

FUTURE TACTICAL TRUCK SYSTEM MAXIMIZATION: ACHIEVING
OBJECTIVE FORCE SUSTAINMENT AND DISTRIBUTION
REQUIREMENTS

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

FUTURE TACTICAL TRUCK SYSTEM MAXIMIZATION: ACHIEVING
OBJECTIVE FORCE SUSTAINMENT AND DISTRIBUTION REQUIREMENTS
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This study explores the Future Tactical Truck System (FTTS) as it applies to the sustainment distribution system on the future battlefield. Objective Force logistics on the battlefield is required by the *Objective Force Concept White Paper* to be sustainable, trainable, versatile, responsive, survivable and agile. The FTTS is scheduled to be the primary transport vehicle that would enable the OF sustainment distribution system. The FTTS, with movement tracking system (MTS) and embedded radio frequency (RF-Tag) technology will improve motor transport operations and sustainment. The primary application of these technologies alone, in and of themselves will not be enough to meet Objective Force requirements. Changes to doctrine, organization, training, leader development, materials, personnel and facilities (DOTLM-PF) have to be explored to maximize the effectiveness of the FTTS enabled sustainment distribution system in the Objective Force. To investigate and gauge the appropriate changes, analysis is needed to test viable concepts. This study explores four proven logistical concepts from top American corporations; Schneider Trucking Corporation's concepts for fleet management and maintenance management, Burlington Northern Sante Fe Railroad's concept for railcar management and Wal-Mart's concept for distribution management. These concepts are applied to a FTTS sustainment distribution model and analyzed through the prism of DOTLM-PF to gain insights on possible changes that meet the Objective Force requirements and maximize effectiveness of the system. Qualitative analysis is used to provide discovery, insight and understanding through the eye of the researcher.

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ACRONYMS

AIT	Automated Identification Technology
BNSF	Burlington Northern Sante Fe (Railroad)
CASCOM	Combined Arms Command
CL	Configured Load
CONUS	Continental United States
COP	Common Operating Picture
CSC	Convoy Support Center
CSS	Combat Service Support
DCD	Directorate for Combat Developments
DOTLM-PF	Doctrine, Organization, Training, Leader Development, Materials – Personnel and Facilities
DPL	Distribution Platoon Leader
DPS	Distribution Platoon Sergeant
DTLOMS	Doctrine, Training, Leader Development, Organization, Materials, Soldiers
D/V	Driver/Vehicle (Team)
FOC	Future Operational Capability
FTTS	Future Tactical Truck System
ITV	In-Transit Visibility
KCS	Kansas City Southern (Railroad)
MTP	Mission Training Plan
MTS	Movement Tracking System
OF	Objective Force
RF-Tag	Radio Frequency Tag

RMA	Revolution in Military Affairs
RML	Revolution in Military Logistics
TRADOC	Training and Doctrine Command
S/V	Soldier/Vehicle Team
SPO	Support Operations Officer
STL	Service Team Leader
UE	Unit of Employment
UA	Unit of Action

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CHAPTER 1

INTRODUCTION

Revolution

The United States Army has embarked on a crusade of change fueled by the end of the Cold War, enemy threat environment and rapid advances in technology. The Army is in the process of developing an Objective Force (OF) that will be far more responsive and dominant across the full spectrum of military operations than the contemporary Legacy Force. The Army leadership has set the stage for a possible revolution in Military Affairs (RMA) by applying new technologies and methods to revolutionize the force to fight and win wars. The RMA is posing significant challenges for logisticians. Former Army Chief of Staff General Reimer said, “There will not be a revolution in military affairs without first having a revolution in military logistics,” (Eden and Edwards, 1998). The logistics community is answering the battle cry for a Revolution in Military Logistics (RML). Currently we are in the process of defining what that revolution entails. The primary thrust is to change the logistical system from a stockage based system to a distribution-based system (TRADOC Pamphlet 525-4-0 2002, 12). Although a battlefield distribution concept has started at the strategic level, it is the change at the tactical level that has the potential to revolutionize military logistics. The development of battlefield distribution concepts and technologies at the tactical level are vital for the Army to attain its goal of a high velocity, streamlined, flexible and agile logistics distribution system in the OF.

Nothing Happens Until Something Moves

The concept of change in the context of development of a battlefield distribution system for the OF has become synonymous with success. Defining what constitutes viable changes at the tactical level to logistics units at best is amorphous. The Objective Force Maneuver Sustainment Operations Training and Doctrine Command (TRADOC) Pamphlet 525-4-0 describes the transportation battlefield functional area in a single sentence, “Move and transfer units, personnel, equipment and supplies to support the concept of operations” (TRADOC Pamphlet 525-4-0 2002, 38). This lone statement fails to recognize that the motor transport function of the battlefield distribution system is the primary catalyst for change in the burgeoning OF sustainment distribution system. This thesis examines how the technology and employment of the Future Tactical Truck System (FTTS) could enable conceptual changes to the force that can maximize the effectiveness of the OF sustainment distribution system.

At the tactical level, the ground component of the distribution pipeline is the motor transport unit. Field Manual (FM) 55-30 states,

Motor transport units support multifunctional logistics organizations such as the Corps Support Command (COSCOM) and the Division Support Command (DISCOM) by moving supplies, personnel, units, and equipment to arm, fuel, fix, and sustain the force.

Throughout its history, from World War II through the present, the motor transport unit has been the primary ground mover in support of the force. Vehicle types have changed over the years but motor unit operations remain static. A true revolution in the motor transport unit has not occurred; however, the FTTS provides the catalyst for change. The Army plans to replace the legacy motor transport fleet with FTTS. This, combined with

the OF vision and Army leaderships' drive to transform the force, presents opportunities for unprecedented logistical change. However, one must note that technology in and of itself is not the sole answer for efficient change. If the Army fails to properly apply technology across the full spectrum of unit operational factors, deficiencies will result. The application of technology through the FTTS may avoid this conundrum. Conceptual applications of the FTTS to the sustainment distribution system must meet OF requirements.

Technological Catalyst

The Army White Paper states,

While the greatest potential for revolutionary advances in capability derives from technology, the Army recognizes that only through the synergy of parallel advances in doctrine, training, leader development, organizations, material and facilities and soldiers (DTLOMS) will the OF achieve its full potential.

The updated model used by Combined Arms Support Command (CASCOM) replaced "soldiers" with "personnel" and added "facilities" to create DOTLM-PF. CASCOM uses this model to review affects of new concepts and capabilities on the force. This thesis examines new conceptual opportunities, enabled by the FTTS technology and analyzed through the prism of DOTLM-PF, to reveal possible changes that could maximize effectiveness in the OF sustainment distribution system. Corporate America has provided a source of proven concepts to apply to the FTTS sustainment distribution system. Top civilian distribution companies have used similar technology for years. Their experience may provide possible solutions that the Army could use to maximize results on the battlefield while suggesting changes to logistics DOTLM-PF. The primary question this thesis examines is: *"How can the Army maximize effective use of the Future Tactical*

Truck System to meet the sustainment and distribution requirements of the Objective Force?”

The FTTS is scheduled for the field in 2008. This allows time for conceptual research and design. This thesis looks to similar technology and distribution systems currently in use by civilian distribution companies to identify parallels and illuminate changes to DOTLM-PF that can maximize the efficiency of the OF FTTS sustainment distribution system.

Secondary Questions

I pose three secondary questions that support the primary question.

1. What are the requirements of the OF sustainment distribution system?

This base knowledge is essential in understanding the performance goals of the OF distribution system. The Army verbalized what the OF distribution system should accomplish in broad terms such as responsive, agile and flexible. What is not clear is how the Army attains these goals. Answering this question by defining the requirements of the OF distribution system provides clear objectives to test against any conceptual changes to DOTLM-PF.

2. What “change agents” are produced when corporate concepts are applied to the FTTS sustainment distribution system?

Change agents are energized concepts that drive change to DOTLM-PF in the FTTS sustainment distribution system to attain OF goals and requirements. It is essential to identify these change agents. Proven concepts that attain the desired results provide the energy, or motivation for change. Technology incorporated only for its primary function will, in most cases, not achieve maximum effectiveness. For example, after the

introduction of the tank in WWI the French used it as a defensive, glorified, mobile artillery piece. This continued until WW II. The Germans, however, extrapolated the secondary advantages of the technology and applied it to their storm trooper offensive tactics concept, which maximized the new technology as an offensive weapon. In short, the energized concept or change agent, of storm trooper tactics with tanks, maximized effectiveness of offensive operations due to the changes made to German DOTLM-PF. The difference in application of technology illustrates how the conceptual exploration of FTTS change agents on DOTLM-PF can achieve desired results. Exploration of these change agents supports answering the primary question.

3. How can the Army qualitatively apply proven logistical concepts to the FTTS sustainment distribution system model?

Civilian corporations that are leaders in their respective industries have used technology and logistic concepts to great advantage. What do these corporate practices have to say to the Army? Some would argue that the Army should not superimpose corporate concepts on military systems due to the differences in culture, mission and the battlefield. These dissenters appear to be in the minority as the Army continues to back its Training with Industry program to cull “good ideas” that they can apply to military operations. For instance, the hub and spoke distribution system, perfected by Federal Express, was put in place in the early 1990s in United States Army Europe. An Army Transportation Captain, who had just completed a year in the Training with Industry program with Federal Express, put the system in place (Buchar 1996, 20). Logistics organizations strive for speed, accuracy, simplicity, and cost effectiveness no matter what environment they operate in.

Significance of the Study

Every revolution has a common idea that focuses the antagonists and rallies them to victory. The idea provides the framework that connects all facets of the cause and gives it life and the chance for success. An RML has yet to form behind a narrowly defined common idea. The RML is defined in broad terms such as distribution based and digitized, but these definitions leave the revolutionaries searching for a rally point and wondering where to start.

The FTTS provides the framework for the build out of battlefield sustainment distribution concepts. These concepts, borrowed from corporate America, are explored to demonstrate the possibility of the real transformation the FTTS presents with its secondary effects on the logistics force. As the primary transport mode that will support the OF Unit of Action (UA); logistical doctrine, organizational structure, training and soldier skills will be built around it. Other modes will complement the FTTS and support it as preloaded module-racks enter theater via sea and air. Automation will track every FTTS and module-rack in theater and supply inventories will be managed and measured by module loads. The Army has to recognize this rally point for the RML to exploit it. Analysis from all levels is needed to identify changes to DOTLM-PF that will optimize sustainment distribution in the OF. In building a future force, as in war, there are no guarantees, however, it can be guaranteed that the leaders in the field have maximum exposure to state opinions, debate and provide feedback on concepts. The lack of a rally point for the RML is slowing the process for logistics transformation. This study investigates if corporate concepts applied to the FTTS sustainment distribution system,

maximizes that system, and in doing so, creates the rally point for a Revolution in Military Logistics.

General Assumptions

The Army will continue the fielding plan of the FTTS to the force and continue to develop the OF basic design as stated in currently published material.

DOTLM-PF methodology will continue to be the Army application of choice for predicting change and gathering insights on impacts of future concepts.

Civilian corporations strive to attain optimum logistical performance through application of technology and new concepts that the Army can emulate to achieve optimum performance in its systems.

Qualitative analyses will continue as an accepted methodology to devise concepts and theories on maximizing system efficiencies.

Limitations

The focus of this research is limited to the FTTS and its impact on the sustainment distribution system in the Unit of Employment (UE) of the OF. Corporate concepts are applied to the FTTS sustainment distribution model presented in chapter 3. Analysis is limited to FTTS impact on DOTLM-PF when it is synergized and energized by the corporate concepts. Although a Logistics Corps is mentioned, it is limited to facilitation of concept analysis on the FTTS sustainment distribution system.

This study is limited to the specific corporate distribution concepts of Schneider Trucking Corporation Regional Operations Centers, Burlington Northern-Santa Fe Regional Centers, and Wal-Mart's Distribution Center operations as they apply to OF FTTS operations.

Operational Definitions

There are terms fundamental to the research that is discussed throughout the thesis. These terms must be clearly defined to support valid research, analysis and conclusions. Critical terms are as follows:

Future Tactical Truck System (FTTS) is a multifunctional, multi proponent single tactical truck family based upon a common chassis design that provides direct support to Unit of Action (UA) Brigades in terms of sustainment and distribution of all classes of supply, equipment and personnel on module-racks.

Module-racks are the lift platforms for the FTTS. There are several types of module-racks from a configured load module-rack that carry a mix of commodities, to bulk fuel and ammunition module-racks, to types like box, flat and troop carrier module-racks.

Sustainment Distribution System is the FTTS enabled support system which facilitates corporate conceptual comparison and synergizes supply and transport functions in the OF. The sustainment battalion in the UE enables the sustainment distribution system.

Distribution Company is a unit with 74 FTTS. The distribution company is located in a sustainment battalion. It provides FTTS sustainment distribution system with FTTS soldier/vehicle (S/V) teams.

Sustainment Battalion is a unit in a UE₁ and UE₂, which facilitates the FTTS sustainment distribution system to test corporate concepts. Battalion is made up of a headquarters company, three distribution companies and a maintenance company. The Sustainment battalion is responsible for set up of a sustainment center.

Sustainment Center is set up by the sustainment battalion to facilitate the FTTS sustainment distribution system. This center manages flows of all classes of supply and module-racks as they move through the distribution system on FTTS module-racks to the Sustainment Battalions and the UA combat units.

Unit of Action (UA) is the OF brigade sized warfighter consisting of up to 6 maneuver battalions. UE sustainment battalions replenish the UA forward support battalions.

Unit of Employment I (UE₁) is the higher level echelon that integrates and synchronizes Army forces for full spectrum operations at the higher tactical and

operational levels of war/conflict. The UE₁ is typically compared to legacy division level.

Unit of Employment II (UE₂) is the higher-level echelon that integrates and synchronizes Army forces for full spectrum operations at the higher tactical and operational levels of war/conflict. The UE is typically compared to legacy corps level.

Objective Force is the future U.S. force designed to be a strategically responsive Army capable of dominating across the spectrum of operations and capable of rapid deployment and rapid transition across mission requirements without loss of momentum.

Legacy Force is the contemporary Army structure, consisting of both heavy and light forces. Light forces are rapidly deployable, but lack mobility, lethality and survivability, where heavy forces are mobile, lethal and survivable but lack deployability.

DOTLM-PF is an acronym defined as follows: Training Pamphlet 71 states that doctrine is a body of thought that is based on fundamental principles by which military forces guide their actions in support of objectives. It represents consensus on how the Army conducts operations. In this thesis, Organizations are the structures within the UE sustainment battalion that include a headquarters, distribution management cell, support management cell, distribution companies with 74 FTTS and a maintenance company. The sustainment battalion is responsible for set up of the sustainment center. Training is instruction and applied exercises for the attainment and retention of knowledge, skills, and attitudes. Leader development and education is developing individuals who influence others to accomplish the mission by providing purpose, direction, and motivation. Effective leadership transforms human potential into effective performance (AR 600-100). In this thesis the leaders are the sustainment battalion officers and non-commissioned officers who manage and execute the FTTS sustainment distribution system from the UE sustainment center. Material in this thesis is the needed equipment necessary to support the FTTS, MTS and RF-Tag technologies. Personnel are the sustainment soldiers who make up the enlisted logistics corps and operate in the sustainment battalion. Facilities are the structures that the unit sets up on the battlefield to operate in.

Movement Tracking System (MTS) provides the capability to identify position, track progress, and communicate with the operators of the FTTS through the use of positioning and commercial communication satellites. Transportation movement control and Combat Support/Combat Service Support (CS/CSS) operations sections have the means to provide assured positive control of assets anywhere in the theater.

Radio Frequency Tag (RF-Tag) is a small tag that is placed on the cargo. The tag has the ability to send or receive information. Logisticians write the shipment information of the cargo to the tag and other logisticians read that information as the cargo flows through the distribution system. Future MTS will have the ability to read RF-Tags of uploaded module-racks.

