. What are the primary technologies you use within your process (e.g., barcoding, radio-frequency identification, satellite tracking)?

c. Do you use commercial-off-the-shelf (COTS) software or develop proprietary software?

d. What factors led to your choice to use COTS or develop proprietary software?

e. If using COTS, what software package are you using and who is the developer?

Appendix C. Interview Response: Burlington-Northern Santa Fe

Title of person interviewed: Assistant Vice President, Technology Services

Grand Tour Question 1: How does your organization view the use of information technology, specifically for tracking assets, as a competitive advantage?

a. How does your organization emphasize the tracking of assets through the logistics pipeline?

BNSF views its asset tracking technology as the most "mission critical" aspect of the company's information technology portfolio. It is BNSF's highest priority and is implemented through our core business system, the Transportation Service Support (TSS) system.

b. How do you organize "information technology" within your organizational structure?

The Chief Information Officer heads Information Technology Services and is a direct report to the President and Chief Executive Officer. Technology Services is staffed with 1162 people.

c. How do information specialists and users integrate into the structure?

BNSF has a well-defined IT governance process that clearly identifies the roles and responsibilities of both the IT and business representatives. The team that governs this process is responsible for BNSF's annual IT planning process. BNSF has a Web Application team that is responsible for most of the customer interfacing applications within TSS, including iTrace. iTrace is the component of TSS which provides shipment visibility to customers.

Grand Tour Question 2: What guidance has your organization provided to development, implementation, and use of your asset-tracking information systems?

a. What is your stated policy/guidance for users of asset-tracking systems?

Users in the business are those responsible for provided service to our customers, and those responsible for tracking and reporting to key customers asset location / eta / etc.

b. How do you disseminate policy/guidance to users?

BNSF primarily manages this process through our IT Governance Process and through the business representatives.

c. How do you ensure personnel follow stated policy/guidance?

Compliance with company policies is managed within each responsible business area.

d. How do you correct for misuse of the systems?

BNSF uses a series of reports that highlight incorrect reporting to TSS. These reports are monitored and a root cause analysis is conducted to determine the "guilty parties." If required, additional training is conducted.

Grand Tour Question 3: How successful has your organization been at implementing your asset-tracking system?

a. How would you classify the success of your asset-tracking system?

BNSF is the premier provider of shipment location information to our customers as compared to all North American rail peers.

b. What were some major obstacles your organization had to overcome in the implementation stage?

The biggest obstacle was probably the cost and logistics of implementing such a critical system shortly after our merger in 1995.

c. What key lessons has your organization learned as a result of implementing your asset-tracking system?

You cannot train too much.

d. Are there any problem areas your organization has yet to resolve?

No.

<u>Grand Tour Question 4</u>: What are the primary success factors that has allowed your organization to successfully implement "real-time" tracking of assets?

a. How do your senior managers remain knowledgeable about the operations of the asset-tracking systems?

BNSF uses a daily "Morning Call" that reviews service interruptions and plan's for the upcoming day's events. This information is fed from the monitoring process.

b. How do you train users of your information systems?

During the original implementation of TSS BNSF had a joint team of IS and business representatives that rolled across the country with a formal training program for field staff. The focus of that effort was to train union workers in the field. BNSF still maintains that remote training capability, but it is not needed since BNSF is not hiring new field workers.

Data entry into TSS is 65% automated. Most of the manual entry is done by a field support team in Ft. Worth. They have supervisory group that conducts any training that is required.

If our customer's request training on our iTrace capability, BNSF's eBusiness implementation team conducts the necessary training.

c. How did you design your asset-tracking information system to ensure successful tracking of assets?

The design of TSS was accomplished with the use of a cross functional team of business and IT staff that were knowledgeable of both business and customer requirements.

d. How do you provide assistance to users of the asset-tracking system?

BNSF maintains a help desk team 24 x 7 to field calls from all users and answers their "how to questions."

Grand Tour Question 5: How do you maintain operability of the asset-tracking systems?

a. How do users and managers know that the systems are working correctly?

Through the daily monitoring process and through weekly status update meetings with IT and business representatives. We currently do not track any statistics regarding rate of entry or average error rate. Managing the data entry process is done on more of an ad hoc basis.

b. How do you measure performance of the tracking systems?

Through a series of standard reports that are reviewed daily by senior management and discussed in the "Morning Call."

c. How do you correct for deficiencies between system performance and measurement standards?

BNSF has a very regimented change control process. Primarily because of changing business process, BNSF might make up to 500 changes a week to our core information system, TSS. This may sound like a lot, but we have a 99+% system availability time. We accomplish this through a planned 40-minute outage each Sunday morning to make necessary changes, including a monthly database reorganization. By planning the outage at a low-peak time, the outage has minor impact on system operability.

d. How do you adjust your systems for surge operations?

TSS was designed for scalability. If needed, BNSF currently has an arrangement with IBM which provides for "capacity on demand" to accommodate for peak periods from a processing and storage standpoint.

<u>Grand Tour Question 6</u>: What is your asset-tracking process, beginning with identification of the item being shipped through delivery at destination?

a. To what level can you maintain visibility (e.g., vehicle, container, specific item)?

BNSF currently tracks shipments by rail vehicle (car, trailer, container) and associates shipments to those vehicles. We currently have the ability to track automotive vehicle shipments by vehicle identification number. In 2003, BNSF plans to add a similar ability to track individual packages contained in rail vehicles.

b. What are the primary technologies you use within your process (e.g., barcoding, radio-frequency identification, satellite tracking)?

BNSF uses satellite tracking for perishable shipment tracking. We are currently implementing a “poor man’s version” (e.g. land-based low bandwidth system) for tracking locomotives and the associated vehicles. Since our vehicles run on fixed track, we use trackside readers that pick up information from vehicle mounted transponders and use that information to update locations, status, etc.

Over 90% of BNSF shipments are originated by customers in an electronic fashion, via either traditional EDI or via our Web Interface. Once BNSF receives an order, the shipper sends us a "Bill of Lading." Upon receipt of the shipment, BNSF assigns a "trip plan." This trip plan is developed in TSS and visible to the customer. The automated monitoring process updates the status of the shipment. Data is entered into the TSS system through a combination of manual and automated means. Currently 65% is automated, using EDI, Trackside readers, etc.

c. Do you use commercial-off-the-shelf (COTS) software or develop proprietary software?

Proprietary software developed with the assistance from IBM and Anderson Consulting. We have since sold the rights to use this system to both the Canadian National Railway and a rail company in Germany.

d. What factors led to your choice to use COTS or develop proprietary software?

BNSF is not aware of any commercial system that would meet both the requirements of managing our rolling assets while providing the necessary information to our customers to assist them in managing their logistics network.

Appendix D. Interview Response: DHL Airways

Title of person interviewed: Chief Information Officer

Grand Tour Question 1: How does your organization view the use of information technology, specifically for tracking assets, as a competitive advantage?

a. How does your organization emphasize the tracking of assets through the logistics pipeline?

Shipment tracking is crucial to DHL processes. DHL operates an "implicit incident monitoring" model. Inherent to this model is what DHL calls a positive scanning policy. This means that, rather than inferring that shipments are moving acceptably through the supply chain without any confirmatory checkpoints, DHL infers that the absence of checkpoints is in itself is unacceptable, within a certain tolerance. Because of this inferred, preemptive set of logic, the quality and timeliness of data is crucial to success.

b. How do you organize "information technology" within your organizational structure?

DHL has ingrained "information technology" into the organizational structure to ensure proper emphasis on its success. The Chief Information Officer holds a seat at the highest "Senior Management" levels and reports directly to the President and Chief Executive Officer.

c. How do information specialists and users integrate into the organizational structure?

DHL created an information systems organization called "IS Program Management" to serve as an interface to the Business Process Areas (BPA). Each BPA is structured with subject matter experts and retains overall custodianship of the success of business initiatives in their areas, including the information systems they use. DHL employs a rigid methodology known as “the GIS process” together with documentation, project reporting, and inspection standards to ensure that all IS requirements are included in the projects. IS Program Management retains the budget for development, testing, documentation, and acceptance of all information systems. The user BPAs typically retain ownership of final acceptance and deployment.

Grand Tour Question 2: What guidance has your organization provided to development, implementation, and use of your asset-tracking information systems?

a. What is your stated policy/guidance for users of asset-tracking systems?

DHL uses rigid operational procedures to govern data quality and timeliness. These standards are cascaded down to DHL’s courier groups in 228 countries. DHL offers operational management incentives based on data quality results.

b. How do you disseminate policy/guidance to users?

DHL uses four primary means to disseminate general policy and guidance into the field:

1. Automation of business rules in information systems, where possible .
2. Field training on new releases
3. Operational workshops
4. Daily operational briefing sessions

c. How do you ensure personnel follow stated policy/guidance?

