2002-12

The Strategic Distribution Management Initiative and its effects on inventory levels and readiness

NuDelman, Devon D.

Monterey, California. Naval Postgraduate School

http://hdl.handle.net/10945/5797

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

THE STRATEGIC DISTRIBUTION MANAGEMENT INITIATIVE AND ITS EFFECTS ON INVENTORY LEVELS AND READINESS

by

Jeffrey A. Schmidt
Devon D. NuDelman

December 2002

Thesis Advisor: Donald Eaton
Second Reader: Ken Doerr

Approved for public release; distribution is unlimited.

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.			
1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** December 2002	**3. REPORT TYPE AND DATES COVERED** Master's Thesis	
4. TITLE AND SUBTITLE The Strategic Distribution Management Initiative And Its Effects On Inventory Levels And Readiness			**5. FUNDING NUMBERS**
6. AUTHOR(S) Schmidt, Jeffrey A. and NuDelman, Devon D.			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release: distribution is unlimited			**12b. DISTRIBUTION CODE**

13. ABSTRACT *(maximum 200 words)*

Until just a few years ago, no organization was tasked with measuring overall effectiveness, design, or optimization of DOD's global supply chain management system. As a result, the Strategic Distribution Management Initiative (SDMI) was created as a joint venture between Defense Logistics Agency (DLA) and the United States Transportation Command (USTRANSCOM) charged with enterprise level redesign, streamlining, and optimization of the DOD global supply chain. This thesis examines the affects of the SDMI implementation on the Army's two maneuver divisions stationed in the Europe. Specifically, it analyzes affects of SDMI implementation on the eight supply support activities located within the two maneuver divisions in USAREUR.

This thesis studies SDMI impacts on inventory levels; inventory turbulence in the SSAs during SDMI implementation; SDMI improvements with respect to readiness; and existing barriers to improving velocity. The research indicates that: (1) expected inventory reductions were not realized following SDMI implementation, (2) inventory turbulence consumes limited resources and is a lucrative target for further improvement, (3) there is no evidence that SDMI increased fleet readiness, and (4) backorder rates and time, along with sub-optimization of pieces of the DOD supply chain, are significant barriers to velocity that still must be broken through.

14. SUBJECT TERMS Strategic Distribution Management Initiative, SDMI, Defense Logistics Agency (DLA), United States Transportation Command (USTC), Logistics.			**15. NUMBER OF PAGES** 90
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited.

THE STRATEGIC DISTRIBUTION MANAGEMENT INTIATIVE AND ITS EFFECTS ON INVENTORY LEVELS AND READINESS

Jeffrey A. Schmidt
Lieutenant Commander, United States Navy
B.S., Pennsylvania State University, 1990

Devon D. NuDelman
Captain, United States Army
B.A., University of Missouri at Saint Louis, 1993

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 2002

Authors:
Jeffrey A. Schmidt

Devon D. NuDelman

Approved by:
Don Eaton
Principal Advisor

Ken Doerr
Associate Advisor

Dean Douglas A. Brook, Ph.D.
Graduate School of Business and Public Policy

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

Until just a few years ago, no organization was tasked with measuring overall effectiveness, design, or optimization of DOD's global supply chain management system. As a result, the Strategic Distribution Management Initiative (SDMI) was created as a joint venture between Defense Logistics Agency (DLA) and the United States Transportation Command (USTRANSCOM) charged with enterprise level redesign, streamlining, and optimization of the DOD global supply chain. This thesis examines the affects of the SDMI implementation on the Army's two maneuver divisions stationed in the Europe. Specifically, it analyzes affects of SDMI implementation on the eight supply support activities located within the two maneuver divisions in USAREUR.