Revolution in Military Logistics is defined as fundamental change in the structure, operation and execution of sustainment distribution on the battlefield.

Summary

This thesis focuses on the effective use of the FTTS in the Objective Force UE.

Corporate concepts applied to the FTTS sustainment distribution system create changes to DOTLM-PF. These concepts energize change to attain OF requirements.

The thesis focuses on one primary piece of equipment (FTTS) and its possible impact on the OF sustainment distribution system, thus limiting the scope of the study. It is also limited by analysis of specific corporate concepts from three top American corporations.

CHAPTER 2

LITERATURE REVIEW

Introduction

The OF concept and framework are under construction from several sources.

General Shinseki provided the force with the basic vision for the OF in *The White Paper*. With this initial vision, conceptualists from TRADOC to CASCOM and from contractors to MMAS students, set out to define how the OF would look and function. In this exciting time of change it is inherently important that the Army looks to all quarters of military and civilian ingenuity to ensure the framework for the OF is created to maximize the effectiveness of the force. To achieve this end, every type of future equipment should nest in force concepts that synergize the capabilities of each through DOTLM-PF integration.

The FTTS has the potential to be a primary support girder for the build out of the OF. A centerpiece which, when nested with the future combat system and DOTLM-PF of a sustainment distribution system, provides the strong framework required to meet OF performance requirements. To accomplish this end, however, the FTTS has to apply to the force in a method that maximizes its efficiency. This goal leads to the primary question of this thesis: How can the Army maximize effective use of the Future Tactical Truck System to meet the requirements of the OF? To answer this primary research question, secondary questions are addressed: What are the requirements of the OF and what conceptual change agents are produced from the application of proven corporate concepts to the FTTS sustainment distribution system? This thesis seeks to conceptualize the maximum application of the FTTS to the OF to meet requirements and attain success

on the battlefield. Simple application of the FTTS technology to produce enhanced mission performance in an evolutionary sense may not be sufficient. Secondary effects of the employment of FTTS technology on DOTLM-PF through the application of corporate concepts may produce the revolutionary change in the logistics force that is required to maximize the system and meet the requirements of the OF.

This chapter reviews available literature and information pertaining to the stated thesis' primary and secondary questions. The initial review summarizes legacy truck operations in the supply-based system to establish a base of knowledge of motor transport. This is followed by a review of OF literature on motor transport requirements for the OF distribution based system. OF requirements that impact motor transport distribution are culled from the available information in the form of implied tasks to motor transport organizations. Shortcomings in the legacy motor transport operations as applied to the OF requirements are identified to communicate FTTS enhancements to current truck operations. This includes a review of CASCOM documents and briefings.

A review of documents that summarize the stated FTTS technologies and their primary applications will inform the reader about the primary effects of the technologies and set up exploration of secondary effects. The Army's testing and intended uses of the technologies are discussed. A review of DOTLM-PF application to the FTTS and how CASCOM integrates this methodology into the development process are discussed. Gaps and limitations in the DOTLM-PF process are identified.

The DOTLM-PF review is followed by a review of documentation that relates the three selected American corporate concepts to the OF FTTS sustainment distribution system. This final review sets the stage for research methodology in Chapter 3 and

analysis in Chapter 4 that produces answers to the thesis primary and secondary questions.

Review of Legacy Motor Transport Literature

To understand the organization and mission of legacy motor transport operations a review of Field Manual (FM) 55-30, *Army Motor Transport Operations* is required. This document provides the base for motor transport operations and sets forth the necessary background knowledge of motor transport. First and foremost, the primary mission of a motor transport distribution organization is to move all classes of supply and personnel in the theater of operations. Movement of ammunition, fuel, food, repair parts and personnel are critical to support the mission and achieve operational success. The maneuver commander relies on the timely deliver of supplies through the battlefield distribution (BD) system to enable his course of action in the fight. The function is not just the physical aspect of moving supplies, equipment, fuel, casualties, food, clothing and ammunition on the battlefield, but the management of transportation assets and the planning of the utilization of those assets to maximize their effects on the battlefield in support of the maneuver commander (FM 55-30 1997).

Army motor transport units are deployed into a theater to support almost all operations including port clearance, theater wide distribution of personnel, supplies, and equipment and sustainment of tactical operations. All legacy motor transport units are organized and operate similarly; however, variations occur in the type of vehicles authorized. For instance, one motor transport unit may have five-ton cargo trucks to carry dry goods and personnel, where another motor transport unit may have 5000K fuel

trucks. These variations in vehicle are due to the class of supply that is delivered and does not change the organization and mission of the motor transport unit. The motor transport unit has a headquarters, operations, maintenance section and three truck platoons.

During execution of the motor transport company mission the operations section consists of an operations officer, truckmaster, assistant truckmaster and dispatcher. The section provides coordination between operating elements of the truck platoons, maintenance platoon, and the customer unit (FM 55-30 1997). The operations officer provides oversight for the section to ensure proper execution of mission tasks. The truckmaster assists in the coordination, supervision and execution of vehicle taskings. The truckmaster is the conduit for information to and from the truck platoons to facilitate mission accomplishment.

The motor transport company has three truck platoons. The platoon leader and platoon sergeant provide command and control, supervision, and technical guidance to truck squads in performance of motor transport missions (FM 55-30 1997). The drivers are the executors of the motor transport company mission. To be successful a driver has to have knowledge of their vehicle functions, maintenance of the vehicle, how to operate in a convoy and how to load and unload the vehicle. Driver responsibilities focus on the proper operation of the vehicle and safe and timely delivery of loads to unit customers. Once the driver accepts the load from the shipper, he alone is directly responsible for its safe delivery (FM 55-30 1997). A motor transport unit's mission success is dependent on its vehicle operators. Motor transport drivers have to protect their cargo from enemy interdiction. This requires a high level of combat skill when under attack. However, the skill demands on motor transport drivers do not require skills far beyond common soldier

tasks and standard vehicle operational responsibilities. FM 21-305, *Manual for the Wheeled Vehicle Driver* establishes the following tasks:

Safely operate your vehicle and comply with applicable host-nation laws and regulations.

Perform before-, during-, and after-operation inspections of your vehicle.

Follow all operator maintenance outlined in the appropriate vehicle technical manual

Care for and cleaning your vehicle and its equipment at all times.

Ensure the safety and comfort of your passengers. Ensuring the security of the vehicle and cargo entrusted to you.

Exercise common sense.

Notify your supervisor NCO of any change in your status, for example, inability to drive due to physical condition or withdrawal of your state operator's license (FM 21-305 1993).

FTTS, MTS and RF-Tag technology are going to assist motor transport drivers in executing their mission. One subject this thesis explores is whether the technology improves mission performance to revolutionize the current military occupational specialty of the motor transport operator to attain Objective Force distribution requirements.

In theater, a motor transport unit sets up within a support base cluster. Depending on the enemy threat, vehicles are dispersed and camouflaged accordingly. The company base camp is where all vehicles and drivers return after a mission is complete. At the base camp the driver rests, performs vehicle maintenance and prepares for the next mission.

The motor transport unit mission-training plan (MTP) identifies the primary tasks a motor transport unit performs to accomplish its mission in the training and evaluation outline. The majority of these tasks evaluate the unit's ability to transport classes of

supply and its ability to protect convoys and cargo. Only recently has a task been added that addresses the onset of the MTS technology. For the most part, the tasks of a motor transport unit remain unchanged since World War II. With the onset of the FTTS with MTS and RF-Tag technology the motor transport field manual and MTP face significant changes to DOTLM-PF. For example, task number 55-2-0016; Maintain In-transit Visibility (ITV), Redirect Operators, and Provide Commitments Using Movement Tracking System was recently added to the task list (Motor Transport MTP 2001). This task provides for a primary effect of the MTS technology and its impact on unit operations, but it falls short of the secondary effects of the technology that are demanded by the OF.

Review of Literature on Objective Force
Motor Transport Requirements

OF literature and digital information is limited to: The United States Army *Objective Force Concept White Paper*, Training and Doctrine Command (TRADOC) Pamphlet 525-4-0, *Objective Force Maneuver Sustainment Operations*, Army compact disc, *The Era of the Objective Force*, the web site; www.objectiveforce.army.mil, and CASCOM OF briefings. The information is broad based and generalized; however, based on the principles, implied tasks for future motor transport are exhumed. Given that principles generally do not change, methods do, the primary objective of the presented literature is to combine new intellectual approaches, capabilities and methods with enduring war-fighting and sustainment principles as they apply to emerging OF maneuver sustainment conditions and challenges (TRADOC Pamphlet 525-4-0 2002).

The United States Army *Objective Force Concept White Paper* is the Army's introduction to the OF. It reaches beyond the current published doctrine and provides the concept for the future. General Shinseki, in his introduction of the *Objective Force Concept White Paper*, invited investigation when he wrote: "The Objective Force concept will benefit from discoveries growing out of additional investigation and experimentation, generated by periodic updates to doctrine, force structure, and training," (DA White Paper 2002). The document outlines the OF characteristics of sustainable, trainable, versatile, responsive, agile, deployable, lethal and survivable. Although the motor transport function of the OF incorporates all these characteristics in some form, it is the sustainable aspect of the OF that foreshadows the implied and specific tasks demanded of future motor transport. Phrases from the text such as "sustained velocity management" and "real time tracking of supplies" have significant meaning to the requirements of motor transport, however, these buzzwords are only a glimpse of what transformation means to motor transport and battlefield distribution.

Technology is a key catalyst mentioned in the *White Paper* for motor transport to attain future goals; however, the *White Paper* warns that technology is not a "Panacea." Technology does not guarantee success as it comes with its own set of weaknesses. The integration of the human and technological enablers, as well as all of the DOTLM-PF areas, are critical to successful transformation to the OF (DA White Paper 2002). Motor transport, like all battlefield functions in the Army, will go through this integration and change. One can deduce from the *Objective Force Concept White Paper* that some battlefield functions are destined to be absorbed through consolidation, while some are retired, and others are created to meet OF requirements. The implication for motor

transport is that it looks and operates substantially different in the OF than its legacy counterpart. Further, it operates with a new concept of operations. This concept envisions a skilled, knowledge-based unit that exploits the revolutionary potential of information superiority and networked drivers, managers, decision makers and customers (DA White Paper 2002). Although the *White Paper* speaks in broad terms, the implications to motor transport form the basis for change in motor transport operations.

Training and Doctrine Command Pamphlet 525-4-0; *Objective Force Maneuver Sustainment Operations*, progress from the broad subjects presented in the *White Paper* and focus on sustainment operations in the OF. The document makes the assertion that motor transport of today will be part of a multifunctional Army Logistics Corps. Velocity and precision gained through technology are referenced to meet the requirements of maneuver sustainment and distribution. This will have a direct affect on the cumbersome legacy motor transport unit. The pamphlet refers to future logistics soldiers as sustainment warriors. Sustainment warriors are described as an empowered core of technically, tactically and information management competent warriors who represent the last 1,000 kilometers of conduit through which all sustainment will pass (TRADOC Pamphlet 525-4-0 2002). The significance for the motor transport driver is the identification of the changes that maximize his/her potential to become a multi-functional and multi-capable sustainment warrior of the OF.

The pamphlet addresses the transportation battlefield functional area (BFA) in one line; “Move and transfer units, personnel, equipment and supplies to support the concept of operations,” (TRADOC Pamphlet 525-4-0 2002). The implication for motor transport is that the Army has not published doctrine to outline the best use of effects of

burgeoning technologies like the FTTS with MTS and RF-Tag for motor transport in the OF. Implied, however, is a new transportation structure to improve real-time logistics command and control (C2). The document demands the development of new transportation systems, which will allow speedy sustainment operations on a reduced footprint. The most significant implied task for change to the motor transport function is to “maximize commonality of systems to simplify and reduce the sustainment load, support multi-functionality, and reduce the myriad numbers of different skills required in today’s organizations” (TRADOC Pamphlet 525-4-0 2002). This open ended guidance invites an open ended investigation of possible changes for motor transport that will meet the requirements of the OF.

In this thesis I explore corporate concepts applicable to motor transport that can attain OF requirements of sustainable, trainable, versatile, agile and responsive as referred to in TRADOC Pamphlet 525-4-0. A review of published OF distribution briefs to date provides insights on current depth of concepts and any gaps that need to be addressed. The OF goals require significant changes to sustainment and distribution operations. Currently, the Army relies on mountains of supplies throughout the theater to support the mission. In the OF, supply positioning is limited while supplies are “pulsed” through an unimpeded distribution pipeline. The legacy force has functional sources of sustainment that require extensive coordination among multiple sources to execute. The Objective Force requires multi-functional organizations to execute a streamlined sustainment distribution system. Where the legacy motor transport force pushes mountains of supplies forward, FTTS delivers precision configured loads forward. The FTTS Technology provides an integrated common operating picture (COP) that enables

precise distribution and sustainment positioning at 50% fuel efficiency and with common packaging in configured loads (CASCOM Objective Force Distribution Brief 2002).

CASCOM developers have a rough sketch of what the baseline UA structure is, but UE proposed structure and functions have yet to be published. The UA initial proposal has a forward support battalion (FSB) with a sustainment company. This company has two distribution platoons that use seventy-four FTTS to re-supply the UA maneuver battalions. Distribution flow to the UA Sustainment Companies is delivered by UE FTTS at a Sustainment Replenishment Site (SRS) for express type replenishment or at a Mission Staging Site (MSS) enabling an extensive preparation for an upcoming mission (CASCOM Objective Force Distribution Brief 2002). A third method of sustainment re-supply is UE FTTS throughput operations directly to the UA maneuver units.

The gap of literature is not only the organizational structure of the UE support organization, but also the distribution concepts it incorporates across DOTLM-PF to accomplish its mission. To try to fill in this gap, I explore civilian corporate concepts that, when applied to the FTTS sustainment distribution system model proposed in this thesis, can possibly maximize UE sustainment distribution. To allow for the application of the corporate concepts to the UE, a logical UE sustainment battalion structure and distribution system model is depicted in chapter 3 to facilitate analysis in chapter 4.

The brief also addresses one form of module-rack called the sustainment module. The concept is based on the multipurpose munitions concept which packages all munitions in a clip that fits on the module. The concept allows for all other commodities to also fit into the clip design. The objective is to build these configured load sustainment

modules at the manufacturer to enable the factory to foxhole supply concept. An example of this is displayed in figure 1.

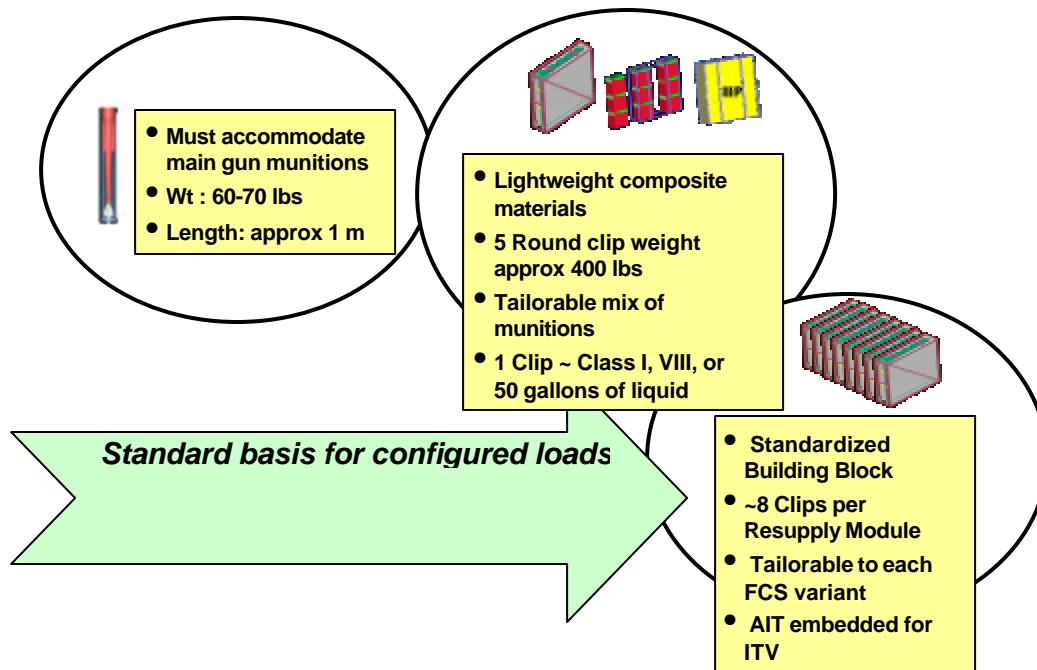


Figure 1: Sustainment Modules (CASCOM, Objective Force Distribution Brief 2002)

Other types of modules “module-racks” have not yet been identified, for instance, bulk commodity module-racks. Bulk module-racks are discussed in later chapters to facilitate analysis.