Through constant measuring of data quality standards, compliance with those standards becomes self-evident. DHL management reviews auto-generated data quality reports daily. Root cause analysis is conducted and key offenders are identified.

d. How do you correct for misuse of the systems?

If an information system design flaw permits minor errant data entry, then personnel are notified of the problem and the flaw will generally be resolved in a future update. Any severe design flaw is resolved immediately. Personnel issues not attributable to system design are addressed when discovered. Persistent offenders are subject to disciplinary action.

Grand Tour Question 3: How successful has your organization been at implementing your asset-tracking system?

a. How would you classify the success of your asset-tracking system?

DHL's tracking capability has been highly successful. DHL's system tracks over 166 million shipments through 228 countries and territories annually with each shipment generating up to 20 checkpoints. The checkpoint system captures events throughout all points of a shipment's physical flow. DHL's system operates 24 x 7.

b. What were some major obstacles your organization had to overcome in the implementation stage?

DHL implemented its shipment tracking system nearly 20 years ago, so this question is difficult to answer. Envisaged issues would likely be ensuring the central database is sized correctly to provide superior performance for populating the data as well as to support the necessary volumes of real-time queries.

c. What key lessons has your organization learned as a result of implementing your asset-tracking system?

The period of implementation makes this question is again difficult to answer.

d. Are there any problem areas your organization has yet to resolve?

The only issues DHL faces is the evolution of the tracking system to meet new requirements as the business evolves.

<u>Grand Tour Question 4</u>: What are the primary success factors that has allowed your organization to successfully implement "real-time" tracking of assets?

a. How do your senior managers remain knowledgeable about the operations of the asset-tracking systems?

DHL uses an on-line report query that provides high-level data quality reports, key offenders reports, and usage statistics reports. All of these reports are accessible by senior management.

b. How do you train users of your information systems?

DHL's primary training method is a "train-the-trainers" process. All materials on the information systems are presented in context of the specific business process area.

c. How did you design your asset-tracking information system to ensure successful tracking of assets?

DHL has world-class design and development methodology, currently working toward CMM Level-4 certification. The DHL approach ensures user requirements are clarified as early as possible, likely volumes, including potential growth, are well understood. Information systems are built in component-like fashion with high reuse of each logical component. Application architecture principals ensure solutions are designed to scale as volumes grow. Service and message-based design provides maximum opportunity to react to new requirements while not impacting existing user functionality.

d. How do you provide assistance to users of the asset-tracking system?

DHL systems use context sensitive and online help for daily use of the systems. DHL also uses classroom instruction and CD based training, along with a technical support helpdesk available 24 x 7.

<u>Grand Tour Question 5</u>: How do you maintain operability of the asset-tracking systems?

a. How do users and managers know that the systems are working correctly?

DHL uses a high degree of proactivity in the system design to allow for database and communications monitoring. This is, in turn, monitored 24 x 7 by a global "follow-the-sun" support team who are empowered to call any of the engineers cited to maintain the failed component. In addition to this monitoring and support capability, the tracking system has three global fail-over "sisters" in London, Kuala Lumpur, and Pheonix.

b. How do you measure performance of the tracking systems?

The systems are designed with special monitors which measure real user experience. They also have several other end-to-end monitoring tools placed in various global locations to simulate users at these points. Any failures detected in these simulations cause immediate alarms to be raised.

c. How do you correct for deficiencies between system performance and measurement standards?

If the system is not performing to standards, more than likely it will have already failed over to one of the "sisters." DHLs proactive monitoring, though, should already have detected critical issues such as hardware failure or communications outages and invoked remedial action.

d. How do you adjust your systems for surge operations?

Because of its global nature, DHLs tracking system was developed to support maximum global peaks. Hence, there is no real surge in the global operations. Since DHL cannot determine exactly how tracking will be used by global customers, DHL relies on the three "fail-over" systems for a failsafe and load balanced environment.

<u>Grand Tour Question 6</u>: What is your asset-tracking process, beginning with identification of the item being shipped through delivery at destination?

a. To what level can you maintain visibility (e.g., vehicle, container, specific item)?

DHL's system can track down to the shipment level, where ever it is and whatever is in it.

b. What are the primary technologies you use within your process?

Generally, DHL uses barcoding and mobile data processing from point of capture through a secure network. High value contract shipments may make use of RFID technology.

c. Do you use commercial-off-the-shelf (COTS) software or develop proprietary software?

DHL developed proprietary software

d. What factors led to your choice to use COTS or develop proprietary software?

Given that there is little commercial development in this particular area, DHL had to rely on the development of proprietary software for its tracking capability.

Appendix E. Interview Response: Roadway Express

Title of person interviewed: Chief Information Officer

Grand Tour Question 1: How does your organization view the use of information technology, specifically for tracking assets, as a competitive advantage?

a. How does your organization emphasize the tracking of assets through the logistics pipeline?

Roadway views the tracking of its key "rolling stock" transportation assets (tractors, trailers, straight trucks) and all freight carried thereon, as an absolute business necessity, a "mission critical" function. Competitive advantage can come, perhaps fleetingly, from establishing either a higher degree of accuracy or more timely, convenient or economical availability of tracking information, to customers. To accomplish this as efficiently as possible, of course, we use information technology. And we *have* been able to regularly devise ways to improve the accuracy, timeliness, convenience and economy of our asset tracking. Non-information-technology related competencies, though, such as employee "reverence for data" and compliance with standard operating procedures are also just as (if not more) critical to accurate asset tracking.

b. How do you organize "information technology" within your organizational structure?

Roadway is headquartered in Akron OH, in which a single, centralized Information Technology office serves the entire company. Roadway's Chief Information Officer heads this office and reports directly to the President & Chief Operating Officer.

Three departments play a critical role in ensuring Roadway's IT capability: Information Technology, Operations Planning & Engineering (OP&E), and Project Management.

Information Technology: The IT Department, consisting of approximately 140 full-time equivalent employees, is primarily organized by business function: groups of 15-25 applications developers each individually addressing the needs of the sales and marketing, human resources, field systems, pricing, customer- and shipment-related functions.

Operations Planning & Engineering (OP&E): Consists of about 50 employees who work closely with field operations to analyze existing operating procedures and find ways to reduce costs or cycle times, or improve the quality of our services. This often includes coordinating with the IT Department to bring new opportunities and technologies to the attention of the organization. They also champion the implementation of new technologies within operations.

Project Management: A central office of project management, reporting on a dotted line basis to the CIO, and directly to the VP of Human Resources, provides project management leadership and services to Roadway's other functions and departments. They provide the leadership necessary to bring on line new technologies.

c. How do information specialists and users integrate into the structure?

I/T and business system owners (such as the OP&E department), facilitated by our central office of project management, jointly prioritize and solve business problems, often involving implementation of new system functionality. The following processes are key: I/T Prioritization Process, Budgeting Process, Automated Programming request process, Matrix Organization.

Grand Tour Question 2: What guidance has your organization provided to development, implementation, and use of your asset-tracking information systems?

a. What is your stated policy/guidance for users of asset-tracking systems?

Roadway's asset tracking system is in one sense "in bits and pieces" scattered throughout (integrated within) a number of business processes and activities. There probably is no one single method or set of "user-documentation" which focuses on our "asset-tracking information system" because the system performs its asset-tracking functions by automatically assembling input from many different places and events types.

Roadway does have an over-arching information systems and information security policy, as well as a corporate code of conduct. Beyond that, we would not have stated "policy" or guidelines for use of our "asset-tracking system" per se. We do have extensive training materials focused on specific job tasks, scattered throughout training for many different jobs. Integrated within each, as appropriate, are the instructions as well as "policies" if appropriate, and guidelines, for use of the tools which do result in our shipments being tracked.

b. How do you disseminate policy/guidance to users?

Over the past several years, Roadway has moved away from a formal "Roadway Manual" in which were assembled, in a 1000+ onion-sheet paged loose-leaf binder, virtually all Roadway policies and guidelines, to a set of smaller, separate documents maintained online and controlled under ISO-9002 documentation standards in an always-current state. We refer internally to this online repository of documents as "Docunet."

c. How do you ensure personnel follow stated policy/guidance?

In general, Roadway's centrally developed and managed training and ISO-9002 certification help ensure consistent use of our computer systems and manual or computer-assisted procedures. More specifically, though, this varies by job function. Roadway conducts internal audits which seek to confirm that policies and guidelines, as well as information systems, are being properly used.

d. How do you correct for misuse of the systems?

A variety of answers are appropriate, ranging from seeking root causes to disciplinary action up to and including termination, depending on the nature of the system, the misuse, and its impact.

<u>Grand Tour Question 3</u>: How successful has your organization been at implementing your asset-tracking system?

a. How would you classify the success of your asset-tracking system?