This thesis studies SDMI impacts on inventory levels; inventory turbulence in the SSAs during SDMI implementation; SDMI improvements with respect to readiness; and existing barriers to improving velocity. The research indicates that: (1) expected inventory reductions were not realized following SDMI implementation, (2) inventory turbulence consumes limited resources and is a lucrative target for further improvement, (3) there is no evidence that SDMI increased fleet readiness, and (4) backorder rates and time, along with sub-optimization of pieces of the DOD supply chain, are significant barriers to velocity that still must be broken through.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

ABF	Availability Balance Files
AMC-AF	Air Mobility Command
AMC	Army Materiel Command
AMDF	Army Master Data File
AMI	Army Managed Item
AMSS	Army Materiel Status System
ANOVA	Analysis of Variance
ASL	Authorized Stockage List
BOD	Board of Directors (SDMI)
CJCS	Chairman, Joint Chiefs of Staff
CONUS	Continental United States
CRA	Central Retention Account
CWT	Customer Wait Time
DAAS	Defense Automated Addressing System
DLA	Defense Logistics Agency
DODAAC	Department of Defense Activity Address Code
DRMO	Defense Reutilization and Marketing Service
DUSD	Deputy Under Secretary of Defense
DUSD-L	Deputy Undersecretary of Defense (Logistics)
EDA	Equipment Downtime Analyzer
EUCOM	European Command
F/AD	Force Activity Designator
FEDLOG	Federal Logistics
ISU	Installation Support Unit
JCS	Joint Chiefs of Staff
LIF	Logistics Intelligence File
LOGSA	Logistics Support Activity
MATCAT	Material Category code
MHE	Material Handling Equipment
MLRS	Multiple Launch Rocket System
MSB	Main Support Battalion
MSC	Military Sealift Command
MSE	Mean Squared Error
MTBF	Mean Time Between Failure
MTMC	Military Traffic Management Command
NAMI	Non-Army Managed Item
NIIN	National Item Identification Number
NMC	Non Mission Capable
NMCM	Non Mission Capable-Maintenance
NMCS	Non Mission Capable-Supply
OCONUS	Out-of-Continental United States
ORF	Operational Readiness Float
OSD	Office of the Secretary of Defense

OST	Order and Shipping Time
PD	Priority Designator
RIC	Routing Identifier Code
RIC SOS	Routing Identifier Code Source of Supply
RIDB	Readiness Integrated Data Base
SAMS	Standard Army Maintenance System
SARSS	Standard Army Retail Supply System
SD	Strategic Distribution (formerly SDMI)
SDMI	Strategic Distribution Management Initiative
SSA	Supply Support Activity
TRANSCOM	see USTRANSCOM
ULLS	Unit Level Logistics System
UMMIPS	Uniform Material Movement and Issue Priority System
UND	Urgency of Need Designator
USAREUR	United States Army Europe
USTRANSCOM	United States Transportation Command
VM	Velocity Management

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to our thesis advisors, RADM (RET) Don Eaton and Dr. Ken Doerr for their assistance and guidance throughout the compilation of this thesis. I also wish to express my sincerest appreciation to Stephanie Pennello, of HQ DLA, for her outstanding support in providing us information and resources, which ultimately became the foundation for our thesis. A special thanks goes to my thesis partner Jeff Schmidt, who helped me get through this milestone, and for his friendship during the last eighteen months. Additionally, I wish to thank Thomas Young, Frank McCrary, and Jesse Rand from LOGSA for undertaking the tedious task of pulling raw data for us from their database and forwarding it to us to be included in our analysis. I also thank Kenneth Girardini, Pat Boren, and Adrian Overton, of RAND, for their assistance in obtaining and passing the raw historical archived data, which was required to conduct our analysis. Finally, I would like to acknowledge the patience and understanding of my family during this lengthy but intellectually challenging time.

- Devon NuDelman

I also would like to extend my gratitude to RADM (Ret.) Eaton and Dr. Ken Doerr for their superlative guidance and energetic support. Ms. Stephanie Pennello at HQ DLA was a tremendous assistance in helping us understand the system and meet the right people. Also, thanks to Mr. Jim Jenkins for funding travel for us to visit several sites along with LTC Tim McNulty's help at DDSP Susquehanna and his orientation to the DDC and CCP system. Certainly, my appreciation goes to Devon for explaining to me the nuances of the Army system and our ongoing discussions regarding Service differences. Finally, a special thanks to my wife, Julianne Schmidt for her love, support and encouragement…she is truly a blessing.