The CASCOM OF Distribution Brief provides base knowledge of the FTTS technology and what its primary effect on the OF is. At this early planning stage,

however, it falls short of secondary effects the FTTS had on the concepts that define the UE sustainment distribution operation. Exactly how each logistics function is affected is unknown and not yet identified in literature down to unit level. What is known is that legacy motor transport has to change dramatically to attain Objective Force requirements.

Review of Technology Literature

The literature on transportation technology may help to resolve shortcomings and enhance the Army's logistic operations. It appears that FTTS with MTS and RF-Tag technology can address the following shortcomings:

Communication with convoys is lacking due to the range of radios.

Contact is lost with convoys twenty kilometers outside base camp and not regained until their return to base camp.

Changes in mission cannot be forwarded to a convoy that has already departed. The flexibility of the truckmaster to provide follow on missions is denied until the convoy arrives back at the base camp.

Most convoys are empty on return trip to base camp area unless a follow on retrograde tasking is previously scheduled.

Empty vehicles equals significant down time when no loads are moving.

Load tracking for in-transit visibility is limited on the fast moving battlefield as drivers pick up and drop off loads without transportation movement control documents or knowledge of their cargo.

Drivers are more concerned with getting cargo from point to point than identification of the cargo and its impact on the maneuver elements.

Material handling equipment may not be at a drop off destination, which causes delay of the convoy.

Customer unit may not be at designated drop off point, which causes delay as convoy searches for the unit.

The literature on the FTTS is limited to briefings, information and concept documents at CASCOM. This information describes the primary affects of the technology on future motor transport. The FTTS is the next generation of trucks and is set to replace the HEMTT, PLS, and FMTV vehicles (CASCOM FTTS Information Paper 2002). The one vehicle type concept was conceived to take advantage of the modularity of future cargoes.

The FTTS will have built in MTS technology. This allows FTTS crews the capability to access real time situational awareness. It also allows efficient use of assets to ensure on-time delivery of scarce logistics, increased efficiency of the fleet and reduction in fratricide (CASCOM FTTS Information Paper 2002). This primary effect may solve command; control, communications, computers and intelligence (C4I) shortcomings experienced in legacy motor transport operations.

Improved load handling may have the most significant primary affect on the motor transport unit and the force. The FTTS has a hydraulic lift arm that elongates and lifts racks onto its bed. This removes the need for material handling equipment (MHE) to load and off-load trucks. Altogether, the projection is that FTTS will replace three families of vehicles, five interface devices, two delivery platforms, and reduce the use of eight different pieces of MHE on the battlefield to produce a seamless sustainment system as displayed in figure 2 (CASCOM FTTS Information Paper 2002).



Figure 2: FTTS Operational Design
(CASCOM, Objective Force Distribution Brief 2002)

The FTTS technology application is still in its infancy. What is yet to be determined is what revolutionary changes will occur to individual units when the FTTS is brought online. A motor transport unit, which is defined by its pacing item vehicles, will be heavily impacted. The primary effects have been noted; however, the secondary effects, which this thesis explores in its analysis, are still lurking in the conceptual background.

The MTS is a satellite system that provides communication and tracking of vehicle assets. The MTS incorporates Global Positioning System (GPS), automated identification technology (AIT), non line-of-site communication and mapping technologies into a package that provides vehicle visibility throughout the world

(CASCOM MTS STRAP 2001). Civilian trucking companies like Schneider Corporation use MTS technology to great effect in their operations. The MTS will allow battlefield sustainment and distribution managers to monitor the location of each vehicle and load in the system. A sustainment manager will have a computer and monitor linked to a satellite feed that sends signals to each vehicle. The vehicle will also send its location via its satellite communicator. The manager will then know the exact location of each vehicle by means of digitized vehicle markers portrayed on a console. MTS also allows the operations section and driver the advantage of communicating to each other via computer satellite uplink. The manager is able to send digitized transmissions to the driver in the vehicle and the driver in turn, can update the manager on pertinent mission information. This allows the manager to have positive control over all the distribution system's vehicles. Managers will have the flexibility to change a mission enroute and give follow-on mission instructions that allows flexibility and agility in the system.

The MTS is configured to operate as a fixed control station and vehicle mounted mobile station. Both utilize notebook type computers with antenna equipment for satellite link up. Sustainment Managers operate the control station. The control station will be able to track unit assets on digitized maps as well as send and receive messages from mobile stations. The control station, although fixed, can be packed for transport when the company headquarters has to relocate. These stations are networked with movement control units to supply the required in-transit visibility (ITV) information link to Transportation Coordinator's Automated Information for Movement System II (TC-AIMS II) enabling unit customers and commanders' ITV. Mobile units may transmit 2-3 messages per hour. Global positioning information may be transmitted at a predetermined

schedule; for example, once every five minutes (CASCOM MTS STRAP 2001). Mobile stations have a map display where the driver and assistant can track their location and progress. Driver and assistant driver monitor the station for messages from the operations section. Topics of messages may range from mission changes, road and weather conditions to enemy actions. Vehicle operators will provide feedback to the sustainment managers via MTS messaging on any problems encountered, such as vehicle operation, traffic, enemy interdiction etc.

How MTS affects motor transport and sustainment operations in ways beyond the primary technology's purpose to truly maximize efficiency and meet Objective Force requirements has yet to be thoroughly investigated.

The literature on RF-Tag technology explored its primary uses, evolution and future prospects of employment. Army movement control teams will use RF-Tags in operations to monitor cargo flow through transportation nodes. RF-Tag technology will allow logisticians to know where cargo is located on the battlefield. ITV of equipment, cargo and supplies is essential as they move through the battlefield distribution system, which is critical to project the force and sustain the mission. RF-Tags are small coded tags having the ability to send or receive information. Logisticians write the shipment information of the cargo to the tag, which is then placed, on the cargo. Other logisticians can read that information as the cargo flows through the distribution system. At key nodes in the system, an antenna or "interrogator" automatically reads the information on the tag and passes it on to a central database (CASCOM MTS STRAP 2001). Logisticians using hand held interrogators read and write this information to tags. This technology may then provide near-real time nodal ITV via the global transportation

network and ultimately total asset visibility (CASCOM MTS STRAP 2001). RF-Tags will save time, as containers no longer need to be inventoried enroute to identify cargo. Other advantages to RF technology include: ability to locate inaccessible cargo quickly in a large distribution node, reduction in written documentation and quick identification of source supplier and customer data.

RF-Tag technology linked with the MTS system on the FTTS is a primary goal of the technology. This application will provide true ITV from origin to destination as the FTTS with MTS will have the ability to read and report its load data.

MTS and RF-ID tags are both key enablers to providing in-transit visibility and status of the Army's 'inventory in motion' and will provide value well beyond their cost; however, when they are integrated, together they have the capability to effectively provide commanders with unrivaled visibility of their cargo and assets as well as the ability to influence the movement of the material in order to meet changing mission requirements. (CASCOM MTS Information Paper 2002)

The implication of this technology to motor transport presents the greatest opportunity for change. CASCOM exploration of the primary benefits of this future technological development noted:

MTS provides the ability to report Arrival/Departure.

A vehicle with an MTS RF-Tag identification interrogator acts as a critical node point.

MTS has the capability to establish "hasty" warehouses or caches.

MTS has the capability to close out a tag.

MTS has the capability to report last known location or constant update for current location of module-racks and trailers to TC AIMS II/GCSS-Army for accountability purposes. (CASCOM MTS Information Paper 2002)

The catalyst for change is the merger of the Objective Force requirements with technology. To attain the distribution based sustainment demanded by the Objective

Force; motor transport requires that it have the capability provided by these technologies. These technologies have secondary effects on sustainment and distribution structure and operations. The sustainment distribution system concept is neither policy nor doctrine (FM 55-80 1997). Documentation that assesses secondary effects of the FTTS with MTS and RF-Tag technologies on the future system is not currently available.

Review of DOTLM-PF Literature

The review of DOTLM-PF literature focuses on the Army's TRADOC Pamphlet 71-9, *Force Development Requirements Determination*, a research project, *Maintaining and Sustaining the United States Army in the 21st Century*, by LTC Fred L. Hart Jr.; and a thesis, *A Logistics Corps: Does the Ongoing Revolution in Military Logistics Demand One?*, by Randolph G. Haufe. DTLOMS was the precursor to DOTLM-PF and is referenced in these documents that use the older acronym. The only difference is "personnel" replaces "soldiers" and "facilities" is added. For the analysis of the impact of corporate concepts on the FTTS sustainment distribution system in this thesis, DOTLM-PF is used. TRADOC Pamphlet 71-9 describes the process for how to determine, document and approve war-fighting requirements in the domains of doctrine, organization, training, leader development, materiel, personnel and facilities. Hart and Haufe provide supporting information to explain the use of the DOTLM-PF model. "The DTLOMS model provides a methodology for examining potential 'change agents' in the RML initiatives," (Hart 1998, 2). For analysis in chapter 4, change agents are the corporate concepts that energize changes to the logistics force DOTLM-PF to attain requirements of the OF.

TRADOC Pamphlet 71-9 explains how the Army produces its future force through the application of the DOTLM-PF methodology. CASCOM is the Directorate for Combat Developments (DCD) for Combat Service Support (CSS) units and is responsible for the Requirements Determination process to develop CSS concepts (CASCOM Transportation Project, 2002). When DCD addresses a new supporting concept they develop a list of Future Operational Capabilities (FOCs). FOCs are structured statements of desired operational capability that establish the foundation upon which Army requirements are based to achieve the progressive ideas articulated in HQ TRADOC- approved concepts (TRADOC Pamphlet 71-9 1999, 6-2). Figure 3 depicts the requirements determination process and the DTLOMS model application to achieve FOCs that support the capstone and subordinate concepts.

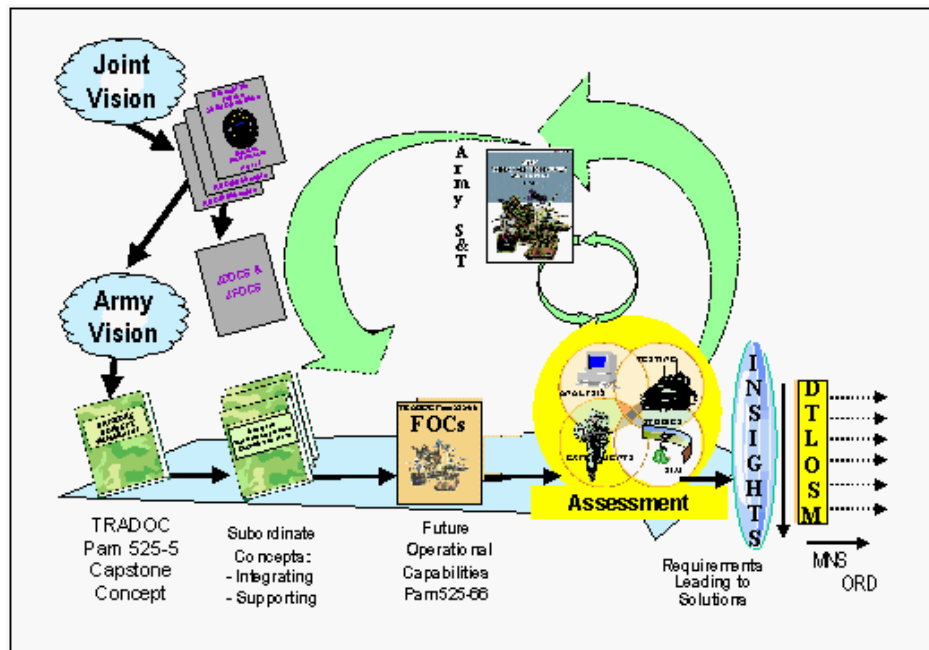


Figure 3: Requirements Determination Process Overview (TRADOC PAM 71-9 1999)

The application of qualitative analysis of corporate concepts to the OF FTTS sustainment distribution system and determination of the effects these concepts enact on DOTLM-PF demands a multifunctional approach. Randolph Haufe highlights that CASCOM's DOTLM-PF development process is deficient for multifunctional development because of the separated principle directorates of CSS, Quartermaster, Ordnance and Transportation. He states that this functional approach towards DOTLM-PF development forces the functional DCDs to compete with one another for resources, which hinders the ability of combat developers to develop sustainment distribution-based logistics DOTLM-PF that support the ongoing RMLs (Haufe 2001, 32). Haufe is persuasive in his argument for a Logistics Corps to replace the fractured CSS Development and Management Structure. He argues that combat developers are torn between allegiance to their functional corps and the demands of the multifunctional sustainment distribution concept. Priorities across the DCDs differ undermining the team approach (Haufe 2001, 88). Multifunctional sustainment distribution DOTLM-PF development requires a single manager. He argues that a Logistics Corps would consolidate responsibility for distribution DOTLM-PF development under a single organization. I build off Haufe's Logistics Corps DOTLM-PF Development and Management Structure (figure 4) and use it to visualize the impacts of the corporate concepts applied to the FTTS sustainment distribution system in the UE.

Logistics Corps DTLOMS Development and Management Structure

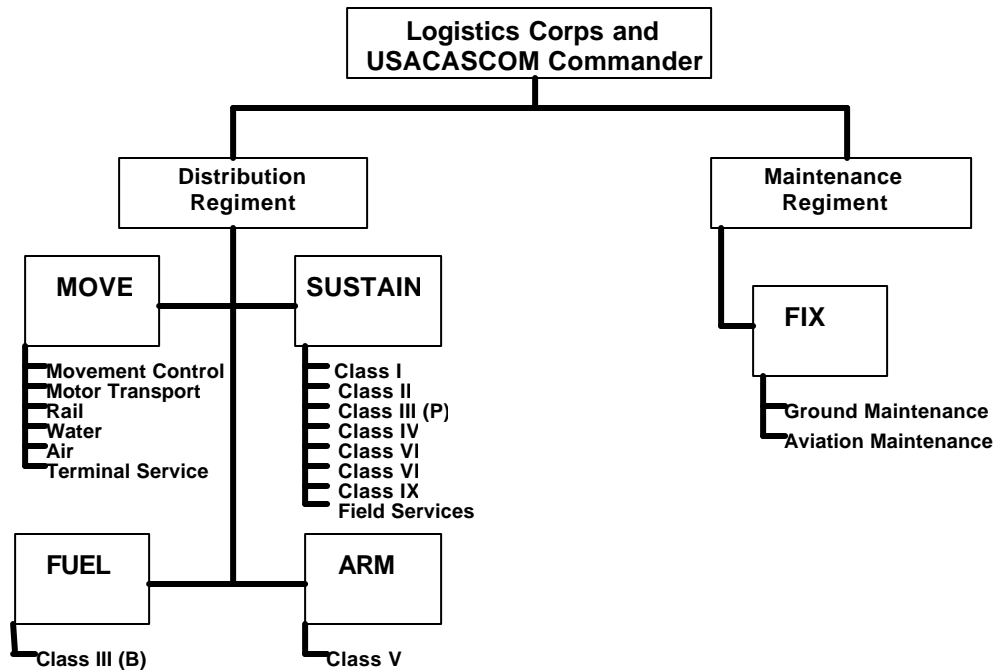


Figure 4: Logistics Corps CSS DTLOMS Development and Management Structure
Source: (Haufe 2001, 93)

Haufe's model allows for the multifunctional focus required to identify changes to logistical DOTLM-PF that will maximize the system. It is also the next logical step to exploit Haufe's forward-looking DOTLM-PF approach.