Overall, very successful. We would point to our very survival (one of only four survivors from among the largest 50 LTL carriers existing in 1979, the year before industry deregulation) as one indication of that success. Clearly, Roadway has also been a widely recognized leader in our industry in producing such innovations as interactive-voice-reply (touch-tone telephone) tracking and web-based tracking within our industry. But the larger success has been our internal innovations such as going beyond merely tracking actual movements, to using each event-update as a trigger for re-calculating *projected* movement of equipment and freight, and then putting that information to use to better prepare for (plan) upcoming operations, reducing cycle times and costs.

b. What were some major obstacles your organization had to overcome in the implementation stage?

One major obstacle has been the accuracy, completeness and timeliness of data entry. One of the key strategies for overcoming this has been to tie other essential business processes into (make them dependent upon) the act of entering the data. For example, in order for our linehaul drivers to be paid, their "dispatch" and "arrival" information at Roadway locations must be entered. Drivers have such a vested interest in getting paid that they are very consistent in presenting themselves and their arrival information to the clerical or supervisory personnel that make those entries, and they "audit" those entries carefully.

Other challenges and obstacles included rolling out our mainframe computer access to all necessary field personnel at the time (c. 1986) we rolled out our "TEC" (Tracking of Equipment and Cargo) mainframe system. A later challenge included integrating that mainframe-based system with other, distributed systems, including our "Yard Control" application which controls the movement of tractors and trailers within the gates of our larger facilities.

As always with such systems, training was also another major challenge.

c. What key lessons has your organization learned as a result of implementing your asset-tracking system?

Proper system integration is one key. Taking the time up-front to ensure that all affected "other systems" are understood, and that inconsistencies or redundancies are not created. In general, careful planning in advance of building a system pays dividends in faster and less troublesome development and implementation.

Those closest to and most knowledgeable of the data must be responsible for the entry of and maintenance of that data. Roadway establishes formal, single-point "ownership" of all major categories of data in our systems, and hold the business owners accountable for the accuracy of "their" data.

Start with the business problem, not the technology; rather than finding ways to introduce "sexy" new technologies, we are always focused on finding the fastest, easiest, least expensive way possible to address a business problem. Sometimes a new technology fits the bill but often, its just a re-use or new twist of an old one.

And, after the technology is in place, *proper use* of the system is just as important as the technology itself. We pride ourselves in *recognizing the importance of human factors such as employee engagement, motivation and skills development* in the implementation of any new system or procedure (or even in maintaining existing systems and procedures at maximum effectiveness.)

d. Are there any problem areas your organization has yet to resolve?

One major hurdle facing us today is obtaining timely and accurate tracking events and other information from our external partners (airfreight carriers, connecting line or commission agent trucking partners, and overseas delivery agents.) We dedicate significant resources to these partnerships, and we also devote resources to establishing, maintaining and promoting industry-wide standards for inter-company communications (e.g. EDI standards and increasingly, XML standards) as a partial solution to this issue.

Grand Tour Question 4: What are the primary success factors that have allowed your organization to successfully implement "real-time" tracking of assets?

a. How do your senior managers remain knowledgeable about the operations of the asset-tracking systems?

Roadway's key to success thus far has been a combination of corporate focus on data reverence and a buy-in of the shipment tracking process. With these two factors set, senior managers ensure success of the systems.

A daily systems status report is issued each morning by voice-mail to all senior I/T managers including the CIO describing the status throughout the prior 24 hours of all major, business-critical systems. Serious problems are reported as soon as known and follow-up or progress reports are also reported on an as-needed basis, again by voice mail to all senior I/T managers including the CIO.

On the business side, a weekly officer staff meeting is held as an opportunity for updates or concerns to be discussed, on any subject including any systems performance issues. It should be noted that our asset tracking systems are almost never of note during either the I/T status voice mails or the officer staff meeting. If there were a serious problem there would be communication to all affected as soon as the problem is recognized, by "blast voice mail," fax or email.

b. How do you train users of your information systems?

Roadway employees are trained on information systems as a part of the larger training in their particular job function. Those jobs involving frequent or constant use of our systems will have a computer-based training (CBT) course provided, but in most cases the appropriate aspects of systems useage would be integrated into training manuals and hands-on demonstrations.

Roadway uses a training development function within the Organizational Development / Human Resources Planning (OD/HRP) Department which develops training programs and materials for those positions or functions deemed most critical to company success. We also have a small (2-3 person) group of training specialists within our I/T outsourcer's organization whose sole function is providing I/T training, including user-training in basic system useage and common business software.

Specifically for the shipment tracking system, Roadway's employees would not be well served by being trained simply in the "system," because no one employee's job would involve every type of event or activity of interest. Roadway trains its employees to perform tasks required for proper asset tracking within their own job or area of responsibility, along with their other (non-asset-tracking-related) tasks.

c. How did you design your asset-tracking information system to ensure successful tracking of assets?

Roadway designed a high degree of automation and integration with other necessary business functions to ensure a successful tracking system. Five primary factors that led to this success are: fully integrated operational databases; assignment of the expected path of a shipment (schedules/lanes); automatic updates of critical shipment status events, such as arrivals and dispatches; installation of Data Collection Terminals (DCT) at the trailer doors of our cross-docking facilities; and installation of a highly efficient database management system (M204).

Fully integrated operational databases: Roadway uses the same computer system throughout all 350 North American facilities. The online transaction processing (OLTP) systems for shipment tracking are tightly integrated with all of our other information systems -- not a 'silo' system.

Assignment of the expected path of a shipment: Each shipment through the Roadway network is assigned a "default" shipment schedule at the time the shipment information is entered into the system. The shipment schedule contains information as to which "nodes" (terminals, relays, marshalling yards and railheads) in the network the shipment will pass through. Shipments are assigned due dates at each node. The due date is used to measure performance for both physical and information movement.

Automatic updates of critical shipment status events: The tracking of shipments within our transportation management system is for the most part inherent within the system: performed automatically, triggered by events, which are recorded in various ways, and for multiple purposes, besides "just" for tracking. System events such as dispatching a trailer and "arriving" a trailer update the status of every shipment on-board that trailer, within the information system.

Installation of Data Collection Terminals (DCT): Roadway installed barcode readers called DCTs at each trailer door of our facilities. Shipment loading and unloading events are automatically updated in the tracking system when captured via a DCT.

Installation of a highly efficient database management system: Roadway installed a Computer Corporation of America's "Model 204" database system designed to support high volumes of updates and query transactions.

d. How do you provide assistance to users of the asset-tracking system?

The system is designed to provide on-line support in the form of a variety of tools to query, report, and measure tracking events. Customers have access to tracking information via phone, web, email, and EDI. Roadway also has a 24x7 help desk available to all users of our system.

Grand Tour Question 5: How do you maintain operability of the asset-tracking systems?

a. How do users and managers know that the systems are working correctly?

From an I/T perspective, management is notified of any system problems or outages, anywhere in the network, within minutes of a report being called into the Help Desk, or of console operators being advised by automated processes of a problem.

From a users perspective, years of use, during which problems were identified due to internal or external customer impact or complaint, have honed the operation of the system to where outright "errors" are rare. Scrutiny is high, since external customers "see" (via our websites) the tracking data, and it may impact their own business.

The only issue which still arises occasionally is system availability meaning the computing system is either available or not. Whenever planned outages are scheduled we try to advise all affected users well in advance; even with 'unplanned' outages, if it is possible to provide even some users some notice, we will. We minimized this, though, through designing a network infrastructure with failsafes, backups, recovery procedures and contingency plans in case of failure. We have either redundancies or backups, or both, as well as manual procedures as fall-backs in case systems still fail, for all mission-critical systems.

b. How do you measure performance of the tracking systems?

Years of use have honed the system to the point where, “if it's running, it's correct.” The business users, monitor no specific measures of the “tracking system's” performance. From an IT perspective, performance is primarily based on throughput of the system. Roadway has established response time goals/measures for key business transactions. Accuracy (established by random audit) or percentage uptime are other examples of metrics used, on various systems or subsystems.

c. How do you correct for deficiencies between system performance and measurement standards?

Again, the tracking system is so "mature" that we have few if any examples of "deficiencies" other than occasional overall system downtime or sluggishness, in which case the I/T reporting and remedy systems “kick in.” In general, when we implement any new information system, we establish during project definition and justification (up front) the objectives and metrics that will be monitored. In most cases these are metrics that must be met in order for the project's forecasted ROI to be achieved. If, during the course of system implementation, the metrics are *not* being met, then the project manager and team is responsible to perform "root cause analysis" and to propose and implement whatever corrective action is deemed most cost-effective.

Upon successful implementation of a project, the project will be formally closed. However, a part of closing each project is to establish any ongoing processes necessary to maintain the changes implemented, finding appropriate permanent "ownership" for those processes. That could include establishing a measuring and monitoring system in which actual performance and measurement standards would be compared, with the "owner" responsible for taking corrective action as needed.

d. How do you adjust your systems for surge operations?