- Jeff Schmidt

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

It has become clear that the Services can no longer afford to do that which suits their individual needs, they must look to combine efforts and more importantly assets wherever and whenever possible. In theory this sounds as if there could be countless benefits to be had; however in reality, it will be no small undertaking. The idea of sharing assets and efforts across Services let alone commands in the military threatens the well-guarded mentality of "this is how we've always done it." Essentially, the military has been tasked to do more with less, do it quicker, more efficiently and more reliably.

In order to address new threats, emerging technologies and ever-changing social and economic environments, the military must look for new and different means to achieve its goals. Years worth of lessons learned and after-action reports coupled with the tremendous impact of the terrorist attack on the World Trade Center and the Pentagon on September 11, 2001 further dictate the need for today's military to adapt, overcome and change its very culture in the face of such adversity.

The volumes of information available at our fingertips via the World Wide Web (WWW) serves to clarify how stratified and insular the Services are, in particular with respect to logistical support. In the late 1990's the highest levels of our Federal Government and the U.S. Military realized the need for change and began discussions centered on the way the Services conduct their business. Numerous changes occurred during the period from 1990 to 2000 that further exacerbated the need for change including: a reduction in the number of military personnel by 33%; an inflation-adjusted decrease in DoD budget by more than 28%; an increase in the power projection overseas with an increase in the number of deployments up to 55; and a 47% decrease in stockage inventory, a decrease of more than $46 billion. [Ref. 1]

A. OVERVIEW

1. Problem Statement

"The USTRANSCOM and DLA partnership has enjoyed measurable success for over two years, but is at a point…where it's time to re-engage, refine, and move forward." [Ref. 2] With the Strategic Distribution Management Initiative (SDMI) at its two and a half year mark, and undergoing a name change by dropping the "initiative," (*from here on, SDMI and SD refer to the same program*), we are at a point where the venture merits a review. From the May 2002 SD Board of Directors (BOD) meeting came several taskers, one in particular (#0205BOD05) is to answer the question: "*Have Strategic Distribution improvements had effects and impact upon readiness and inventory levels?*" A particular item of interest (question) of the BOD is "a*re Strategic Distribution improvements resulting in reduced inventories…and consequently saving in inventory costs?*" Related to that inventory question, we will consider, "To what extent are units experiencing inventory turbulence; and what are the ramifications?" In the same vein, one should ask, "Are improvements being made that make a difference to readiness?" Is SDMI influencing requisition cycle time for critical requisitions and ultimately affect readiness of fleets? [Ref. 2]

2. Purpose

This thesis examines the effects of the SDMI implementation on the Army's two maneuver divisions stationed in the European Command (EUCOM). Our primary objective is to determine the effect SDMI has had on inventory levels and readiness. In addition to addressing and answering the BOD's questions, our alternative objectives include examination of barriers to improving velocity that still exist while focusing on lucrative targets that may impact readiness.

B. SCOPE

This thesis will study SDMI goals, objectives and implementation impacts pertaining to the eight Class IX Supply Support Activities (SSAs) organic to the two Army divisions in the United States Army, Europe (USAEUR). Specifically, it will address inventory levels, inventory turbulence, and requisition cycle time associated with the eight SSAs.

This thesis seeks to answer the following questions:

- Have Strategic Distribution improvements resulted in reduced inventories?
- Is inventory turbulence and its related costs an area for further scrutiny and possible improvement?

- Are the SD improvements being made ones that make a significant difference to readiness?

- What lucrative targets (in terms of requisition cycle time) exist which have a large potential payoff in terms of readiness?