Schneider National Trucking, Wal-mart and Burlington Northern-Sante Fe Railroad Review of Selected Corporate Models

The FTTS provides the Army with an opportunity for significant, even revolutionary change. This thesis explores three top companies from corporate America for insights to qualitatively identify effects of corporate concepts on the FTTS

sustainment distribution system and possible changes to DOTLM-PF energized by those concepts. Schneider National Trucking, Wal-Mart and Burlington Northern-Sante Fe Railroad are the selected companies for study. All three have key operational practices that the Army would like to emulate in practice to attain similar quality results. All three use a regional hub distribution and management system to maximize performance. Each is a leader in their business and has operations, methods and practices that provide conceptual solutions to the Army as the Army visualizes incorporation of the FTTS into a distribution based sustainment system.

Schneider National was selected for several important reasons. First, they are one of the premier trucking companies in North America. Second, they have pioneered the infusion of technology into the primitive trucking industry, leading the way as an example of how to execute ground distribution at maximum effectiveness. A literature review of Schneider National is limited. This is due, in part, to their status as a private company, which negates interested stockholders and financial institutions from demanding information and business media from writing stories. Schneider, however, is very open about what they do and how they do it due to their ability to produce quality service. Their web site is a source for information on the company. Schneider National, founded in 1935, operates 14,000 tractors, 40,000 trailers and has partnerships with over 6,000 carriers (Schneider 2003). Schneider covers more than five million loaded miles per day and is utilized by two-thirds of the Fortune 500 companies. They operate out of 36 operating centers in North America (Schneider 2003). Ranked number one by the Logistics Management & Distribution Report Quest for Quality in 2001, this trucking company has a great deal of conceptual logistics knowledge to offer the Army.

Although Schneider drivers do not operate in a combat environment, their primary mission is the same as their soldier counterparts in the Army. Schneider National moves all types of commodities in a timely manner to satisfy their customers' needs and missions. The innovative transportation solutions they have designed to solve customers' transportation requirements may, when applied to the Army's requirements in the FTTS sustainment distribution system, maximize effectiveness of sustainment support in the OF.

Schneider was the first carrier to install a two-way satellite communication system in all 6000 of their over-the-road trucks in 1986. Schneider's experience with over seventeen years of MTS technology is a valuable resource. Schneider continues to lead the trucking industry in applying technology to their distribution system by consistently upgrading their MTS and hub support structure.

Schneider built their operation from the driver and vehicle up, understanding that the driver and vehicle team is the key to mission success in the distribution system. The rest of the company personnel and infrastructure focuses on supporting that driver/vehicle team to ensure all commodities arrive to the proper client at the right time. Their success and high degree of quality service is an example to other organizations that desire similar results. Their use of technology and concepts appears to have application to the soldier/vehicle (S/V) team in the FTTS sustainment distribution system.

A literature review of Burlington Northern-Sante Fe Railroad (BNSF) does not reveal any sources that connect railcar distribution management concepts to the FTTS sustainment distribution system. However, my research notes the similarities between railcars and the FTTS module-racks. Using CASCOM's identified configured load (CL)

sustainment module-rack, I conceived additional module-racks to carry and store bulk commodities (figure 5).

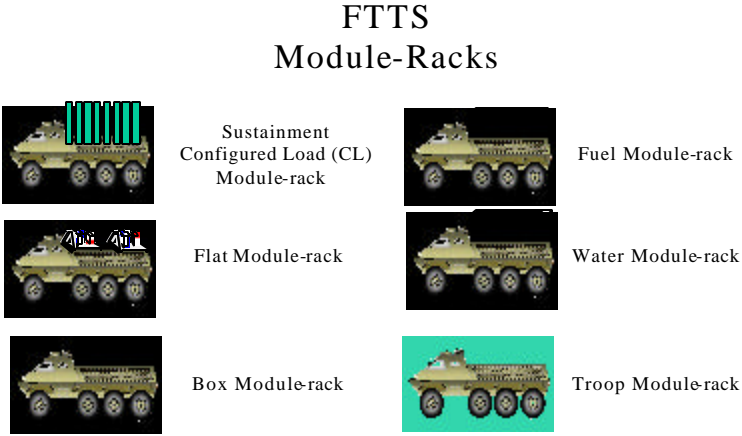


Figure 5: Module-racks

The FTTS carries these various types of twenty-foot module-racks, which the hydraulic lift arm can load onto its chassis. The FTTS carries all commodities on the battlefield on module-racks just as railcars carry all manner of commodities on rail. Each module-rack represents the specific types of commodities, similar to railcars. For instance, there is a fuel module-rack that would hold 2,500 gallons, self serve pump capable, and stackable contained in a twenty foot International Standards Organization (ISO) frame. There is a box module-rack for dry goods in the various classes of supply and a reefer module-rack for perishable foods. There is an open box module-rack for commodities as well as covered troop carrying module-racks to transport soldiers. There

are sustainment module-racks designed to carry multiple commodities at the same time and made for configured loads prepared outside of theater.

The similarities between commodity type railcars like box, flat and tanker and their counterparts in the FTTS module-rack system are investigated to observe any valuable concepts that apply to railcar management that carry over to FTTS module-racks. To avoid supply-based problems these various module-racks of all types require effective management on the future battlefield. If efficient concepts are not adopted, mountains of module-racks will replace mountains of supplies with timely support jeopardized. The most significant similarity is that both railcars and module-racks are the limiting factors for the commodity pipeline. The number of module-racks on the battlefield determines the maximum amount of commodity uploaded and ready to go at anyone time just as the amount of railcars available determine the amount of commodity that could be moved. Once the commodity is removed from the railcar or module-rack this empty platform has to be relocated and reloaded which makes management of empty module-racks extremely important to the overall operation and battle-rhythm of the FTTS sustainment distribution system.

Although a literature comparison between railcars and module-racks does not exist, a literature review of BNSF and railroad management concepts in general explores these concepts to identify possible parallels with the FTTS sustainment distribution system. Based on a review of their website, BNSF is a premiere national railroad company headquartered in Fort Worth, Texas that operates one of the largest railroad networks in North America, with 33,000 route miles covering twenty-eight states and two Canadian provinces (BNSF 2003). The railway moves more inter-modal traffic than any

other rail system in the world; making it the proper choice for this study. The challenge to BNSF is managing their distribution system to maximize timeliness and service. They are responsible for transporting commodities from grain and coal to chemicals and automobiles. As with the Army, BNSF strives to provide exceptional support services by having the right people and the right systems in place at the critical times.

BNSF has regional hubs called Network Operations Centers. These regional hubs allow for the integration of dispatchers and other operations people to quickly and efficiently coordinate their efforts to make decisions and to provide for ready access to real-time information needed to make those decisions. Part of that management is to ensure the railcars with lift capability are sufficient for the customer's mission. The similar challenge for the Army with FTTS is to manage module-racks to ensure timely delivery to UAs, efficient retrograde management of empty module-racks and reload operations to maximize the volume of the FTTS distribution pipeline.

Major Tom White's MMAS thesis (1988) explored the inner workings of Kansas City Southern (KCS) Railway and their enhancements to optimize operations. Although a smaller company than BNSF, KCS faced the same operational issues of managing their fleet. Major White focused on the full spectrum of the company's operation, briefly describing railcar management policy.

A team of railcar managers used an automated tracking system to monitor the location and status of railcars. For a customer who did a large volume of business with KCS, car managers dedicated a group of cars, known as a pool, to service that particular customer. Whenever the pool cars unloaded anywhere in the system, they were automatically routed back to the station to serve their designated customer. Once the size of the pools had been determined, pool cars operated without further involvement by the car managers. Railcars that were not assigned to a pool were known as *free-runners* and were assigned on a case by

case basis. If necessary, free-runners were used to augment pool cars to meet spikes in demand at the pool locations. (White 1998)

White's quantitative analyses using embedded optimization as a simulation on KCS's gondola railcar fleet management concluded that using the entire gondola fleet as free-runners, instead of pooling railcars for specific customers, was the most timely, reliable and affordable method for optimized customer service. In contrast, the Army's legacy force assigns its lift platforms down to company level. There is a case made to keep module-rack ownership at theater level and create a "free-runner" environment for module-racks to flow through. White concluded the free runner environment is the most effective.

The management techniques, tools and concepts BNSF managers use to maximize railcar management could possibly assist the Army in future management of module-racks on the battlefield.

A literature review of Wal-Mart's premiere distribution system reveals the effectiveness of their methods. Wal-Mart sets a great example for the Army because it attacks management of physical distribution with a ferociousness not seen in any other company.

Distribution has been so successful at Wal-Mart because senior management views this part of the company as a competitive advantage, not as some afterthought or necessary evil. And they support it with capitol investment. A lot of companies don't want to spend any money on distribution unless they have to. Ours spends because we continually demonstrate that it lowers our cost. This is a very strategic point in understanding Wal-Mart. (Walton 1982)

Joe Hardin
Executive Vice President, Logistics and Personnel

A recent article in *Chain Store Age*, a New York business periodical, points out that Wal-Mart owes much of its success to ability to self-distribute merchandise from a

vast network of modern distribution centers. Wal-Mart divides the country into regions served by a distribution center in each region, which supplies all the stores that are within one day's local haul. Sam Walton, Wal-Mart's founder ensured this by flying his personal plane on reconnaissance missions to scout for new distribution center sites strategically located to supply the front line stores. Wal-Mart operates sixty two distribution centers; serving this distribution network was one of the largest private truck fleets in the country with more than 3,000 tractors and 12,000 trailers having an on time delivery record of 99.5 percent (Refrigerated Transporter 2002). These distribution centers sole focus is on timely re-supply of Wal-Mart stores while keeping inventory footprints low. This network allows speedy deliveries and cost management discipline making Wal-Mart the most efficient retail supply distributor in the world.

Wal-Mart, like Schneider, has been an innovator of new technology. They apply technology to their distribution system to attain maximum effectiveness. Wal-Mart, using its own satellite communication and information system tracks the timely movement of resupply from the distribution centers to meet the needs of front line stores. Michael Schrage in *Wal-Mart Trumps Moore's Law* describes the key to Wal-Mart's success.

The technology that went into what Wal-Mart did was not brand new and not especially at the technological frontiers, but when it was combined with the firm's managerial and organizational innovations, the impact was huge. (Schrage 2002)

The Army, as it applies the FTTS technology to the force, has to look beyond the baseline technology and discover innovations in structure, organization and systems to maximize effectiveness of the FTTS. Wal-Mart is the retail industry leader in inventory distribution

and supply replenishment, a feat that Army logisticians would like to emulate for their customers on the battlefield.

The literature review of Wal-Mart discovered gaps in the application of their successful Distribution Center concepts as compared to possible applications to the Army battlefield distribution concept. Although the armed services follows Federal Express's use of aerial hub and spoke systems in Europe and Wal-Mart's just-in-time inventory for class IX in garrison; which achieves great success, the Army battlefield distribution system has not looked to Wal-Mart for concepts on the battlefield. A qualitative analysis of Wal-Mart's distribution system in chapter 4 will attempt to fill that gap and provide conceptual insights to produce changes to DOTLM-PF that may maximize FTTS effectiveness and the OF sustainment distribution system.

The literature review of the three selected corporations reinforces the need for the Army to investigate distribution management concepts from corporate leaders in the world today. Although the Army operates in a very different environment, quality sustainment and distribution concepts at their simple base have similar effects that provide opportunities to attain the efficiency of those stellar corporate organizations. Schneider Regional Operating Center concepts allow for the driver/vehicle team to focus on their mission and customer. BNSF railcar management concepts allowed for BNSF frontline workers to stay focused on running a highly efficient railroad to meet their mission and satisfy their customers. Wal-Mart Distribution Center concepts allowed for timely delivery and inventory stockage of stores, which allow the store managers to focus on the art of the sale and their customer. These proven distribution management concepts incorporated into an Army FTTS sustainment distribution system may allow logisticians

the ability to maximize the system's effectiveness and gain the trust of their customers; the war-fighters. This may then free up the war-fighter to focus on execution and the proper course of action to defeat the enemy on the battlefield.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

The objective of this thesis is to identify corporate concepts that can effectively leverage the FTTS technology to maximize the distribution based sustainment system of the OF. To achieve this end, parallel corporate concepts are analyzed. This chapter describes the qualitative analysis approach used to identify concepts and how they are applied to the FTTS in the UE sustainment system. The first section identifies the features of qualitative analysis that apply to this study. The second section describes the process for identifying the model used to apply corporate concepts to the FTTS sustainment distribution system. The third section describes how concepts are applied as change agents to drive change to DOTLM-PF to facilitate employment of corporate concepts to the FTTS in the UE.

Qualitative Research

The underlying theory of qualitative analysis focuses on discovery, insight and understanding through the eye of the researcher. In contrast to quantitative research, which takes apart a phenomenon to examine component parts, qualitative research can reveal how all the parts work together to form a whole (Merriam 1998, 6). The multitude of primary and secondary effects the FTTS technology has on the OF distribution system at this early stage of development requires a qualitative eye. One issue is that FTTS will not be fielded until 2008; quantitative testing of the actual FTTS within a distribution system is still years off. UE organizational and mission planning; however, is currently under study and that fact necessitates qualitative analysis for insight to build an efficient

OF sustainment distribution system with FTTS. Although individual aspects of technological efficiencies have to be quantitatively analyzed in the future as the FTTS is fielded and incorporated into a distribution system, the conceptual applications of the FTTS to this system are readily observable and communicated through the qualitative research method. The concepts of the three corporate distribution systems investigated affect whole systems that have many moving parts. Select corporate concepts are applied to the FTTS distribution system in the UE to draw conclusions and recommendations.

Qualitative research usually requires fieldwork with the researcher physically going to a location to observe and record the desired phenomenon. In this study, fieldwork was performed at Schneider National's Operations Center in Des Moines, Iowa and BNSF Railroad Operations Center in Kansas City, KS. Interviews were performed and operations observed to view selected concepts in action. Qualitative research also relies on document data collection to draw insights. Wal-Mart is very protective of their corporate distribution operations in the highly competitive retail business; however, through telephonic research as well as document resources in print and on-line, a qualitative conceptual observation is drawn for the purposes of this thesis.

Qualitative research primarily employs an inductive research strategy (Merriam 1998, 7). For instance, this thesis builds concepts for the FTTS distribution system that feed the theory that corporate distribution concepts provide models for the OF that maximize the efficient use of FTTS. The observed data and explanation of data in narrative form inductively derives concepts that drive changes to legacy DOTLM-PF to attain OF requirements.

The qualitative method includes descriptive words and pictures to describe concepts and applications. This allows clear explanations of concepts as they apply to the OF, still in its early stages of development. Conclusions are allowed to grow from deductions drawn from the data. Pictures, diagrams and narratives are used to depict the effects of corporate concepts on the FTTS sustainment distribution system in the UE.

In summary, this thesis began with a broad philosophical assumption that top corporate distribution systems can assist Army planning as it builds out the OF FTTS sustainment distribution system. Data collection through techniques such as interviews, observations and documents are used to identify conceptual themes. These conceptual themes are explained and applied in the analytical narrative in chapter 4. The qualitative study used for this project fosters understanding of the phenomenon; process and concepts employed in the distribution systems of three highly successful corporate subjects to facilitate insights, which attempt to answer the thesis' primary question.