Our primary enterprise database environment has been able to handle increased transaction volumes in the most recent cases of business "surges," the 1997 UPS strike and the bankruptcy and closure in September 2002 of competitor Consolidated Freightways (CF). We continually tune the system applications and monitor system utilization and capacity. We also poll all knowledgeable parties for inputs into quarterly and annual updates of forecasts of systems capacity requirements. We have as-yet-unexercised options to de-prioritize non-mission-critical systems in order to provide additional "surge" capacity if needed. Our vendors would also be expected to provide quick access to additional hardware capacity in a time of great need; strong relationships and mutually beneficial business ties give some assurance, as does past experience, that this would be effective.

<u>Grand Tour Question 6</u>: What is your asset-tracking process, beginning with identification of the item being shipped through delivery at destination?

a. To what level can you maintain visibility (e.g., vehicle, container, specific item)?

Roadway maintains "automated" visibility (regularly updated timestamp, location, and status) within the transportation management system down to, but not below, the "shipment" level. Roadway defines a "shipment" as a unit of freight picked up at a single shipper's location during a single stop, all of which is destined to a single receiver. Each shipment is comprised of one or many handling units (cartons, skids, etc.); the handling units themselves are *not* separately tracked.

While there is no explicit tracking of individual handling units, there are several associations maintained in our systems between a shipment and these more detailed components of a shipment. For one, we maintain the *count* of handling units that should be traveling together as the shipment. Any changes to this count, for example each time the shipment is unloaded or again loaded, are also recorded in our system, along with date, time and employee identification. Secondly, we have "line item detail," transcribed from the original bill of lading into our system and associated with each shipment. The line item detail often describes the contents of the shipment at the handling unit and/or lower level (e.g. item within carton).

In instances where a shipment becomes separated into two or more "waygroups" within our freight system, we have procedures which, whenever possible, identify the “original” shipment and its separated handling units as being “related.” In these cases, we assign a new unique identifying number to the “offspring” waygroups, while maintaining an association of each with the original shipment. These “offspring” or “related” waygroups are then tracked as any other “shipment” would be.

b. What are the primary technologies you use within your process (e.g., barcoding, radio-frequency identification, satellite tracking)?

Roadway uses GPS on a limited subset of our fleets (about 10% of our 3000+ linehaul tractors and about 40% of our 6000+ pickup-and-delivery tractors). With regard to shipment tracking, Roadway uses barcoding as its primary automated data collection method. They presently make no use of radio-frequency identification, although they are considering it for future use.

c. Do you use commercial-off-the-shelf (COTS) software or develop proprietary software?

The vast majority of the software we use is proprietary, developed by our own applications development (programming) staff. The shipment tracking system is one of those and, like most, has evolved over the course of many years.

d. What factors led to your choice to use COTS or develop proprietary software?

The primary factor that led to Roadway's choice is that they feel they can, and have demonstrably, develop and maintain their own software better, faster and cheaper than anyone else. Better means with functionality that provides more business benefits. Faster and cheaper is of course with reference to a given functionality.

A more fashionable way of expressing this would be to say that we consider developing LTL transportation management software to be a "core competency" and its functionality to be strategically important to our mission, and therefore not something that we would entrust to an outside, third party.

Appendix F. Interview Response: Stolt-Nielsen

Title of person interviewed: Chief Information Officer

Because of Stolt-Nielsen's low reliance on automated tracking of shipments, most questions in the interview guide are not applicable. Thus, the following summary of how Stolt-Nielsen operates is provided.

The automated tracking of shipments is not a high priority to our customers, so we do not emphasize this as a business strategy. Two primary factors drive our low reliance on automated cargo tracking: the customers intimate knowledge of the voyage and the non-rigidity of our operating schedule. Because of these factors, much of the cargo tracking is conducted over the telephone. Remember, within our deepsea fleet, we operate only about 500 voyages per year and this is divided among several tradelanes.

We do have a new automated, web-based tracking system called Stolt Track and Trace, which is based on technology from our sister company Optimum Logistics. Cargo booking still must be done over the phone and all management of the cargo (berth nominations, quantity changes, Notice of Arrival, Bill of Lading, etc.) is still conducted over the phone, fax, or email. Our system only provides cargo by customer (i.e. all cargoes for a single customer). It contains the following information, which is updated nightly or every two hours in our new system:

Cargo (product name as provided by the customer)
Volume (estimated or actual depending on if the bill of lading has been produced)
Ship
Voyage number

Origin port/berth
Destination port/berth
Estimated or actual arrival at the origination port
Estimated or actual arrival at the destination port

Having only the time arriving at port is a bit controversial with our customers. Because of the nature of our trade, our time in port can be several days and we might visit multiple berths. Thus, while we arrive in port on a Tuesday, we may not load or discharge the cargo until Saturday. We still must satisfy the laydays, but we reserve flexibility to change the berth rotation to make the call as efficient as possible. Thus, the customer does not know exactly when we will arrive until we submit a Notice of Readiness (NOR).

A NOR is an official document that states we are ready to dock at a particular berth and load or discharge cargo. We do work with the customer and terminal unofficially to keep them informed of when we are likely to arrive at a berth, but none of this information is in Cargo Tracking.

Beyond Cargo Tracking, we have a few points where we provide contractual alerts to customers typically via email or fax. Usually one week before arrival at a port we send the customer a final ETA that provides the estimated time of arrival at either the origination or destination port as appropriate. After port departure, we send a port time advisory with the Statement of Facts regarding critical port times for each cargo. This information is the basis for demurrage calculations.

Cargo Tracking does not provide specific location information for a cargo or a ship. It only provides the latest estimates for the port arrivals specific to a cargo. This means, for example, that a customer with a cargo that is scheduled for loading in Houston and discharging in Singapore will not know when or even that we are stopping at Kobe, Ulsan and Shenzen along the way.

Usage of track and trace is very low. Most customers prefer to rely on the ETA's we send out or call the broker to get more specific information. No more than a handful of customers use the system with any level of reliability. In discussing this fact with customers, we believe that a few additional customers would use the system if we had berth level information, but even with detailed berth level information, most of our customers would not use the system.

Appendix G. Interview Response: Union Pacific

Title of person interviewed: Assistant Vice President, E-Business

The slides and pictures contained in this interview questionnaire were provided by the interviewee via e-mail to serve as examples for his answers.

Grand Tour Question 1: How does your organization view the use of information technology, specifically for tracking assets, as a competitive advantage?

a. How does your organization emphasize the tracking of assets through the logistics pipeline?

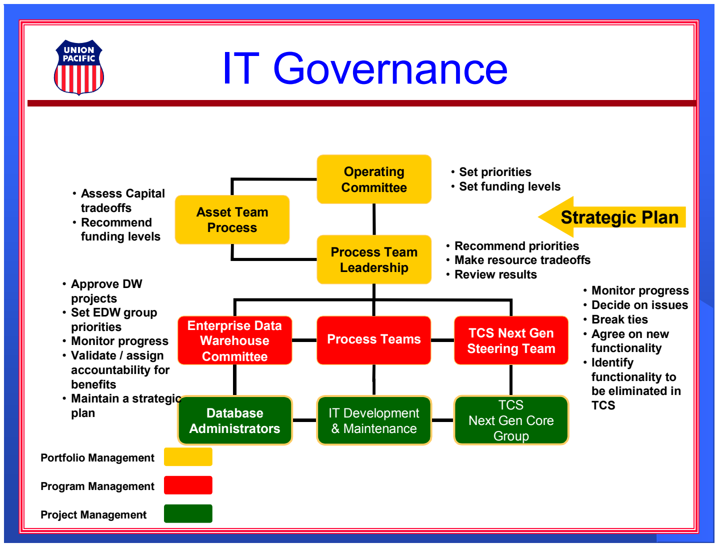
It is critical to business operations. Providing a customer with this capability can mean the difference between getting business or not; it supports our customer's Just-in-Time processes. On a more general note, technology is an investment in the future growth of our company. Technology helps cut costs by allowing us to do business more efficient, which in turn builds our core business.

b. How do you organize "information technology" within your organizational structure?

The Chief Information Officer heads Information Technology Organization and is a direct report to the President and Chief Executive Officer. IT is staffed with over 1000 people.

c. How do information specialists and users integrate into the structure?

The following slide depicts Union Pacific's governance of information technology. They use a team approach to integrate information technology along with business decision makers.



<u>Grand Tour Question 2</u>: What guidance has your organization provided to development, implementation, and use of your asset-tracking information systems?

a. What is your stated policy/guidance for users of asset-tracking systems?

As stated previously, we view all technology as the growth of our company. We ensure our employees recognize the importance of all of our technology, not just the tracking and tracing function.

b. How do you disseminate policy/guidance to users?

Primarily, through our core business rules.

c. How do you ensure personnel follow stated policy/guidance?