C. EXPECTED BENEFITS OF THE STUDY

This thesis primarily benefits the SD team by objectively addressing some of the questions posed by the BOD. Moreover, it will address areas for further scrutiny and possible improvement commensurate with the goals and objectives stipulated in both the SDMI Project Guidance [Ref. 3] and the Project Management Plan [Ref. 4]. It is our goal to provide a view of the SDMI program from the 'micro' perspective and compare that to the 'macro' analysis available from the program itself. Additionally, this thesis might provide a new perspective and create discussion on topics not yet considered, as well as provide new perspectives on current topics.

D. ORGANIZATION

Chapter II will lay the groundwork for the "entering arguments" as the individual strategic organizations contributed to SDMI in its early stages. Additionally, it will provide a brief background into the basic core members of the SD through a literature review. Chapter III discusses the methodology used for the analysis. Chapter IV presents our analysis and results. Finally, in Chapter V we will discuss our conclusions and recommendations.

THIS PAGE INTENTIONALLY LEFT BLANK

II. LITERATURE REVIEW

A. BACKGROUND- PRE-SDMI ARCHITECTURE

This chapter summarizes the literature relating to the entities contributing to and participating in the SDMI from its inception. Additionally, the review discusses basic theories, goals and missions of the contributing sources along with the individual entities and their current philosophies as each entered the SDMI Program.

1. Joint Vision 2010/2020

Joint Vision 2010 (JV 2010) was formulated and released by the Joint Chiefs of Staff in 1996. In June 2000, Joint Vision 2020 (JV2020) was released by the Joint Chiefs of Staff, which further expanded upon the theories and policies of JV 2010. Collectively, the two documents contributed to the framework of the SDMI program.

To quote the introduction of the JV 2010 document, "Joint Vision 2010 is the conceptual template for how America's Forces will channel the vitality and innovation of our people and leverage technological opportunities to achieve new levels of effectiveness in joint war fighting." [Ref. 5] Essentially, JV2010 formulated a mission foundation upon which the military could build. It focuses on the technological advances of the time, which then was just a mere taste of the breakthroughs we've experienced since. The overarching focus of JV2010 was the future of war fighting in the early 21st century utilizing improved intelligence and command control centered on information technology developments. Finally, JV 2010 identified four operational concepts that would form its basis: *Dominant Maneuver, Precision Engagement, Full Dimensional Protection* and *Focused Logistics*. [Ref. 5]

Joint Vision 2020 focuses on the transformation process the military is undergoing to create "a force that is dominant across the full spectrum of military operations- persuasive in peace, decisive in war, preeminent in any form of conflict." [Ref. 6] As with JV 2010, the four operational concepts: Dominant Maneuver, Precision Engagement, Full Dimensional Protection and Focused Logistics remain primary to the Joint Vision. The overarching theme of JV2020 is full spectrum dominance through optimized application of the operational concepts. Additionally, the focus on the flexibility and responsiveness of the 'Joint' environment was stressed even more than was in JV2010. Finally, Joint Vision 2020 does not focus on the materiel aspect of the future of the military, rather it focuses more on developing doctrine, effective organizations and properly educated and trained leaders and personnel that can take advantage of available technology. [Ref. 6]

2. Velocity Management

Commissioned in 1995, the Army's *Velocity Management* (VM) Initiative has completely transformed the way the Army conducts its business. Centered in the focus of VM is material and information flow from providers to users. VM sought to optimize the speed and accuracy of that flow by analyzing processes throughout the establishment. As a result, VM has shown dramatic improvements in the Army's logistics processes in terms of time, quality and cost. Creating a drastic reduction in materiel delivery time, the Army has created a high-velocity, streamlined order fulfillment mechanism. Additionally, VM has successfully integrated the repair processes, which further serves the users with more readily available repair parts and materiel. [Ref. 7]