Model

The model for analysis of data from the three corporate subjects is derived from conceptual themes incorporated in all three and relating to the FTTS sustainment distribution system in the OF. Leaders in their industries, the three subjects were selected for their ability to maximize their operational effectiveness in the distribution operation of their individual corporate mission. Each operation uses a form of the hub and spoke distribution system to maximize speed and quality of service. The hubs consist of centers that manage and support the flows of equipment and the commodities they carry. Schneider created area operations centers for driver/vehicle team care and support to ensure a high state of mission readiness of equipment and drivers to meet customer

needs. Wal-Mart developed area distribution centers to receive, manage and disburse commodities to their front line stores using their own private truck fleet. BNSF developed old rail nodes like Kansas City into an operations center to manage railcar positioning and movement of commodities to and from their customers. The conceived base model for the UE Sustainment Center is the area operations center theme that is borrowed from the corporate examples (figure 6).

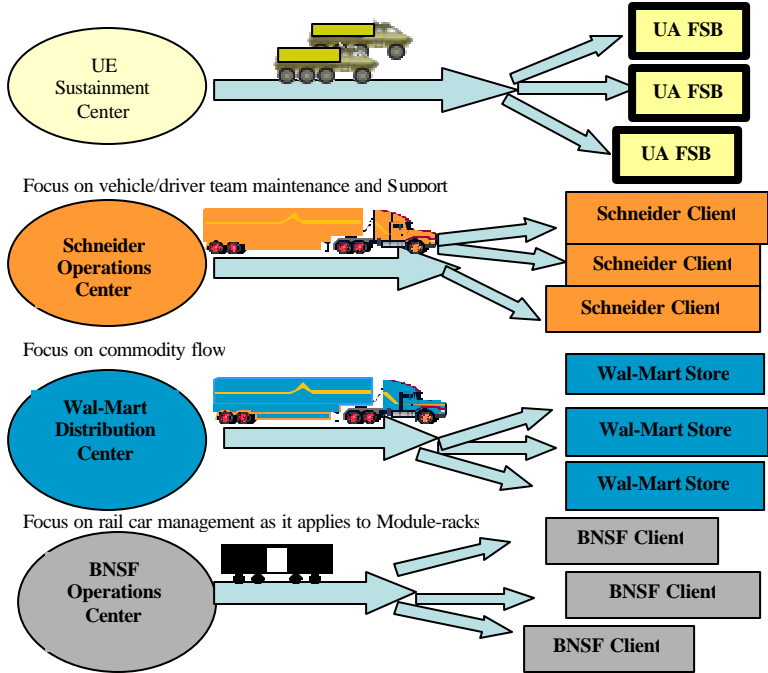


Figure 6: Area Operation Centers

The model is defined further to produce a viable organization structure that presents the best opportunity to identify affects of the concepts on the OF sustainment distribution system and answer the thesis’ primary and secondary questions. The

following organizational structure for the FTTS sustainment distribution system was conceived through research of the OF in chapter II and applicability to the analyzed corporate concepts (figure 7).

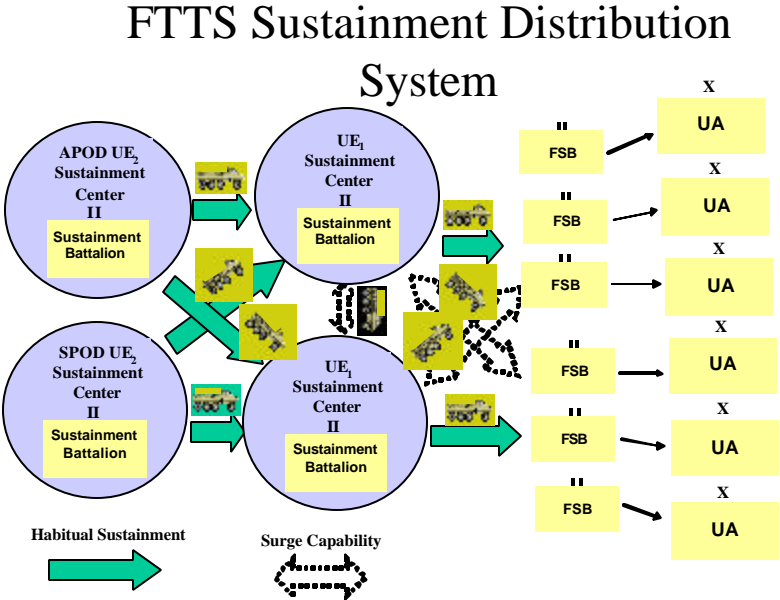


Figure 7: FTTS Sustainment Distribution System

In the absence of published UE Organizational data, this structure is used for facilitation of corporate concept analysis for this thesis. UA Forward Support Battalion data is based on published CASCOM briefings. The UE sustainment center consists of a sustainment battalion, which is made up of a headquarters, three distribution companies and one maintenance company (figure 8). Each distribution company has 74 FTTS, the backbone of the sustainment distribution system.

Sustainment Battalion

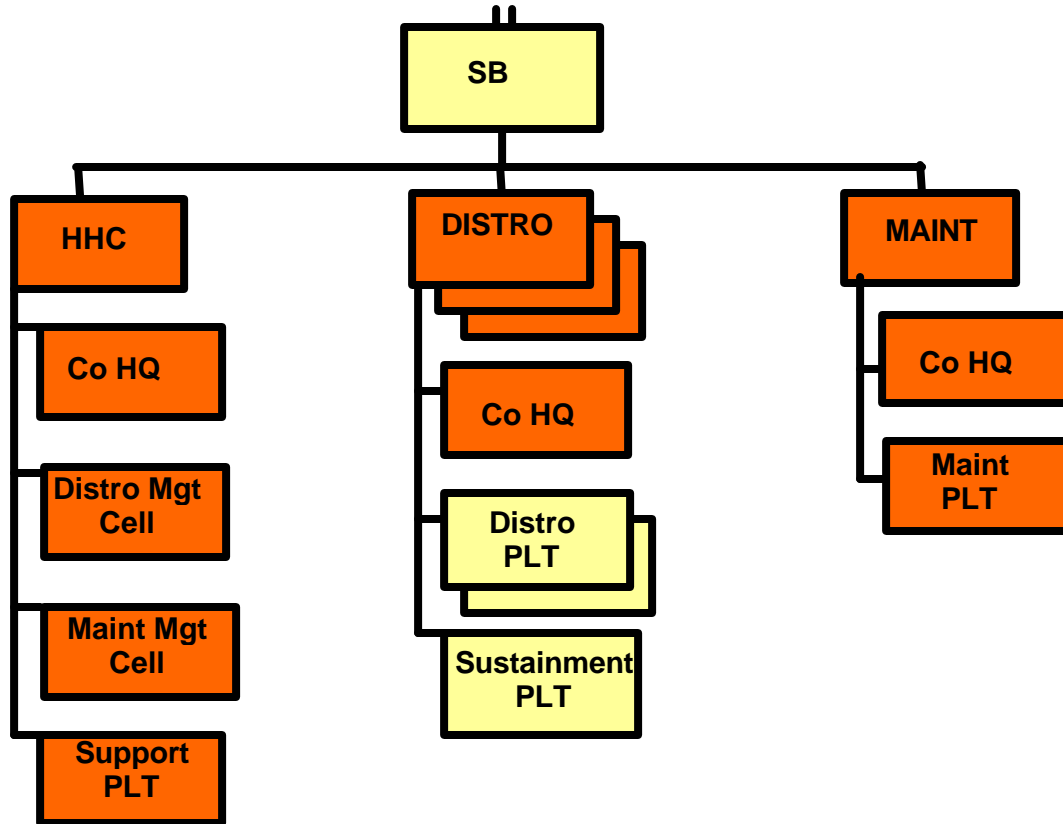


Figure 8: OF UE Sustainment Battalion Model

To stay within the limitations of the study while maximizing findings, the base model conceptual theme focuses on specific concepts from each corporate subject. The study focuses on Schneider's operational concepts for maintenance and driver support at the operations center to draw insights on possible concepts for FTTS soldier/vehicle (S/V) team life support, maintenance and care in the UE Sustainment Center. BNSF was observed to derive tools for maximizing railcar management that could assist in the FTTS

module-rack management efficiency in the UE Sustainment Center. Wal-Mart's distribution center operational concept was researched to investigate commodity and inventory flows and how that relates to the FTTS in the UE Sustainment Center. The application of these corporate concepts to the FTTS based UE Sustainment Center creates change to legacy logistical units like the motor transport company. These changes are explored to provide insight on possible ways to maximize the efficiency of the FTTS based sustainment distribution system.

Change Agents

Change agents are the catalysts that provide the energy for change. Similar to a free electron that attaches to an atom to create an ion, the change agent is a corporate concept that applies to OF logistical DOTLM-PF that energize changes in the force to attain OF requirements. Change agents applied within the confines of the UE sustainment center model and derived from qualitative analysis set the theory and the parameters for the methodology of this study. The linkage of corporate functions to FTTS sustainment distribution system functions and the produced change agent effects on DOTLM-PF are presented in the Concept Analysis Card format depicted in figure 9.

<p>Concept Analysis Card</p> <p>Concept:</p> <p>Application to FTTS Sustainment Distribution System:</p> <p>Conceptual Change Agent:</p> <p>Change Agent effect on Doctrine:</p> <p>Change Agent effect on Organizations:</p> <p>Change Agent effect on Training:</p> <p>Change Agent effect on Leadership Development:</p> <p>Change Agent effect on Material:</p> <p>Change Agent effect on Personnel:</p> <p>Change Agent effect on Facilities:</p>
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Figure 9: Concept Analysis Card

Chapter Summary

The four Concept Analysis Cards developed in this study help to depict possible impacts of the selected corporate concepts on the FTTS sustainment distribution system. The OF sustainment center model with a sustainment battalion, headquarters, distribution and maintenance companies is the model used to apply the corporate concepts to the OF. Although the OF UE units are not published at the time of this writing, the model is in line with CASCOM preliminary structure. The qualitative methodology used in this thesis provides the researcher the ability to look at a separate concept or mix of concepts to apply to the FTTS in the UE. It also provides the opportunity to develop and apply the corporate concepts to the OF sustainment distribution system through one's own

interpretive view scope. The intent of the presented model is to create a framework to present answers to the primary and secondary thesis questions that apply successful corporate concepts to logistical DOTLM-PF to maximize the FTTS sustainment distribution system.

CHAPTER 4

ANALYSIS

Introduction

This chapter analyzes the conceptual research discovered through documents and fieldwork pertaining to the three corporate subjects: Schneider, BNSF and Wal-Mart. The development of concepts applied to the FTTS based distribution system derive from discovery, insight and understanding of selected corporate concepts as perceived through the eye of the researcher. Concepts are applied to the OF FTTS sustainment distribution system and impacts recorded based on the author's interpretation and visualization. Analysis answers the supporting thesis questions of how corporate concepts apply to the FTTS based sustainment distribution system could induce change that maximize the system and meet the requirements of the OF. The applied concepts, described as change agents, are conceptual catalysts for change to DOTLM-PF to attain maximized results of the FTTS based sustainment distribution system.

The qualitative analysis model described in Chapter 3 is used to develop the analysis. The model consists of five parts:

The corporate function that the concept enables is identified and described to lay the foundation of the concept and how it was used by the corporate entity.

Possible application to the FTTS based sustainment distribution system is interpreted and visualized through qualitative analysis.

Concept as a change agent and why it is a catalyst of change that can transform the force is interpreted through qualitative analysis.

OF requirements impacted by the concept are interpreted through qualitative analysis.

Effects the change agent has on DOTLM-PF are interpreted through qualitative analysis.

Using the qualitative model I produced four Concept Analysis Cards for each analyzed concept. The card is an information document to gain insight on possible conceptual applications for the FTTS sustainment distribution system. The research produced four Concept Analysis Cards based on corporate concepts discovered while exploring the following four corporate functions: Fleet management, maintenance management, module-rack management and distribution management. Corporate concepts embedded in the four functions to produce proven maximized results are discussed via the model to identify possible application to the FTTS based sustainment distribution system. The analysis cards that resulted from the qualitative analysis are presented below.

Concept Analysis Card #1

Corporate model: Schneider National Corporation

Corporate Function: Fleet Management

Fleet management is defined as the function of how Schneider manages their line-haul driver and vehicle (D/V) teams to maximize the effectiveness of the fleet to achieve corporate operational goals. Schneider employs a concept that provides structure, support and efficient management to their D/V teams to maximize operational time for served customers.

Schneider employs twelve regional operations centers and sixteen smaller service centers strategically in the United States to facilitate fleet management. D/V teams are usually employed in the system for two to three week tours (Halder 2003). When employed into the system after a two to four day recuperation period, they enter from the

closest home station operations center. Each D/V team is assigned a Service Team Leader (STL) as their primary leadership contact. Each STL has forty to sixty D/V teams under their supervision (Halder 2003). Similar to Army platoon leaders, the STL is responsible for the welfare, care and support of their assigned D/V teams.

STLs operate out of the operations centers and supervise their D/V teams via the MTS. The STLs are responsible for providing a status of their assigned D/V teams to the home office operations center in Green Bay, Wisconsin to facilitate mission orders. Missions are sent down from Green Bay and filtered through the STLs to identify any conflicts before assignment to a D/V team. Monitored by their STL on MTS; the D/V team executes the assigned missions. Upon completion of the one mission, the STL provides orders from the home office to execute a follow-on mission via MTS. This process continues until the tour is complete. During this time the STL provides coordinating instructions, assists with any issues the D/V team may have and tracks customers' loads. Although the STL at the D/V team's home station is the primary supervisor, the team is allowed to stop at any Schneider operations center along its routes to access field support.

Operational and service centers provide field support for the D/V teams throughout the tour. The centers have a field desk area, which each driver reports to upon arrival. This allows the center accountability of all D/V teams in its area. The field desk provides information for the D/V team and assists the D/V team in their field needs. A fuel station is provided for quick fueling and fluid refills/checks. Co-located with the re-fuel point is a small repair shack that allows the driver to switch out common parts i.e. bulbs and windshield wipers (higher echelon maintenance is performed at the operations

center maintenance facility and is addressed in Analysis Card #2 as a separate concept). For the drivers' needs, the center provides a feeding area, shower facility, laundry, phones, fax, and entertainment center with games, TV, mini-mart store, and computers for personal use. The D/V team takes advantage of this field support during or in-between missions to recuperate, re-fit, and refuel. These stops are designed as pit stops to execute as needed during the two to three week tour. Although the D/V team driver may have stopped at several operations centers during his tour, he is still responsible for communicating status and issues to his STL back at his home operations center (Halder 2003).

The concept of STLs as front line supervisors integrated and synergized within an operations center support concept to D/V teams throughout the area of operations is unique to Schneider (Halder 2003). Schneider's record proves itself as extremely effective in timely first class support and responsiveness to customers. Schneider also provides superior care and support to their D/V teams. This fleet management concept is the model used in this thesis to provide similar results for the OF FTTS sustainment distribution system.

Concept Application to OF: Schneider fleet management concept applies to the FTTS fleet management UE₁ sustainment center model depicted in chapter 3. The sustainment battalion in the UE sustainment center manages FTTS operations from a distribution management cell. Support operations officer (SPO) is primary manager of the distribution management cell. Distribution platoon leaders (DPL) and platoon sergeants (DPS) monitor, supervise and care for assigned FTTS S/V teams from a distribution company operations cell using MTS. The platoon leadership feeds status of platoon FTTS

S/V teams to the battalion distribution management cell. The sustainment battalion headquarters company support platoon sets up and manages convoy service centers (CSC), which facilitates field support for S/V teams.

Conceptual Change Agent: The concept induces change to achieve the OF goals of timely support and maximum efficient use of the FTTS while simultaneously taking care of soldiers. Thus, it is a catalyst for driving change to DOTLM-PF to attain desired results that have been proven in Schneider's business practice.