Pro-active management coupled with quality, hard-working employees.

d. How do you correct for misuse of the systems?

Again, through pro-active management, which could involve training or any number of disciplinary actions, if needed.

Grand Tour Question 3: How successful has your organization been at implementing your asset-tracking system?

a. How would you classify the success of your asset-tracking system?

Very successful. In the last several years, we have emphasized technology growth as the key to our future. Many years ago, we created the industry's first car-scheduling system. Most recently, we stood up a third-party logistics company, Insight Logistics, to oversee our DaimlerChrysler vehicle shipping operations. Their sole job is the management of shipments through the supply chain.

b. What were some major obstacles your organization had to overcome in the implementation stage?

Developing integrated systems to communicate with all companies involved in a rail shipment. Movements by rail typically involve multiple transportation modes and may even be loaded on rail cars of several rail companies.

c. What key lessons has your organization learned as a result of implementing your asset-tracking system?

1. The relationship with the customer is key to maintaining a high quality operating system (data quality, timeliness, etc). A poor relationship will lead to poor quality. Technology costs money, so a company that wants to get by simply on low cost does not support technological growth.

2. People matter. Pro-active, hard workers that understand the customer and the purpose of the technology support the change to technology.

d. Are there any problem areas your organization has yet to resolve?

Continuing to develop the technology to communicate with each other using common standards. Also, data quality, accuracy, and timeliness continue to be problems.

Grand Tour Question 4: What are the primary success factors that has allowed your organization to successfully implement "real-time" tracking of assets?

a. How do your senior managers remain knowledgeable about the operations of the asset-tracking systems?

We have a team on call to respond to any problem with the system. Our Transportation Control System has built in alerts to automatically page a manager of a pending problem, either technology or delivery driven.

b. How do you train users of your information systems?

Through a structured training program that ensures the employee understand the purpose of the system and its benefit to UP and our customers. The training uses real data input with up to a month or more of on-the-job mentoring.

c. How did you design your asset-tracking information system to ensure successful tracking of assets?

By integrating it as a decision-making system within our Transportation Control System. Our system allows customers to request expediting their shipments and using the system, we can provide an answer back within 4 hours.

We also hold the IT shop jointly accountable for the failure of any process that relates to an information system, primarily on-time-delivery.

d. How do you provide assistance to users of the asset-tracking system?

Any user, any question, any data, any time

Grand Tour Question 5: How do you maintain operability of the asset-tracking systems?

a. How do users and managers know that the systems are working correctly?

b. How do you measure performance of the tracking systems?

By tying the performance to our business measures: on-time-delivery, number of items in the supply chain. We also use system use, number of transactions per user, and response time to inquiries.

c. How do you correct for deficiencies between system performance and measurement standards?

d. How do you adjust your systems for surge operations?

Using operational simulation to identify trouble locations and develop plans for supporting these trouble spots.

Grand Tour Question 6: What is your asset-tracking process, beginning with identification of the item being shipped through delivery at destination?

a. To what level can you maintain visibility (e.g., vehicle, container, specific item)?

Through association with the rail cars, we can provide visibility down to the shipment item level. This depends on the information provided to us by our customers. For example, our track and trace system can show status reports by Rail Car, Purchase Order Number, or Stock Keeping Unit (SKU).

b. What are the primary technologies you use within your process (e.g., barcoding, radio-frequency identification, satellite tracking)?

The primary interface with our customers is through direct data feed through electronic data interchange or XML, or through our web-based, Transportation Control System software. We also provide customers with an Interactive Voice Response system. Our data entry is primarily automated, with 94-97 per cent business-to-business or via XML.

To track our rail cars, which provides for real time tracking down to the shipment item level, we use Global Positioning Systems and Automated Equipment Identification (AEI) technology. Trackside AEI transponders read rail car identifications and automatically transmit the data into our TCS. We also use hand held technology and wireless onboard reporting systems to help with the data accuracy and timeliness of current rail car locations. Both of these technologies are shown in the following pictures.

c. Do you use commercial-off-the-shelf (COTS) software or develop proprietary software?

Proprietary software. We developed our Transportation Control System in the 1980s as the first rail car scheduling system. We've evolved the system with a web-based interface. TCS provides our customer with a complete door-to-door trip plan by which we measure our performance. The Track and Trace function of the TCS is the minimum function for our customers. It provides the current location of the shipment, the history of where it has been, an ETA to the current destination, and the ability to see how it will move in order to reach that destination. The following picture demonstrates some of the capabilities of the TCS.

d. What factors led to your choice to use COTS or develop proprietary software?

Lack of availability of the software necessary to meet our business objectives.

Appendix H. Interview Response: United Parcel Service

Title of person interviewed: Senior Technology Manager

Grand Tour Question 1: How does your organization view the use of information technology, specifically for tracking assets, as a competitive advantage?

Tracking assets is a core part of UPS's business. Consequently, how well we can track assets (in this case packages for shipment) is a key competitive advantage. Information technology (IT) is fundamental to our business. At UPS, technology is so closely interwoven with the business that it powers every service the company offers and every operation it performs. UPS has exhibited extraordinary commitment to IT, investing more than $16 billion since 1985 on an integrated global network that is unmatched in the industry. Examples of this investment:

IT connects millions of buyers and sellers worldwide through a massive, award-winning telecommunications network.

IT streamlines business processes for UPS and its customers by electronically collecting package information on more than 90 percent of all packages that move through the UPS system.

IT provides the backbone for a ubiquitous Internet presence that extends to more than 60,000 customer Web sites that integrate UPS tools.

IT generates and immediately answers 7.2 million tracking requests daily.

IT allows UPS to extend its business into every facet of supply chain management, and to flexibly and rapidly address changing business needs as new opportunities arise.

IT consists of the world's largest DB2 database (18.41 terabytes) and one of the world's largest Oracle databases (7,618 terabytes), providing a solid foundation for data management.

a. How does your organization emphasize the tracking of assets through the logistics pipeline?

Tracking assets in the logistics pipeline is fundamental to UPS's business. Tracking electronically facilitates the process – as evidenced by UPS's ability to track electronically 90 percent of the packages that move through the UPS system. Because tracking IS our business – we don't have to "emphasize" it. It's an essential part of the service we provide to customers; therefore, the company is driven to provide world-class tracking capabilities.

b. How do you organize "information technology" within your organizational structure?

The UPS IT organization consists of 5,000 people. The CIO of UPS sits on the management committee of the company. Management relied on four core processes to align IT projects with strategic business objectives to eliminate duplicative efforts and support cross-functionality:

Customer Information Management (CIM) – systems that interfaced directly with the customer (e.g., tracking/shipping systems, Web-based systems, EDI)

Package Management – pickup, delivery, sort and transport of packages (i.e., core operations)

Product Management – identification, design, development and marketing of new cross-functional services

Customer Relationship Management (CRM) – systems supporting internal units for servicing customers and supporting the sales of new services (e.g., sales force automation, call centers)

A cross-functional team manages each of the core processes while a senior executive heads them, and an IT owner helps prioritize needs and resource requirements across functions.

Projects are prioritized based on the strength of their business cases and financial metrics (e.g., return on investment, net present value), but non-financial metrics are also considered so that non-core projects can be given adequate resources. For example, the CRM process team emphasized the importance of international projects by giving them higher priority, even if domestic projects were more financially attractive. Why? International business was (and is) of strategic importance to the company's growth.

c. How do information specialists and users integrate into the structure?

On virtually all IT projects – from e-procurement to tracking systems – there are users assigned to the team who work closely with IT specialists to ensure that the project development and implementation stays aligned with user requirements, as well as the business initiative behind the project. This alignment between IT and users is occurring at every level of the company. For example, the Information and Technology Strategy Committee (ITSC) is composed of 15 senior managers from all functional areas within the company. ITSC is chartered with studying the impacts and application of new technologies and setting near-term technology direction.

Grand Tour Question 2: What guidance has your organization provided to development, implementation, and use of your asset-tracking information systems?

Because asset-tracking is core to our business, UPS has developed proprietary systems over many years to provide this functionality. This technology is an integral part of an employee's day-to-day job functions. Consequently, corporate policies have been developed to provide guidance on the use and protection of the company's physical and intellectual property.

a. What is your stated policy/guidance for users of asset-tracking systems?

Following is the corporate policy on technology (page 42 of our corporate policy book) in general. It applies to asset-tracking systems and any other technology in use at UPS:

We Support the Use and Protection of Technology

We evaluate emerging technologies to identify areas that may have application in improving and enhancing our competitive position.

We acquire or develop technologies that provide our customers with improved service at competitive rates and support our organization with more cost-effective systems and processes.

We recognize the value of information and treat it as a confidential asset that must be protected from unauthorized access or loss. When we develop our own technology, we aggressively protect our investment through patents, copyrights, or confidential treatment of trade secret information.

We do not duplicate any copyrighted work without the permission of the copyright owner, nor de we disclose any information shared with us confidentially.

b. How do you disseminate policy/guidance to users?

In writing via corporate policy book and verbally by managers and supervisors.

c. How do you ensure personnel follow stated policy/guidance?

Primarily through day-to-day management oversight. Of course, UPS also uses technology to monitor use and access of its systems by employees, vendors, consultants, hackers, etc. Misuse or unauthorized use of technology can result in termination of employment. UPS went public in 1999, but is still majority owned by employees. It’s counter to the employee’s best interest to misuse company property or intellectual capital..

d. How do you correct for misuse of the systems?

Multi-level technical security measures are in place and when/if a “hole” is uncovered – additional measures are taken to correct it. Employees misusing systems are reprimanded accordingly, with the most severe reprimand being termination.

Grand Tour Question 3: How successful has your organization been at implementing your asset-tracking system?

a. How would you classify the success of your asset-tracking system?

UPS believes it has the best system in the world. UPS customers worldwide who generated $30.6 billion in revenue in 2001 are the best testimonial to the success of the company's tracking system. We service every address in the United States and provide service in more than 200 countries and territories. We ship and track 13.6 million packages/documents every day. We manage 6.6 million daily on-line tracking requests via our web site, which takes 66.4 million hits per day. We service 7.9 million customers daily – 1.8 million pick-up and 6.1 million deliveries. We track each and every one of those packages through a sophisticated, global network.

b. What were some major obstacles your organization had to overcome in the implementation stage?

The UPS tracking system has evolved since the company's inception in 1907. A multitude of obstacles have been faced and overcome over the years. Automation has been evolutionary at UPS – given the longevity of the company. Given the long history of the company, this question is difficult to answer without looking at a specific time period.

c. What key lessons has your organization learned as a result of implementing your asset-tracking system?

Again, given the long history of the company, a vast number of lessons have been learned! Key to the success of any tracking system is the data base architecture. The world's largest DB2 database and one of the world's largest Oracle databases form the foundation of the UPS tracking system. Because of the scope and scale of the databases, UPS had to work closely with the vendors (IBM and Oracle) many years ago to ensure that the database software could handle the complexity of UPS's requirements. In addition, UPS has been a pioneer in meta data repositories – starting its repository more than a decade ago.

UPS has also pioneered the use of wireless field hardware -- the DIAD (Delivery Information Access Device) -- which forms the basis of our tracking system. This hardware typically needs to be refreshed every five years.

Redundancy of data is, obviously, key to any tracking system. UPS has two major data centers – one in Mahwah, NJ and one in Atlanta, GA. Both data centers are world-class facilities. All core, mission critical systems are fully redundant.

d. Are there any problem areas your organization has yet to resolve?

There are no significant problem areas we've yet to resolve. Continuous improvement, however, is certainly desired. The "major" issue at this point is maintaining a global network and keeping it secure, running smoothly and in a position to grow as customers needs dictate.

<u>Grand Tour Question 4</u>: What are the primary success factors that have allowed your organization to successfully implement "real-time" tracking of assets?

UPS has been successful developing and deploying its global tracking system for a number of reasons. Specifically, the company has implemented structure and processes that closely tie technology investment to business initiatives. Through the corporate structure and processes, the functional areas of the business (e.g., operations, customer service, product/service development, etc.) are closely aligned with the IT function. This has ensured that the development of the tracking system has stayed closely aligned with the needs of customers and the business over time. This has also ensured that the tracking system always has been an inherent part of the business.

a. How do your senior managers remain knowledgeable about the operations of the asset-tracking systems?

Senior management is apprised of all technology initiatives on a regular basis. Again, technology is such an inherent part of how UPS conducts business – it is a topic of daily conversation at the company.

b. How do you train users of your information systems?

UPS uses a variety of training methodologies – everything from video, CBT to classroom instruction.

c. How did you design your asset-tracking information system to ensure successful tracking of assets?

Without dealving into proprietary information, database architecture is key and scanning barcode data at key points in the tracking network is key. Finally, keeping a global network up and running to transmit the data is, obviously, critical to successful tracking. A plethora of technologies are at play to make UPS's global tracking system the world-class system that it is.

d. How do you provide assistance to users of the asset-tracking system?

UPS has a technical support group dedicated to assisting users of the tracking system as well as all computer systems at UPS. The technical support group is part of the IT organization.

Grand Tour Question 5: How do you maintain operability of the asset-tracking systems?

a. How do users and managers know that the systems are working correctly?

If the systems are not working correctly, users and managers know it immediately – because they use it day-to-day in their jobs. The UPS IT organization monitors the system 24x7x365 through network management systems, monitoring devices, etc.

Managers and users who do not use a tracking system in their daily jobs, but need to know how the system is functioning (to interface with customers, etc.) are notified of problems via internal e-mail communications.

b. How do you measure performance of the tracking systems?

Measuring performance of the Internet portion of the tracking system is done primarily by tracking requests.

c. How do you correct for deficiencies between system performance and measurement standards?

Depends on the deficiency and its root cause. Is it a hardware failure that results in replacement or a software glitch that requires a bug fix?

d. How do you adjust your systems for surge operations?

UPS can count on a surge in operations at least once per year during the holiday season. For example, UPS can count on shipping 300 million packages between Thanksgiving and Christmas. This tremendous surge in operations is planned for months in advance. Loading of systems is reviewed and plans are outlined to accommodate anticipated increases. The plans could involve anything from purchasing new hardware to increase capacity to reconfiguring existing systems to optimize capacity.

The plan also typically involves increase in temporary workforce and aircraft available to accommodate express shipments.

Grand Tour Question 6: What is your asset-tracking process, beginning with identification of the item being shipped through delivery at destination?

a. To what level can you maintain visibility (e.g., vehicle, container, specific item)?

UPS maintains end-to-end visibility to the specific item.

b. What are the primary technologies you use within your process (e.g., barcoding, radio-frequency identification, satellite tracking)?

UPS employs a variety of technologies through its system, including barcoding, radio frequency ID, Bluetooth, 802.11B, acoustical radio, optical data transmission, etc. From a wide-area network perspective, UPS uses a variety of voice and data terrestrial services, as well as analog and digital wireless services. GPRS has been deployed in Europe and GPRS and CDMA is being tested in the U.S.

c. Do you use commercial-off-the-shelf (COTS) software or develop proprietary software?

Proprietary.

d. What factors led to your choice to use COTS or develop proprietary software?

UPS was a pioneer in the development of tracking systems. The tracking system represents competitive advantage; therefore, the company has its own proprietary system. In addition, no vendor provides a COTS system with the scope and scale required by UPS.

Appendix I. Interview Response: Vector Supply Chain Management

Title of person interviewed: Chief Information Officer

Grand Tour Question 1: How does your organization view the use of information technology, specifically for tracking assets, as a competitive advantage?

a. How does your organization emphasize the tracking of assets through the logistics pipeline?

While tracking is important, the information trail it leaves provides the basis for continuous improvement of our Supply Chain processes by identifying the nature of the problem and where the problem exists.

b. How do you organize "information technology" within your organizational structure?

We market our company as a "people, process, technology" company so information technology is an integral part of our business offering. Internally, Vector has 120 personnel in the IT department which is headed by the Chief Information Officer. The CIO reports directly to the Chief Executive Officer.

c. How do information specialists and users integrate into the structure?

Vector uses a comprehensive System Development Life Cycle (SDLC) along with an associated Project Management process that clearly delineates roles and responsibilities. A Business Process Leader heads up this process.

Grand Tour Question 2: What guidance has your organization provided to development, implementation, and use of your asset-tracking information systems?

a. What is your stated policy/guidance for users of asset-tracking systems?

Our tracking process is our business process therefore we give it the highest levels of development, testing, training, continuous improvement (lessons learned) with all of the staff.

b. How do you disseminate policy/guidance to users?

It is inherent in the SDLC process.

c. How do you ensure personnel follow stated policy/guidance?

By analyzing the supply chain, we can determine, through root cause analysis, if the problem is system related or user error. Also, setting the timing criteria provides a means to measure performance.

d. How do you correct for misuse of the systems?

Focus on the weaknesses within the process. Elevate the importance of the information trail by making our vendor’s payment based on the information that is provided; if there are lapses, then there are penalties.

Grand Tour Question 3: How successful has your organization been at implementing your asset-tracking system?

a. How would you classify the success of your asset-tracking system?

We implemented the "people, process, and technology" for the tracking of the North American GM Vehicle delivery processes and reduced the average transit time by "several" days. That speaks for our success.

b. What were some major obstacles your organization had to overcome in the implementation stage?

Adjusting to the evolution of track and trace technology. This evolution leaves companies at different stages of technology and using different status coding. Vector had to a reconciliation process for this problem.