OF Requirements Impacted:

Sustainable: Integrated fleet management concept provides greater efficiency in the sustainment system due to increased FTTS S/V team operational time to support customers.

Trainable: S/V teams not only train basic skills, but how to operate in the FTTS sustainment distribution system.

Versatile: Schneider's fleet management concept will allow full strength of theater FTTS fleet to be on call for support and to react quickly to the changing battlefield.

Responsive: MTS communication will allow the S/V teams to stay out on mission for a tour of multiple missions without having to return to home base after one turn.

Agile: The concept will allow the FTTS sustainment distribution system to stretch and absorb surge requirements with the ability to keep S/V teams on mission.

Change Agent Effect on Doctrine: The concept is a change agent because it provides the energy to drive change to doctrine to attain the desired OF requirements above. This concept acts as a change agent to doctrine due to the maximized effect it will have on the FTTS in the OF. Based on the literature review in chapter 2, the following changes to motor transport company doctrine may occur when this concept is incorporated.

Schneider's fleet management concept energizes change to doctrine that removes the layer of support for each individual motor transport company and consolidates it as a distribution company in the UE sustainment battalion with distribution platoons of FTTS-S/V teams. The sustainment battalion headquarters company support platoon provides field support in the form of a CSC, not only for their assigned FTTS S/V teams, but also for all those in the theater fleet that visit the CSC for field support.

The tasking authority flows from the SPO and the distribution management cell through the DPL/DPS to the FTTS S/V teams via MTS.

In the UE sustainment battalion, any FTTS assigned to the battalion's distribution management cell is available for mission assignment.

The FTTS S/V team deploys as a single entity or as a member of a group of FTTS S/V teams. It requires a UE sustainment center distribution management cell to task it, a CSC to support it and a DPL/DPS to supervise it.

The DPL and DPS have a more digitized, than direct role on the influence of their S/V Teams on the battlefield.

DPLs/DPSs supervise and manage the S/V teams, and the classes of supplies transported in the module-racks. MTS with RF-Tag readers provide ITV for every load bearing module rack that is uploaded on a FTTS. The DPLs are multifunctional officers who not only understand movement of commodities, but also specialty requirements of each class of supply.

Change Agent Effect on Organizations: The energy that drives changes to organizations is derived from the OF goal of a smaller logistics footprint while simultaneously maximizing efficiency of the system.

The UE sustainment battalion headquarters, distribution and maintenance companies facilitate the FTTS sustainment distribution system.

Legacy motor transport company level bivouacs are replaced by CSCs in the UE sustainment center.

Multifunctional sustainment soldiers train in proper maintenance of up to 80% of FTTS maintenance requirements eliminating the legacy unit maintenance platoon.

CSC life support function reduces repetitive company structure in theater.

Change Agent Effect on Training: The advantages of the S/V team as a system within a system is the energy that drives changes to training to employ this concept. The S/V team has to have situational awareness of their place as an individual FTTS team on the battlefield and also how they fit into the FTTS sustainment distribution system as a whole. This concept gives the S/V team the umbrella of supervised autonomy. Although directed, supervised and monitored by the DPL/DPS via MTS, the S/V team is autonomous on the battlefield, moving from one mission to the next, one convoy element to another, to facilitate maximum efficiency and logistics flow to the sustainment distribution system.

Training focus is not only on basic FTTS driver manual skills such as PMCS, operation of hydraulics, safety and MTS and RF-Tag technology, but also on mastery of the FTTS sustainment distribution concept and how the soldier and FTTS are employed in the system.

Sustainment soldiers are multifunctional and qualified to handle and disburse the commodities moved on the FTTS module racks.

Sustainment soldiers are able to focus maintenance training on the base model FTTS to master their skills and account for up to 80% of required maintenance.

Sustainment soldiers are able to comprehend MTS technical aspects as well as conceptual; not only how to use it and maintain it, but when and why. Only critical mission messages are sent due to the limited capacity of the MTS message pipeline. The soldier learns what information is important for the DPL/DPS to know. The soldier determines how information can affect the customer and higher mission. Training focuses on higher conceptual knowledge and not just moving a supply from point to point.

Sustainment soldiers are taught, just as their infantry soldier brethren, to think and react on the battlefield within the parameters set by their leadership. This incorporated trust and discipline within the system facilitates proper soldier execution in the FTTS sustainment distribution system. Training fosters this critical aspect of system function.

The relationship between soldiers and their vehicles changes to a system oriented relationship. As the S/V team, the soldiers have a special relationship with their

FTTS. Just as a soldier/dog teams work together to forge a close relationship, so do the soldiers in the FTTS S/V teams forge close relationships with their assigned FTTS. Training facilitates this connection to assist soldiers in understanding their role as a system within a system. With the autonomy on the battlefield, also comes a greater reliance on the FTTS for survival and support needs. The S/V team spends most of their time together and that close bond increases performance of the individual S/V teams.

Training emphasizes discipline and adaptation in the system. When several FTTS are brought together for a mission from different distribution companies in the UE sustainment battalion, the soldiers automatically execute a convoy standing operating procedure that creates the convoy chain of command and S/V team roles in the convoy for execution of a mission.

Change Agent Effect on Leadership Development: The energy that drives changes to leadership development are derived from the goal of positioning knowledgeable leaders in the FTTS sustainment distribution system to enable maximization of the system.

Leaders develop skills to manage their S/V teams.

All leaders are multifunctional with a core base of skills.

DPLs and maintenance platoon leaders (MPLs) in the UE sustainment company are multifunctional with expert identifiers from electives earned at the basic course to enhance their positional knowledge.

NCOs are multifunctional with an in depth understanding of the FTTS and the sustainment distribution system.

NCOs in the distribution platoons learn, not only how to execute as a part of the S/V team in the system, but also the standing operating procedures for discipline, structure, and command and control of FTTS convoys.

Change Agent Effect on Materials: The energy that drives change to materials is the OF goal of fewer materials required (footprint) to support the mission.

A more agile, responsive fleet allows for lower inventories scattered across the battlefield thus requiring less materials to move and support.

Single truck vehicle type (FTTS) reduces required class IX and maintenance assets.

Mountains of supplies are replaced by responsive distribution of commodities on module-racks.

Change Agent Effect on Personnel: The energy that drives change to soldiers is the demand that the soldier comprehended the sustainment distribution system and his S/V team's place in it. Cultural understanding of his S/V team as a system within a system and how the team can effectively maximize their performance on the battlefield is a key element of system efficiency.

Soldiers become multifunctional sustainment soldiers.

Soldiers gain autonomy in the system, yet function as part of the whole and understand their place in the system.

Soldiers are knowledgeable of the MTS and RF-Tag technology and how it synergizes with their FTTS S/V team to provide managers with ITV and the COP thus maximizing the responsiveness of the system.

Soldiers attain greater knowledge and awareness of the FTTS sustainment distribution system.

Change Agent Effect on Facilities: The energy that drives change to facilities is the effort to provide responsive sustainment distribution support.

Sustainment battalion Headquarters Company sets up and manages CSC facility for S/V team field support.

CSC provides life support to S/V teams across the battlefield, which eliminates the need for company bivouacs.

Concept Analysis Card #2

Corporate model: Schneider National Corporation

Corporate Function: Maintenance Management

Maintenance management is defined as the function of how Schneider manages maintenance of their vehicles to maximize the effectiveness of the fleet to achieve corporate operational goals. Schneider employs a concept that provides structure, support and efficient management of their maintenance function to maximize operational time for customers.

Schneider employs twelve regional operations centers and sixteen smaller service centers strategically located in the United States to facilitate maintenance management. Operational and service centers provide maintenance support for D/V teams. The driver is supported by maintenance facilities located in Schneider operations centers across the country. Upon arrival of a D/V team at a center the driver reports to the field desk. This combined with MTS data allows the center to maintain accountability of all D/V teams in its area. The field desk provides information for the D/V team and assists the D/V team with field support. The driver is responsible for maintaining preventive maintenance checks and services (PMCS) of his vehicle. Schneider maintains fuel stations for quick fueling and fluid refills/checks and other PMCS issues. Collocated with the refuel point is a small repair shack that allows the driver to switch out common parts. The operations center maintenance facility performs higher echelon maintenance.

The operation centers divide maintenance into three sub-functions: programmed maintenance, frequency repairs and express visit. The programmed maintenance is scheduled based on mileage and preplanned services. Frequency repairs are un-programmed maintenance performed to fix a vehicle that requires more than one hour to fix. Express visits are maintenance jobs performed in less than an hour. The operation

centers' maintenance shops consist of two sections, one for express visits, and one for programmed and unprogrammed repairs.

When a driver has a maintenance issue during a tour, he can go to the closest operations center in his vicinity. After reporting into the field desk, a mechanic will work with the driver to verify the fault. Upon verification the D/V team will be sent to the express maintenance or the un-programmed maintenance depending on the time involved for the repair. For preprogrammed maintenance and services the D/V team will report to their home operations center at the designated time.

The Schneider concept for maintenance support, integrated and synergized within an operations center support concept throughout the area of operations is unique to Schneider (Halder 2003). Schneider receives many industry awards for this proven maintenance concept that is extremely effective in timely first class support and responsiveness to D/V teams and ultimately customers. Schneider also provides superior maintenance and support to their equipment. Schneider's concept for maintenance support is the model used to provide similar quality results for maintenance in the OF FTTS sustainment distribution system.

Application to OF: UE sustainment battalion maintenance company operates maintenance facility with three subfunctions consisting of programmed maintenance, immediate maintenance and express maintenance.

Conceptual Change Agent: The concept as a change agent provides the model for timely maintenance management in the OF sustainment center which maximizes efficient use of the FTTS. Thus, it acts as a catalyst driving change to DOTLM-PF to attain desired results and goals.

OF Requirements Impacted:

Sustainable: The class IX requirement is greatly reduced due to the common FTTS model base.

Trainable: Multifunctional sustainment soldiers who pursue a FTTS maintenance specialty identifier focus solely on the FTTS system, which allows for increased repair timeliness. These soldiers can serve in the maintenance company as FTTS level III mechanics.

Versatile: The modular nature of the sustainment company maintenance sections allows for consolidation at the UE sustainment center depending on the size of the FTTS fleet that is supported.

Responsive: Effective response from maintenance management is achieved through the triage of un-programmed maintenance to either the immediate maintenance section or express lane section depending on the time involved for repair and programmed services.

Agile: The concept allows for rapid maintenance response to fleet mechanical issues, thus preserving agility of the whole force.

Change Agent Effect on Doctrine: The energy that drives change to doctrine was the desire to attain the above OF requirements. This concept acts as a change agent to doctrine by maximizing the effect it has on maintenance management for the FTTS in the OF.

Maintenance section modularity is possible due to the FTTS base model, which provides a singular engine and component model to focus on.

Embedding the FTTS into the doctrine model allows the maintenance company to execute their mission similarly to a medical facility.

All sustainment soldiers are knowledgeable on operator and mechanic level I and II maintenance, which provides responsiveness in the system.

All FTTS in theater can receive immediate or express maintenance from any sustainment center.

The UE sustainment battalion maintenance management cell monitors class IX stockage, tracking of deadlined vehicles, recovery and evacuation procedures and workload.

Programmed services and maintenance are performed at S/V teams home sustainment center.

Change Agent Effect on Organizations: The OF goal of a smaller, flexible maintenance logistics footprint is the energy that drives the organizational changes.

Sustainment battalion maintenance management cell is created to facilitate assigned FTTS fleet maintenance tracking and class IX status. Battalion Maintenance Officer (BMO) has oversight over this cell.

FTTS level III maintenance companies in the UE sustainment battalions replace the many Legacy force DS maintenance companies.

The maintenance company is modular at the platoon level, which creates flexibility in the size of the maintenance operation in relation to the FTTS fleet size.

Change Agent Effect on Training: The advantage of a sustainment soldier force skilled in maintenance of their FTTS is the energy that drives changes to training. The goal is effectively training the skills required to maintain their FTTS while also training the maintenance system. Mastery of how the maintenance system works and how the FTTS S/V team flows through that system are key and essential to maximizing this method.

All sustainment soldiers receive operator and basic mechanic level training (level I and II) on their FTTS to enable execution of 80% of the maintenance workload.

Sustainment soldiers who desire the mechanic level skill identifier for FTTS level III maintenance can pursue this identifier as an elective.

The maintenance company will train on set up of the programmed maintenance; immediate maintenance and express visit facilities within the UE sustainment battalion structure.

Training incorporates C4I linkage with the BMO in the battalion maintenance management cell for class IX support and tracking; the SPO in the distribution management cell for priorities as they relate to the COP; and the DPLs in the

sustainment company operations cell for status and supervisory support of the S/V teams in the system.

Change Agent Effect on Leadership Development: The purpose of positioning knowledgeable leaders in the FTTS sustainment distribution system drives changes to leadership development while maximizing the system.

Leaders have an integral knowledge of the maintenance management system within the FTTS sustainment distribution system.

Logistics officers' education has to qualify them on level I and II maintenance expertise.

Logistics officers who desire the maintenance identifier can pursue that elective which prepares them for duties as a BMO, maintenance commander or maintenance management cell staffer.

NCOs in the maintenance company have advanced FTTS component maintenance skill identifiers.

Change Agent Effect on Materials: The OF goal of fewer materials required to support the maintenance mission is the energy that drives change to maintenance materials.

FTTS vehicle type greatly reduces materials needed to support a diverse fleet. Requisition, stockage and issue of parts are streamlined and effective.

Sustainment soldier maintenance skill identifiers for level II maintenance negate the legacy level II company maintenance sections, thus reducing logistics footprint.

Platoon materials packed and transported on maintenance module-racks reduce lift requirements.

Maintenance support teams (MST) assist the fleet from a contact module-rack. Maintenance facility materials for set up are pre-packed on module-racks, which reduce lift requirements.

Change Agent Effect on Personnel: The demand that the soldier comprehended the maintenance management system and his S/V team's place in it is the energy that

drives change. This cultural paradigm shift places a much greater responsibility on the soldier as the supervisor and maintainer of his S/V team. The soldier becomes an integral part of level II and III maintenance.

Soldiers in the FTTS sustainment distribution system assist with level III jobs to expedite repairs and play a far greater role in the maintenance of their vehicle.

Mechanics verify faults and assist sustainment soldiers with level II maintenance jobs.

Soldiers can pursue maintenance skill identifiers to attain a maintenance company slot beyond their basic sustainment soldier skills.

Soldiers gain greater responsibility for their assigned vehicle.

Soldiers are culturally indoctrinated to understand their individual S/V team role in the greater sustainment distribution system.

The focus on one basic vehicle type allows for specific education and training for soldiers to maintain their assigned FTTS to the required higher maintenance levels of the OF.

Change Agent Effect on Facilities: The effort to provide responsive maintenance support to the FTTS fleet is the energy that drives change to facilities.

Sustainment battalion Maintenance Company in UE sustainment center sets up a maintenance facility with three sub-functions consisting of programmed maintenance, immediate maintenance and express maintenance.

Facility for express maintenance is next to, but separate from programmed and immediate maintenance facility.

Facilities are modular and packed on module-racks, which simplifies deployment and set up.

Concept Analysis Card #3

Corporate model: Burlington Northern Sante Fe Railroad Corporation

Corporate Function: Railcar Management

This analysis builds off Major Tom White's thesis *Simulation and Optimization at Kansas City Southern Railway: Equipping Management for Success* and the railcar management concept used at BNSF. Based on the literature review in chapter 2, Major Tom White's analysis of the Kansas City Southern (KCS) Railroad found that KCS pooled railcars for specific customers. Major White's analysis of KCS's railcar management proved that by not pooling the sampled gondola railcars, KCS would have maximized reliable service and timely delivery in their system. His recommendation was that the sampled gondola railcar fleet would function at a higher level of efficiency if all the cars were free-runners (unassigned) instead of pooled for specific clients in the system.