Other major problems included the quality and timeliness of data provided from the transportation carriers.

c. What key lessons has your organization learned as a result of implementing your asset-tracking system?

First, all affected parties must be involved from the planning stage forward. Also, it is not always easy to "classify" the nature of problems and then institutionalize the correction process.

d. Are there any problem areas your organization has yet to resolve?

Quality of data, anything that costs money is slow to correct.

Grand Tour Question 4: What are the primary success factors that has allowed your organization to successfully implement "real-time" tracking of assets?

a. How do your senior managers remain knowledgeable about the operations of the asset-tracking systems?

In example sited above it comes from improved performance in the delivery process which is measured in terms of reduced transit times, reduced exception situations.

b. How do you train users of your information systems?

We plan for training early in the SDLC process. We go through a repetitive Define, Practice, Refine process that becomes second nature when we implement a system. We then maintain a user-testing environment where people can continue to be trained. This is a very formal training program that include mock runs of the system.

c. How did you design your asset-tracking information system to ensure successful tracking of assets?

By insuring system is capable of tracking those situations which are most important to improving the performance and reliability of the transportation process.

d. How do you provide assistance to users of the asset-tracking system?

We provide 24-hour technical support

Grand Tour Question 5: How do you maintain operability of the asset-tracking systems?

a. How do users and managers know that the systems are working correctly?

Through Exception Management, or identifying and eradicating through "exceptions" that arise. The trip plan establishes a basis for conducting root cause analysis—where am I having the problem and how can I prevent the problems in the future. We also have on-going compliance reporting, metrics, system monitoring to ensure conformance to service level agreement thresholds.

b. How do you measure performance of the tracking systems?

Vector SCM develops a trip plan for each shipment, called an Engineered Transportation Network. The trip plan includes several milestone events that trigger events in the system. There are initially default times associated with the milestones that serve as a basis for measuring performance.

c. How do you correct for deficiencies between system performance and measurement standards?

Depends on the nature of the problem. If it's the timing, we tune the system.

d. How do you adjust your systems for surge operations?

Balance cost of computer resources versus benefit of handling surge.

Grand Tour Question 6: What is your asset-tracking process, beginning with identification of the item being shipped through delivery at destination?

a. To what level can you maintain visibility (e.g., vehicle, container, specific item)?

Through association and a hierarchy of control numbers, we maintain visibility at the lowest levels within an order. An order has a number associated with it. A hierarchy should be developed for everything contained in that order. If there is a change to the order, such as a consolidation, then the change should be noted in the system. By maintaining an accurate record, it is easily possible to track shipments to the lowest level. For vehicle, we are tracking at the Vehicle Identification Number (VIN).

b. What are the primary technologies you use within your process (e.g., barcoding, radio-frequency identification, satellite tracking)?

We receive most of our information directly from carriers through EDI.

c. Do you use commercial-off-the-shelf (COTS) software or develop proprietary software?

Both

d. What factors led to your choice to use COTS or develop proprietary software?

If a commercial solution exists, we use it. Otherwise we design the system.

e. If using COTS, what software package are you using and who is the developer?

G-Log

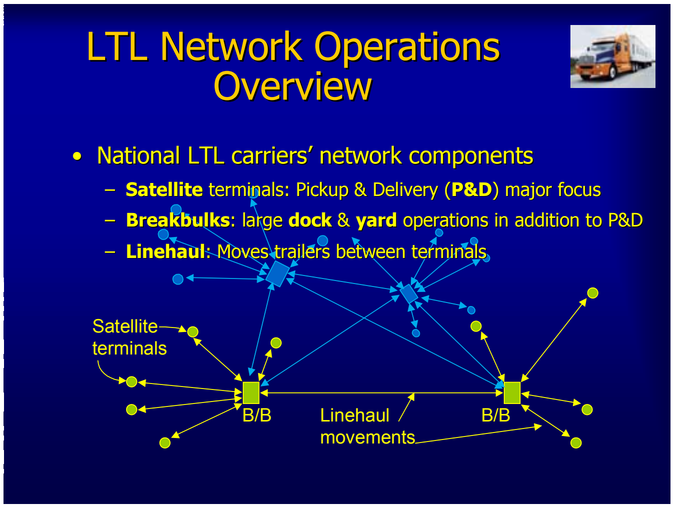
Appendix J. Observations: Roadway Express Site Visit

Setting

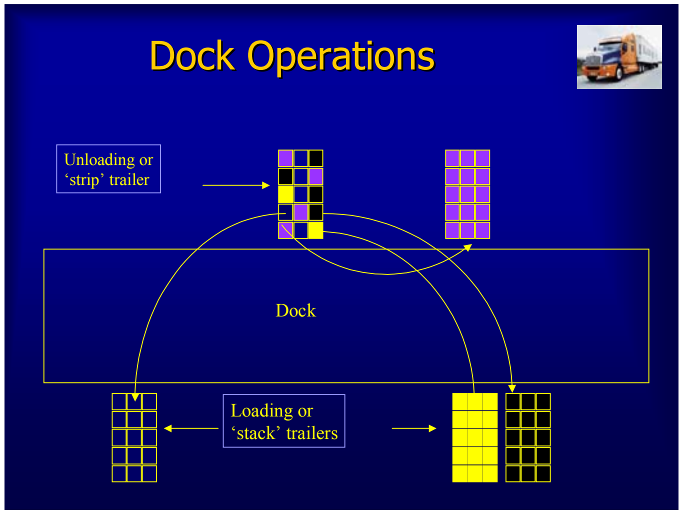
The Akron General Office (AGO) and break bulk facility, both in Akron, Ohio served as the setting of a November 2002 tour of Roadway Express. The tour included meetings with Roadway senior IT managers, including the Chief Information Officer, and a tour of their break bulk facility. The researcher noted the following observations during the tour:

Basic Operations

Roadway is a less-than-truck-load (LTL) company. To optimize operations, Roadway instituted a hub-and-spoke network that consists of 29 hubs across the United States. Roadway picks-up and delivers over 50,000 shipments per day with the average shipment being 1200 pounds, 1100 miles, and 2 to 3 business days in transit. Through repacking shipments or combining trailer loads, Roadway optimizes trailer loads at each stage in the hub-and-spoke network. The following diagram shows Roadway's hub-and-spoke network.



Dock operations focus on the optimization of shipments. Shipments arriving at a dock may have many different destinations. At each stage in the hub-and-spoke, unloaded shipments are sorted and reloaded into groups with a common next destination. Each transfer of a shipment refines the sort to a smaller geography base. The following diagram shows the operations on this sorting process. A trailer arrives with shipments for many locations, coded by color in the diagram. As the trailer is unloaded, each shipment is transferred to a dock coded for a specific location. Each sorted shipment is then reloaded onto a trailer for the next destination. Each trailer will typically be dispatched at 90-100 per cent capacity. This process continues throughout the network until shipments arrive at their delivery location.



In-transit Visibility (ITV) of Shipments

Roadway uses a system called Tracking of Equipment and Cargo (TEC) as their ITV system. Within that system, they provide ITV primarily at the handling unit level. Associating this term with DOD terminology, they provide ITV at the increment level. Through association, they can provide ITV at an item level. However, this depends upon the information provided by the customer. If a detailed packing list is provide, Roadway will input the information into their database and provide visibility at this level.

Roadway manually inputs originating data about the shipment into TEC. When a shipment is received, Roadway creates a barcode label, with an associated Permanent Rotating Order (PRO) number, and affixes a label to the shipment and to the bill of lading. A PRO is not reused for several years. When inputting data into TEC, the data entry professional will first scan the PRO on the bill of lading to ensure accurate entry. The data entry professional will then proceed to manually input the rest of the shipment information, including trailer identification on which the freight was loaded and the identification of each shipment. If a customer provides details of each item within the shipment, Roadway also enters the SKU number of each item.

Although Roadway uses a manual data entry, the design of TEC semi-automates this process. The database “remembers” details about customers and their shipments. After scanning the PRO, the customers information will appear on screen. If a shipment is “remembered,” the data entry professional simply selects a box to indicate the shipment. This holds true also for any shipment item that Roadway previously input. Once data entry is complete, the system updates the status of the shipment.

After the initial data entry, Roadway’s ITV process is automated using linear barcode technology. Roadway relies on manual checks for backup to ensure the automated process is working. When a shipment is unloaded, a dockworker scans their employee identification number from their ID card, the trailer number from which the shipment is unloaded, and the PRO number from a waybill or bill of lading. The dockworker then counts handling units within the shipment. As long as the number of handling units matches the waybill, Roadway assumes that the shipment is intact and the data is accurate. A similar process occurs for loading a trailer. Once complete, the system updates the status of the shipment to show its current location.

Upon each driver's return at the end of the route-day, the driver must give the dispatcher delivery receipts. The dispatcher will scan the PRO on each delivery receipt. The computer will then update the status of the shipment to show that it was delivered. Roadway is currently working on real-time update of delivery for premium-service items by having the driver acknowledge delivery with an onboard computer.

Timed events serve as a measure of performance.

Roadway plans out specific standard timing events for each shipment passing through the Roadway network. The timing of these events is used for knowing when visibility transactions should occur. By tying these two events together, Roadway forms the foundation for a measure of performance.

Elevated importance of data entry position

Roadway recognizes that every step in the ITV process is critical to success. The company's top management emphasizes a "reverence for data" and instills measures to ensure employees at each step in the process adopt the same philosophy. This is apparent in the emphasis they place on their data entry position.

Roadway elevated the importance of the data entry clerk by "professionalizing" the position. As a first step, they changed the name from data entry clerk to an Acquired Shipment Detail (ASD) Professional. Through a simple name change, and emphasis on the position from top management, being an ASD Professional is now an honored position. To strengthen the "professional" claim, Roadway developed a certification process for the ASD Professional. The certification process involves classroom instruction, hands-on training, and over 100 hours of supervised work. At the end of the process, Roadway issues each professional a certificate of completion of training. They emphasize this certification by only allowing certified professionals to work within the database.

During the tour, the researcher informally and spontaneously interviewed an ASD Professional in an attempt to discern the level of pride in the employee's job. The ASD Professional demonstrated a high level of pride in her job and clearly understood the importance of her position within the company.

Use a formal error reporting and auditing process

"Junk in results in junk out." This is a common phrase for entering data into an information system. Roadway attempts to decrease the "junk" entering the system through a formal error reporting and auditing process. Their ITV information system generates error reports on any problem within the system, specifically for data entry items. Three to four employees are dedicated to reviewing the auditing reports. Their audit reports are presented to all levels of management and to the ASD Professionals. One metric that is reviewed is the percentage of mistakes in data entry per ASD Professional. Demonstrating the level of skill of the ASD Professional, the employee interviewed, previously mentioned, boasted less than a 1% error rate. That rate is impressive, considering, as a team, the ASD Professionals at that operational site enter over 1000 shipment orders per day.

Employee driven process development

Roadway uses a concept of "employee engagement of fundamental business (EEFB)" as the basis for the development of processes for the company. EEFB is a positive approach to learning that employs a training process called “Appreciate Inquiry (AI)” developed by Case Western University. Through AI, Roadway brings together at a summit meeting stakeholders in a specific process. These employees develop an “opportunity map” is an action plan that defines the current and future business for their process, including the who, what, and how of the process. Through AI, employees become owners of the process and hold a vested interest in the success of the process.

Develop a Curriculum

To develop training standards, Roadway uses a process called “Develop a Curriculum (DACUM).” DACUM is a formal process for developing a structured training plan. Through DACUM, Roadway creates a competency profile for each position within the company. This profile is a matrix that defines the responsibilities of the position and the training required for the position. Training on TEC is included in the competency profile for any position that requires the training.

Appendix K. Observations: United Parcel Service Site Visit

Setting

The World Port sorting facility in Louisville, Kentucky served as the setting of a January 2003 tour of United Parcel Service. The tour included a brief overview of UPS, a tour of the World Port facility, and a tour of UPS Air Cargo. The researcher noted the following observations during the tour:

Basic Operations

UPS developed a network of "hubs" or central sorting facilities located throughout the world to efficiently move packages through their supply chain. Each hub is "fed" by a number of local operating centers, which serve as home base for UPS pickup and delivery vehicles. Packages from the local operating center are transported to the hub, usually by tractor-trailer and are unloaded. The packages are sorted by ZIP code and consolidated on conveyor belts. Packages bound for a specific geographical region are all consolidated on the same conveyor belt. Then packages are routed either to an out-bound trailer for local delivery, or to a delivery truck serving the immediate area. Before being loaded, each package is checked one last time, just to make sure it has been sorted correctly.

The World Port facility in Louisville is a major hub in the UPS network. Each night in a three to four hour time frame, between 90 and 100 flights arrive then depart from World Port. Within this time frame, World Port unloads, sorts, then re-loads over 900,000 packages per day. Because of requirements of the conveyor system used for sorting the packages, any one of these packages cannot exceed 150 pounds in weight.

Automation

UPS World Port uses an automated system to sort the packages flowing through the facility. When a customer delivers a package to a local operating center, the package is weight and a UPS label is affixed to the package. The label contains a tracking number that is easily readable both by human and computer. A two-dimensional barcode, called the Maxicode, allows for automation.

When an airplane or truck arrives at World Port, a worker scans the airplane or truck, along with the first two packages unloaded. This creates an association that updates all other packages onboard. The packages are unloaded and placed label side up onto an automated conveyor system. At this point, the UPS computer system takes control and automatically sorts the packages through control of the conveyor system and use of strategically placed “photo eye” barcode readers. Information stored in the system, related to the barcode, tells the computer system the next destination of each package. When the package arrives at the sorting destination, it drops into a bin where a worker can load the package into an air container. Once the air container is full, the worker loads the container onto the next airplane. From unload to this point the process is fully automated unless a problem occurs. If the computer system has any problem with a package, such as inability to read the barcode label, the package is passed onto a conveyor that is monitored by workers. A worker checks the package to determine the nature of the problem. If the barcode is unreadable, the worker prints and affixes a new label. The worker then places the package in the correct destination bin for upload. Problems arise in less than 1% of all packages moving through the sorting facility.

The Air Force is not like UPS

Perception is that the Air Force would like to run air cargo operations similar to UPS. Observations made at World Port clearly identify the Air Force as being significantly different from UPS.

The primary difference originates in the type of shipment in each environment. UPS maximum shipment weight is 150 pounds. This weight is the maximum weight that can safely be loaded onto the conveyor system. It also allows for workers to lift the package for loading and unloading. The automated sorting process used by UPS enhances their capability to maintain visibility over each package.

As primarily an air cargo carrier, the Air Force lies to the opposite extreme. The shipping containers used by the Air Force weigh more than the maximum shipment weight of UPS. Air cargo pallets weigh nearly 200 pounds and shipment weights can easily exceed several thousand pounds. To be able to maintain a similar capability like UPS, the Air Force would have to develop an automated conveyor system that could handle shipment weights well in excess of several thousand pounds.

UPS Air Cargo

In 1982, UPS expanded their package handling business to include air freight. UPS Air Cargo began as a side business where UPS transported Dole pineapples from Hawaii to the continental United States. The company later expanded the air cargo business to forward freight between 150 airports throughout the world. UPS Air Cargo uses primarily a manual process, unlike the package handling side of the company. The tracking system provides visibility through an airway bill number. All items in the shipment are associated to the waybill number. To maintain visibility over each shipment, in many cases, UPS Air Cargo relies on manual input of shipment information. In a general sense, UPS Air Cargo more closely resembles air cargo operations of the Air Force.

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Vita

Captain Michael L. Horsey was born in Springfield, Missouri. After graduating in the top two percent of high school class, he attended the Honors College at Southwest Missouri State University in Springfield, Missouri. He graduated *Cum Laude* with a Bachelor of Science in Chemistry. On 21 June 1996, he was commissioned into the U.S. Air Force through Officer Training School.

In his first assignment, he served as a Chemist and Program Manager in the Air Force Research Laboratory, Munitions Directorate at Eglin AFB Florida. In 1998, he entered the Logistics Plans career field and transferred to Beale AFB California. As the Installation Deployment Officer, he led the 9th Reconnaissance Wing to an "Excellent" overall rating and was selected as an Outstanding Performer during the Air Combat Command Operational Readiness Inspection.

In August 2001, he entered the Graduate Logistics Management program at the Air Force Institute of Technology. Upon graduation, he will be assigned to the Logistics Staff at Air Combat Command (ACC), Langley AFB Virginia.

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14. ABSTRACT

Over the past decade, the Department of Defense has developed an In-transit Visibility capability. Despite significant funding and research in developing this capability, the initial deployment in support of Operation ENDURING FREEDOM (OEF) in 2001 highlighted an ongoing problem to achieve ITV within the U.S. Air Force. Initial results from Headquarters USAF initiated studies point to a need to focus on business processes related ITV management.

This research employed a multiple case study design embedded in a functional benchmarking process to solicit ITV management "best practices" from leaders in the civilian logistics industry and to identify gaps between their practices and those of the Air Force. The data collection method used electronic mail as a portal to conducting subject matter expert interviews. Using the data collected from the benchmarking partners, the research recognized 19 "best practices" and compared the civilian and military environments in 41 areas. This evaluation highlighted gaps between practices used in the civilian industry and those used by the Air Force. These gaps served as areas of opportunity in which the Air Force can evaluate alternative management practices in an effort to improve the ITV process. Using these gaps as a foundation, the research proposed fourteen recommendations for action.

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