BNSF manages the distribution of railcars from their operations center in Fort Worth, TX. An automated tracking system similar to RF-Tags tracks all railcar locations and statuses in the system. BNSF assigns their railcars based on availability and location in the system and treats them as free-runners, just as Major White had recommended for KCS. BNSF has specialty cars for certain customers that are located near those customers at the closest regional operations center. BNSF does not pool their railcars. Steve Weatherby, the BNSF Kansas regional manager, notes that a natural pooling effect of freerunners will occur in the system depending on where the customers are located and what type of railcar they demand (Weatherby 2003). For instance, if most of the coal railcar clients are in the Midwest then the majority of free-runner coal railcars will naturally locate in the Midwest regional center hubs. Weatherby claims that by pooling cars for specific clients you are restricting your inventory of available railcars thus adding more cars in the system to handle client requests (Weatherby 2003). He adds that

removing restrictions on available railcars means less railcars needed in the system and less transit time to the client (Weatherby 2003). In summation, a free-runner railcar system allows for quick response to customer requests and reduces the required size of the fleet, and requires less field management than an assigned pooled railcar system.

Application to OF: This concept creates parallels between railcar management and the module-rack management that is addressed and incorporated into the FTTS sustainment distribution system model. In the model, the FTTS system uses module-racks to store and transit classes of supply to the UA brigades. Module-racks are in similar forms to railcars such as fuel, box, flat and configured load (CL) sustainment module-racks. Many module-racks are loaded in CONUS depots for factory to foxhole distribution such as the CL module-racks that move class V, prepackaged class I and III. However, there are also bulk commodity module-racks such as fuel, water and box module-racks that are built in theater to move the commodities through the system. Host nation support as well as bulk supplies from fuel and container ships supply commodities to a UE₂ sustainment center to load onto module-racks for input into the FTTS sustainment distribution system.

This concept dictates that units should not own module-racks. As an integrated distribution system, the module-racks would move in, out and around the theater freely as a system asset. This allows for free movement of module-racks across the system without the restriction of unit ownership and a property book accountability issue. The module-rack free-runner system allows for empty module-racks and unassigned loaded module racks to move freely through the system. Configured loads for specific units are identified through the RF-Tag and delivered to that unit. Once empty, the module-rack returns to

the free-runner system and relocates anywhere in or out of theater for re-loading. Loaded unassigned module-racks, like bulk fuel module-racks are free-runners until assigned to a customer by a material manager and addressed via the attached RF-Tag. RF-tags allow module-racks to be tracked by any MTS or RF-Tag monitor in the system. This provides near real time accountability of all module-racks in the system.

Management of module-racks, both full and empty, is a critical concept in maximizing the efficiency of the FTTS sustainment distribution system. BNSF's concept application of free-runner module-racks is used to maximize the OF FTTS sustainment distribution system.

Conceptual Change Agent: The concept is a change agent as it drives change to how we manage delivery platforms in the OF theater. The module-rack becomes an integral part of the system. The effective free-runner management concept drives how module-racks are incorporated on the OF battlefield to maximize efficiency which is the catalyst for change.

OF Requirements Impacted:

Sustainable: Supply, distribution and sustainment embodied in the FTTS module-rack free-runner system is designed to maximize sustainability of the force. Sustainment arrives in configured sustainment module-racks from CONUS or is built in theater from bulk assets onto fuel, box and flat module-racks to sustain the force.

Trainable: Simple in concept, the distribution management cell material manager coordinates the supply flow on module-racks.

Versatile: The free-runner module-rack management system provides for module-racks to be configured and assigned anywhere in the system.

Responsive: System owned free-runner module-racks provide free flow of commodities across the integrated distribution system without property book accountability issues at the unit level, thereby increasing responsiveness to customer needs.

Agile: Free-runner module-racks allow for factory to foxhole delivery of assigned module-racks to specific units as well as sustainment center assignment of bulk supply module-racks to units to meet sustainment requirements.

Change Agent Effect on Doctrine: The energy that drives change to doctrine is the desire to attain the OF requirements above. The free-runner concept acts as a change agent to doctrine due to the maximizing effect it has on the FTTS sustainment distribution system in the OF. The FTTS module-rack is the device that fuses distribution, sustainment and supply in the OF. Commodities are distributed, stored and measured on module-racks. The efficient BNSF concept of a free-runner railcar system increases efficiency in the module-rack system, which operates within the FTTS distribution sustainment system model.

The OF sustainment battalion not only moves the commodities from point to point on module-racks, but stores the commodities on module-racks in the UE sustainment centers and manages inventories of loaded and empty module-racks for sustainment management.

In the OF FTTS sustainment distribution system, all commodities are loaded on a module-rack and temporarily stored in a UE holding area awaiting assignment to a UA unit. Free-runners that are loaded, but unassigned, are held for near term requirements at a UE sustainment center.

Free-runner module-racks do not burden the force with restrictive accountability.

The free-runner system allows for all FTTS in the system the ability to retrieve and deliver module-racks regardless of who handled the module-rack in the past.

The free-runner system focuses the FTTS S/V team on timely delivery and accountability of the commodity on the module-rack.

The SPO in the UE sustainment battalion distribution management cell manages the free-runner system in his sustainment battalion's area of operations.

Free-runner concept allows for a FTTS S/V team to pick up any empty module-rack on the battlefield and retrograde it to the rear for re-load.

Change Agent Effect on Organizations: The energy that drives changes to organizations is the OF goal of a smaller logistics footprint.

Legacy motor transport and supply companies consolidate and become the sustainment battalion distribution companies. Part of the distribution company mission is to facilitate the free-runner module-rack system as part of the greater FTTS sustainment distribution system.

Module-racks are not on unit property books. They are a strategic asset; however, the sustainment soldier is responsible for any damage done to a platform in his/her control.

Distribution company sustainment platoon sets up and manages module-rack holding areas in the sustainment center.

Change Agent Effect on Training: The energy that drives changes to training is the requirement for a fluid module-rack operational environment to allow for responsive reload and delivery of supplies. Sustainment soldiers are trained to operate within that environment and understand the free-runner concept. Free-runner conceptual training focuses sustainment soldiers on timely delivery and retrograde of module-racks.

Sustainment soldiers train on executing module-rack delivery and retrograde operations.

Sustainment soldiers train on the categories of loaded module-racks.

The ability to automatically respond to module-racks in need of retrograde when an S/V team is moving to the rear from a UA replenishment operation is a thought process that is ingrained in the soldiers through training.

Sustainment soldiers train on accountability of the module-racks as they move through the system.

Training on damage accountability focuses on S/V team inspections of each module-rack before a move to record any damage to it.

Change Agent Effect on Leadership Development: The energy that drives changes to leadership development derives from the goal of leaders understanding the FTTS

sustainment distribution system and how the free-runner module-rack concept enhances that system.

Leadership, both officers and NCOs require knowledge of the multifunctional spectrum of the module-rack free runner system.

Initiative is developed to foster awareness of module-rack flow and its vital importance to system performance.

Leaders are experts on movement, storage and loading/unloading of supplies on module-racks.

Change Agent Effect on Materials: The energy that drives change to materials is the OF goal of fewer materials required to support the mission.

Sustainment battalions do not have the many platforms and storage devices of the present day legacy force.

Free-runner module-racks result in a smaller requirement for module-racks in the system.

Quick retrograde of empty module-racks to a theater re-load site allow for responsive logistics and a reduced module-rack requirement.

Change Agent Effect on Personnel: The energy that drives change to soldiers is the demand that the soldier comprehend the free-runner module rack system and its impact on the sustainment distribution system. Cultural understanding of flowing module-racks to and from the UA replenishment sites is essential. Initiative and information flow is critical to the soldiers' impact on the system.

Soldiers play a key role in module-rack management and flow.

Soldiers maximize responsiveness in the free-runner system because of their knowledge of the MTS and RF-Tag technology and the role they play in information flow that provides managers with ITV and COP.

Sustainment soldiers develop an inherent responsibility for the module-racks and the commodities they carry through control measures, inspections and reporting procedures during the missions.

Change Agent Effect on Facilities: The energy that drives change to facilities is the effort to provide quality module-rack management to maximize sustainment of customer units.

Sustainment platoon from the distribution company sets up module-rack holding areas in the UE sustainment center.

Module-rack holding areas come in several types: UA assigned holding areas, unassigned loaded module racks by commodity type and empty module-racks for retrograde by commodity type.

Concept Analysis Card #4

Corporate model: Wal-Mart Corporation

Corporate Function: Distribution Management

Distribution management defines the function of how Wal-Mart manages their supply to support their front line store inventories. Wal-Mart uses the hub and spoke distribution method to enable the distribution function that maintains the optimum inventory levels at supported stores. Wal-Mart has developed a network of regional distribution centers (hubs) that receive supplies from vendors. These supplies are cross-docked at the distribution center to awaiting Wal-Mart trucks for one-day delivery to supported stores (spokes). Inventory held at the distribution center is kept as low as possible to reduce costs and footprint. Items that have a history of demand-surge are held in holding areas at the distribution center to meet those requirements.

Distribution centers are strategically placed for supporting all stores within the radius of 150 miles to ensure timely support. Wal-Mart's digitized and networked store inventory system provides the necessary information to order supplies quickly. Once

ordered and delivered by the vendor the item is received at the store location within one day. Wal-Mart works diligently with vendors to ensure they are responsive to requests.

Wal-Mart employs an inventory concept that provides responsive support without mountains of supplies on hand in the distribution centers. This reduces costs of holding and managing large stocks while at the same time increasing cross-dock flow of inventory in the distribution center. Wal-Mart incorporates their own truck fleet to transport inventory from the distribution centers to the stores. This allows Wal-Mart to control a critical enabler to their system without reliance on an outside source.

Wal-Mart's distribution concept synergizes distribution and sustainment of store inventories. The integration of distribution and sustainment of inventories leads to reduction of costs, stockage levels and facilities. Their concept increases timeliness and responsiveness. Wal-Mart proves itself as extremely effective in timely first class support and responsiveness to their front line stores and customers. This distribution management concept is used to achieve similar results for the OF FTTS sustainment distribution system model.

Application of Concept to OF: FTTS enables the sustainment distribution system from UE sustainment centers to UA brigades. The FTTS sustainment distribution system uses the UE sustainment centers as area hubs to feed supplies to their supported UAs. Ideally, CONUS depots configure loads on module-racks for shipment to the UE sustainment centers. Some commodities arrive loose or in bulk and have to be built on module-racks in the UE₂ sustainment centers. Loaded module-racks that arrive at the UE₁ sustainment center and that are addressed to a specific UA customer are held in a temporary holding area addressed to that UA. After a replenishment mission is

coordinated through the distribution management cell, FTTS S/V teams are dispatched to the UA's holding area to pick up the module-racks and execute the mission. Unassigned loaded module-racks are held in a commodity holding area for unplanned surge requirements. For instance, unassigned loaded class III (B) module-racks are located in an identified class III (B) module-rack holding area awaiting assignment. These levels are strictly managed to maintain optimum allowance for surge requirements without the creation of iron-mountains that increase the footprint and management requirements.

UE₁ sustainment centers are strategically placed to allow for local haul of supplies, which allow for two or more round trips by each FTTS S/V team per day. UE₂ sustainment centers are strategically placed at APODs and SPODs to feed supplies to the forward positioned UE₁ for delivery to the UAs. The OF's digitized and networked supply system is critical in triggering the FTTS replenishment missions to the UAs.

The concept calls for loaded module-racks to move swiftly through the UE sustainment centers to the customer UAs. Concept employment provides responsive support without mountains of supplies on hand in the UE sustainment centers. This reduces costs of holding and managing large stocks. It increases the speed of sustainment flow. Responsive FTTS S/V teams act as critical enablers to the system. Concept is extremely effective in timely first class support and responsiveness from UE sustainment centers to UA brigades.

Conceptual Change Agent: The concept as a change agent energizes change in distribution management to apply a proven business practice to the FTTS sustainment distributions system model to enhance effectiveness.

OF Requirements Impacted:

Sustainable: The integration of this distribution concept is focused on sustainability of the force without large inventories.

Trainable: Concept requires sustainment soldiers to be aware of flow of sustainment and its impact on UA customers.

Versatile: Concept allows for commodities to enter theater FTTS sustainment distribution system from all modes.

Responsive: Concept provides responsive support from UE sustainment centers to UA customers.

Agile: The smaller supply inventory stored on module-racks allows the UE₁ sustainment centers to relocate and set up a new site quickly.

Change Agent Effect on Doctrine: The energy that drives change to doctrine is the goal of attaining OF requirements. The concept creates doctrinal hubs in the UE sustainment centers with sustainment flow via the FTTS module-racks out to the supported UA brigades on the spokes of the system.

UE sustainment centers (hubs) support UAs (spokes) enabled by the FTTS S/V team are the catalyst for an efficient distribution sustainment system.

Module-racks are not only the distribution platform, but the storage device and measuring device of all classes of supply.

The UE sustainment battalion distribution management cell maintains status of all classes of supply and coordinates deliveries through the DPLs/DPSs to the FTTS S/V teams.

Distribution company sustainment platoons manage module-rack holding areas.

FTTS S/V Teams assemble at UA module-rack holding areas in a UE sustainment center, load module-racks, form a convoy based on the distribution management cell's command and control guidelines, and execute the mission.

Set up of module-rack holding areas is by UA address, and if unassigned, by class of commodity.

Change Agent Effect on Organizations: The energy that drives changes to organizations is induced to streamline the distribution process and reduce inventories and structure on the battlefield.

The sustainment battalion in the UEs executes the distribution management mission.

Supply management is controlled by the SPO in the sustainment battalion distribution cell.

The distribution company sustainment platoon reports supply inventory status to the distribution management cell.

Change Agent Effect on Training: The energy that drives changes to training is the goal of empowering soldiers to set up a viable sustainment distribution hub and spoke system for the OF that meets requirements. Soldiers understand how to operate within the system to maximize efficiencies.

Training encompasses sustainment soldier understanding of the UE sustainment center layout and flow of module-racks through it.

Soldiers in sustainment platoon who manage module-rack holding areas receive specialty supply identifier through electives at school.

Soldiers train to be both self-sufficient and part of a convoy team to distribute loaded module-racks to customers.

Convoys can be formed from FTTS S/V teams from different distribution companies.

Sustainment soldiers from sustainment platoon using RF-Tag information keep track of supply inventories in UE sustainment center module-rack holding areas.

Training is focused on a thorough understanding of the sustainment distribution management system and how commodities flow through the system on module racks to the UA customer at designated replenishment sites.

Change Agent Effect on Leadership Development: The energy that drives changes to leadership development for this concept is the need for multifunctional distribution system managers and not just functional specialists. Leaders need to understand the full

scope of the FTTS sustainment distribution system and the flow of supplies through its hubs and spokes to achieve the requirements of the OF as presented in *The White Paper*.

Development of all logistics officers starts with a thorough understanding of the flow of supplies through the FTTS sustainment distribution system in the Logistics Officer Basic Course.

Officers take electives to gain a specialty identifier for supply management, which qualifies them for placement in the UE distribution management cell or as a sustainment platoon leader. Inventory management and understanding of accountability of supplies loaded on module-racks to create statuses and logistics estimates is essential.

NCOs are developed to lead and manage the sustainment soldiers who execute the missions that flow supplies through the UE sustainment center hub.

Change Agent Effect on Materials: The energy that drives changes to materials is the focus on the flow of supplies on module-racks.

Module-racks are the primary platform for lift, storage and accountability of supplies.

The module-rack concept enables maximization of the presented concept of hub and spoke logistics from the UE sustainment centers to the UA brigades.

Bulk supplies that arrive from host nation or from bulk transports to the UE₂ are loaded onto module-racks.

Change Agent Effect on Personnel: The energy that drives change with this concept is the development of a soldier who comprehends the flow of sustainment through the system. This understanding can lead to individual applications of soldiers to the tasks at hand to maximize effectiveness of the system.

Sustainment soldiers engaged in distribution management distribute supplies to UA customers. They also inventory, maintain and account for the supplies and the module-racks the supplies are loaded on.

Multifunctional and highly skilled, the sustainment soldier is able to work with all commodities on all types of module-racks as they flow through the sustainment distribution system.

Although sustainment soldiers have greater responsibility than their legacy counterparts; the FTTS sustainment distribution center hub and spoke concept is compact, cohesive and comprehensible.

Change Agent Effect on Facilities: The energy that drives change to facilities is the effort to provide quality sustainment management through the hub and spoke system concept to maximize sustainment of customer units.

Sustainment battalion in the UE sustainment center sets up hub sustainment system to support UA customers.

Headquarters Company sets up CSC, distribution management cell and maintenance management cell.

Maintenance Company sets up programmed, immediate and express maintenance facilities.

Distribution Company(s) sustainment platoon sets up module-rack holding areas and convoy staging area.

Chapter Summary

This chapter discussed the concept analysis cards produced by the qualitative analysis of four corporate concepts as applied to the OF sustainment distribution system model depicted in chapter 3. Concepts were applied to an OF UE sustainment center. Analysis was based on units created to facilitate the corporate conceptual framework. The created units; sustainment battalion with headquarters, distribution and maintenance companies were in line with researched UA unit information published by CASCOM. The UE units and functions were not yet published at the time of this writing. The sustainment center model was used to apply proven corporate concepts to DOTLM-PF to develop a maximized FTTS sustainment distribution system that meets the requirements of the OF as presented in *The White Paper*.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Introduction

The *Objective Force Concept White Paper* requires that Objective Force logistics on the battlefield be sustainable, trainable, versatile, responsive and agile. The FTTS is scheduled to be the primary transport vehicle that will enable the OF sustainment distribution system. The FTTS has MTS with RF-Tag technology that will improve motor transport operations and sustainment of the force. The primary application of these technologies alone, in and of themselves will not be enough to meet OF requirements. This research explored possible changes to DOTLM-PF to maximize the effectiveness of the FTTS enabled sustainment distribution system in the OF. The researcher conducted analysis of the OF requirements and commercial distribution centers to identify viable future concepts that hold promise for the OF. The research identified and analyzed four concepts from the corporations researched. These concepts were applied to the presented FTTS sustainment distribution model and analyzed through the prism of DOTLM-PF to gain insights on possible changes to maximize effectiveness of the system. Qualitative analysis was used to provide discovery, insight and understanding through the eye of the researcher.

Thesis Question

The researcher recognized a gap in discussion of secondary effects of the FTTS on the sustainment distribution system that could meet the requirements of the OF. To this end the researcher questioned: *“How can the Army maximize effective use of the Future Tactical Truck System to meet the sustainment and distribution requirements of*

the Objective Force?” Before this question could be answered, secondary questions had to be answered first: What are the requirements of the OF sustainment distribution sustainment system; what “change agents” are produced when corporate concepts are applied to the FTTS sustainment distribution system; and how could the Army qualitatively apply proven corporate logistical concepts to the FTTS sustainment distribution system model?

Conclusions

Concepts

The four corporate concepts applied to the modeled FTTS sustainment distribution system are all viable concepts for the achievement of Objective Force requirements. Conceptual change agents applied to DOTLM-PF energize changes, which leverage a focused, streamlined and multifunctional sustainment distribution force for the future that is sustainable, trainable, versatile, responsive and agile.

Schneider’s fleet management concept provides FTTS S/V teams the autonomy to be responsive to system needs while executing within a disciplined and controlled system. Sustainment soldier care provided by the CSC ensures soldiers’ field support needs are addressed while maximizing operational readiness to ensure sustainability of the force. Soldiers are trained to focus on the S/V team concept and have awareness of their position as a system within a system. The streamlined focus of the sustainment soldier allows for multifunctional expertise, not only on the FTTS and its technologies, but also on how to handle and report all classes of supply on FTTS module-racks.

Schneider’s maintenance management concept provides responsive maintenance support to the FTTS fleet. Enabled by the single type FTTS engine and chassis, the

sustainment soldier can perform up to 80 percent of maintenance requirements. FTTS mechanics in the maintenance company will provide oversight and perform level III maintenance to ensure quick turn-around time. The three-pronged support concept of express, immediate and programmed maintenance effectively triages FTTS in the maintenance system. Agility and versatility are achieved to support the maintenance needs of any FTTS arriving in the sustainment center. The maintenance management cell can provide superior over site of the maintenance needs of the FTTS fleet through early warning from MTS to responsive class IX support. Maximizing maintenance support is a key enabler of superior sustainment to the force.

BNSF railcar management concept uses free-runners and allows maximum effectiveness of module-rack management on the battlefield and beyond. Free-runner module-racks allow for a responsive sustainment system that can surge with requirements as necessary. Synergized supply transport and storage on module-racks enables sustainment and distribution and is of key importance to the multifunctional system. Module-racks, configured and bulk provide required versatility, agility and responsiveness to sustain the force.

Wal-Mart's distribution management concept provides sustainment flow management techniques that maximize sustainment to the force. Distribution management on module-racks in UA holding areas at the sustainment center to pulse supplies to UA FSB replenishment sites provide responsive and agile support. The hub and spoke concept is enabled by the FTTS S/V team versatility in theater. Sustainment soldiers easily calculate inventories, which are monitored with RF-Tags and by module-racks that are built to measure the commodity that is uploaded. The distribution

management cell is able to provide responsive support with superior C4I of module-racks, inventories and FTTS S/V teams.

The concepts researched and applied in this study provide answers to the secondary questions posed in this thesis and ultimately answer the primary question. There is ample room for interpretive analysis due to the qualitative structure of this study. At this early stage of planning for the Objective Force, concepts put forth from all quarters should be heard and analyzed to make proper decisions and achieve maximized results. The product produced from this study, the Concept Analysis Cards, are an additional perspective for planners to reference for calculating the right mix of changes to DOTLM-PF the Objective Force requires.

Recommendation

Planners for the Objective Force should look closely at all concepts put forth from the field, academia and corporate America to ascertain the appropriate changes to the system that will achieve maximum results. Plans based on primary effects of FTTS technology that do not address secondary effects of possible changes to DOTLM-PF could fall short of Objective Force goals. Objective Force logistics should be multifunctional, with transport and supply synergized into a sustainment distribution system that is straight forward, trainable and supportable.

Areas for Further Research

Recommended topics for additional research are many. Several related issues that demand additional study and analysis are presented below.

How is the FTTS the enabler for the Revolution in Military Logistics? Although this possibility was posed in this thesis it was beyond the scope of the document.

However, this research could be a base to make a case for the FTTS as the rally point to focus logisticians on the base enabler for the future logistical system. Analysis could research the synergistic qualities of the FTTS in the logistics functional areas of transport, supply and maintenance. Arguments could center around the need for a driving force to focus the functional areas on a revolutionary concept or principle that the FTTS provides.

What is the optimal organization for the UE sustainment support unit? This thesis used the sustainment battalion model to facilitate analysis; however that is just one of many organizations which could be identified to support the Unit of Action Brigades from the UE. This question would open up opportunities to discuss multifunctional makeup, occupational specialties, structure and additional equipment. Many variables could be explored to test for optimization. As this unit should be multifunctional throughout, it presents an open debate by function how that should be applied.

Using quantitative analysis, what is the optimal FTTS sustainment distribution concept? This question would support or deny the concepts put forth in this thesis. Follow up quantitative analysis is required to take this research to the next level. Concepts approached from a statistical standpoint that support or deny qualitative concepts would assist to determine viability.

Summary

The FTTS was defined as the enabler of the Objective Force sustainment distribution system. The application of the FTTS to the force and the structure and system built around it served as the catalyst for a multifunctional logistics system. Concepts that maximized efficiency in this system were developed from corporate examples and set the

stage for attainment of Objective Force requirements as well as a possible Revolution in Military Logistics.

REFERENCE LIST

- Anderson, LTC Nicholas J. 2001. Challenge of Total Asset Visibility. *Army Logistician*, January-February, 8-12.
- Baumgardner, Neil. 2000. Keane Outlines Need For Army Logistics Transformation *Defense Daily*, 14 December.
- Boney-Harris, Gwendolyn. 2001. Optimizing Logistics For Army Transformation. Strategy Research Project, Carlisle Barracks: O.S. Army War College.
- Buchar, John W. 1996. System Synergism For XXI Century Logistics. Research Project, Carlisle Barracks: O.S. Army War College.
- BNSF. 2003. Burlington Northern Sante Fe Incorporated. Available from, www.bnsf.com. Internet: Accessed 10 January 2003.
- Cannon, Charles C. Jr. 2000. Logistical Challenges on the Battlefield. *ARMY Magazine*, October.
- CASCOM FTTS Information Paper. 2002. *Future Tactical Truck System (FTTS)*. Fort Lee, VA: Information Paper received via e-mail 10 December 2002.
- CASCOM MTS Information Paper. 2002. *Movement Tracking System and AIT Integration*, Fort Lee, VA: Information paper received via e-mail 10 December 2002.
- CASCOM MTS STRAP. 2001. *System Training Plan (STRAP) for the Movement Tracking System (MTS)*. Fort Lee, VA: Version 3.
- CASCOM Objective Force Distribution Brief. 2002. *Objective Force Distribution Brief*. Fort Lee, VA. Information Paper received via e-mail 10 December 2002.
- CASCOM Transportation Project. 2002. *Directorate of Combat Developments (DCD) for Transportation Project/POC List*. Fort Lee, VA: Available from, <http://www.cascom.army.mil/Transportation/Employee/POC%20List.htm>. Internet: Accessed 17 October 2002.
- CASCOM Transportation Vision. 2002. *Transportation Army Vision*. Fort Lee, VA: <http://www.cascom.army.mil/cmdstaff/vision/trans/TRANS.HTM>. Internet: Accessed 23 October 2002.
- CGSC G1/G4 Battle Book. 1997. *G1/G4 Battle Book*. Ft Leavenworth, KS: United States Command and General Staff College.

- Creswell, John W. 1998. *Qualitative Inquiry and Research Design, Choosing Among Five Traditions*. Thousand Oaks, California: Sage Publications.
- DA White Paper. 2002. *Objective Force Concept White Paper*. Washington D.C.: Government Printing Office.
- DA 2010 Vision. 1996. *Army Vision 2010, Focused Logistics*. Available from, http://www.army.mil/2010/focused_logistics.htm., Internet: Accessed 23 September 2002.
- DOD Joint Vision. 2001. *Joint Vision 2020*. Washington D.C.: Government Printing Office.
- Drazek, Gregory P. and Linda A. Novak. 2000. Logistics Technology 2010 Implications for DOD. Research Project, McLean, Virginia: Logistics Management Institute, December.
- Eden, Dr. Rick and Thomas J. Edwards. 1998. Velocity Management and the Revolution in Military Logistics. Rand Arroyo Center: Available from <http://www.almc.army.mil/ALOG/issues/JanFeb99/MS397.htm>, Internet: Accessed 30 Oct 2002.
- FM 21-305. 1993. *Manual for the Wheeled Vehicle Driver*. Washington D.C.: Government Printing Office.
- FM 55-30. 1997. *Army Motor Transport Operations*. Washington D.C.: Government Printing Office.
- FM 55-80. 1997. *Army Container Operations*. Washington D.C.: Government Printing Office.
- FM 63-4. 1984. *Combat Service Support Operations*. Washington D.C.: Government Printing Office.
- Graves, MAJ Gregory H. 2001. Obstacles to CSS Transformation. *Army Logistician*, July-August, 7-11.
- Halder, Lance. 2003. Schneider National Manager. Interview held at Des Moines, Iowa Operations Center by author.
- Hart, Fred L. 1998. Maintaining and Sustaining the United States Army in the Twenty First Century. Research Project, Carlisle Barracks: O.S. Army War College.

- Haufe, Randolph G. 2001. A Logistics Corps: Does the Ongoing Revolution in Military Logistics Demand One. Masters Thesis, United States Army Command and General Staff College, Fort Leavenworth, KS.
- Kratz, Lou, and Alex Smimow. 2001. Future Logistics Environment. *Logistics Spectrum*, July-September, 8-10.
- Malone, Michael S. 2002. The Sam and Gordon Tag Team, Wal-Mart's Rules Because It Has a Beat on Moore's Law. *ABCNEWS.com*, Available from http://www.abcnews.go.com/sections/business/SiliconInsider/SiliconInsider_020222.html, Internet: Accessed 29 January 2003.
- Mason, Ray. 2000. Logisticians Explore Ways to Reduce CSS' Tail. *Army Logistician*, May-June, 48-49.
- McKay, Robert J., and Kathy Flowers. 2000. Transformation in Army Logistics. *Military Review*, September-October, 44-50. Available from CALL Public Access Database, Document number RWP-02-64-1590.
- Merriam, Sharan B. 1998. *Qualitative Research and Case Study Applications in Education*. San Francisco: Jossey-Bass.
- Motor Transport MTP. 2001. *Army Training and Evaluation Plan 55-718-30-MTP Mission Training Plan for the Transportation Motor Transport Company*. Washington D.C.
- Orsini, Eric A., and COL Glenn J. Harrod. 2000. Transforming Logistics to Support the Army Chief of Staff's Vision. *Army Logistician*, March-April, 17-19.
- Pacific Northwest National Laboratories. 2002. *RF Tags*. Available from, <http://www.pnl.gov/nsd/commercial/rftags/background.html>, Internet: Accessed 20 October 2002.
- Paulus, Robert D. 2001. Industry and Logistics Transformation. *Army Logistician*, July-August.
- Payne, David. 2000. Distribution-Based Logistics. *Army Logistician*, January-February, 38-41.
- Refrigerated Transporter. 2002. Corporate Culture Provides Wal-Mart Competitive Advantage. Available from, http://www.refrigeratedtrans.com/ar/transportation_corporate_culture_provides, Internet: Accessed 21 January 2003.
- Schneider. 2003. Schneider National Incorporated. Available from, www.schneider.com, Internet: Accessed 5 January 2003.

- Schrage, Michael. 2002. Wal-Mart Trumps Moore's Law. *Technological Review*, March: Available from <http://www.technologyreview.com/articles/schrage0302.asp>, Internet: Accessed 13 February 2003.
- TACOM Truck Status. 2000. *Concepts for 21st Century Truck-Based Tactical Vehicles STO Status*. Update Briefing.
- TRADOC Pamphlet 71-9. 1999. *Force Development, Requirements Determination*. Washington D.C.: Government Printing Office.
- TRADOC Pamphlet 525-4-0. 2002. *Objective Force Maneuver Sustainment Operations*. Washington D.C.: Government Printing Office.
- TRADOC Pamphlet 525-68. 2002. *Concept for Modularity*. Washington D.C.: Government Printing Office.
- Tolar, Larry L. 2002. Maneuver Sustainment for Army Transformation. *Army Logistician*, July-August, 2-6.
- Walton, Sam, with John Huey. 1982. *Made in America: My Story*. New York: Doubleday.
- Weatherby, Steve. 2003. Burlington Northern Sante Fe Operations Manager. Interview held at Kansas City, Missouri Operations Center by author.
- White, Thomas P. 1998. Simulation and Optimization at Kansas City Southern Railway: Equipping Management for Success. Masters Thesis. United States Army Command and General Staff College, Fort Leavenworth, KS.
- Wilson, Johnnie E., John G. Coburn and Daniel G. Brown. 1999. Our Revolution in Military Logistics: Supporting the 21st Century Soldier. *Army Logistician*, January-February.
- Wolcott, Harry F. 2001. *Writing Up Qualitative Research*. Thousand Oaks, California: Sage Publications.

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