Of key influence to the SD Program was the constant, heavy involvement in the VM process by senior leaders throughout the Army. Furthermore, VM utilized an effective process improvement procedure called Define Measure Improve (D-M-I), which will be covered later in the discussion on the SDMI Program infrastructure. The object of the DMI procedure is that it is a constant series of steps whereby processes are clearly defined, accurately measured, and the results are applied to create process improvements. Subsequent changes led to rapid and continuous improvement. Overall success of the VM program is indicated by institutionalization of the potential for achieving and sustaining large-scale process improvement based on the success experienced by the Army. [Ref. 7]

Many military organizations have been plagued by the inherent sense of a need for an 'iron mountain' of supplies and support equipment in order to fulfill its mission. This mentality has been brought about by years of disconnect between the "declared" reliability of a piece of equipment and its related inventory versus the "actual" reliability or Mean Time Between Failure (MTBF) and its related inventory attempts to meet those actual data points. Set out to disprove this mindset by focusing on replacing mass with velocity, VM used the parameter of Customer Wait time (CWT) as a key measure for improvements. Customer wait time is defined as, "the total elapsed time between issuance of a customer order and satisfaction of that order. Ideally, CWT will include all customer orders, regardless of commodity or source, immediate issues, and backorders (and) include issues from wholesale and retail stocks as well as various other arrangements." [Ref. 8]

One issue here is that the act of "Cannibalization" or as the Army terms, "Controlled Substitution," and its destructive impact on calculating CWT. The problem is that cannibalized or substituted parts are taken from another piece of "downed" equipment, which satisfies the immediate problem, but does not negate the need for the requisition. Thus the equipment that the original requisition is ordered against is often repaired and fully mission capable (FMC) before the requisition is satisfied by the system. While VM used CWT as a measure of success, it also attempted to relate VM improvements to readiness. The Rand study discussing VM (Reference 7) details an Army initiative called Equipment Downtime Analyzer (EDA), which was developed to draw a correlation between "measurement activities" and "improvement activities." Essentially, the EDA is supposed to assist in making the connection between VM improvements and readiness. The discussion, however, falls short of stating that EDA was able to link VM to any improvements in readiness. [Ref. 7]

Another aspect of VM that played heavily in the development of SDMI is the inventory management process. The very nature of military logistics demands that mobility play a key role in support decisions. VM sought to optimize inventories maintained at the local installations by balancing customer performance objectives, cost and mobility issues. In conjunction with the RAND Corporation, VM aimed at improving local fill rates of requisitions by offering a broader, yet shallower inventory from which to select. Two dimensions of inventory performance were defined, measured and showed improvements. "Performance" metrics were defined concerning time and quality dimensions while "resource" metrics measured the costs involved. [Ref. 7]

3. High Yield Logistics

Through *High Yield Logistics*, the Navy seeks to deliver the highest quality service to expeditionary forces around the globe while reducing Navy's total ownership costs. The High Yield Logistics Initiative has a three-pronged approach. First is to reduce cost through transforming the traditional means of weapon systems support. By concentrating on coordinating between the acquisition and logistics communities, the Navy is attempting to address high Operating and Support (O&S) costs for fielded systems through inserting technology. This technology insertion refers to 'designing in' product support in the product development stages as well as improving the technology incorporated in repair parts, engineering them for longer life cycles and optimal operating parameters. Through improving the technology of the repair parts, the Navy hopes to realize higher reliability factors in its equipment, less downtime and less repair costs. This is one of the more pro-active approaches to addressing the *cause* of many logistics issues, by improving reliability factors of merit, higher MTBF and longer repair cycles, an improved logistics support system will naturally follow. Overall, the Navy envisions this initiative as freeing funds for modernizing and recapitalizing current weapon systems as well as investing in new weapons systems. [Ref. 9]

The second approach to High Yield Logistics involves a web-based program called One Touch Support which applies business process reengineering concepts by identifying best-value suppliers, integrated systems and technology, customer–centered metrics and tailored customer support. [Ref. 9] Taking advantage of the latest web technology, the One Touch Support website maintains the highest quality and most up-to-date information available for today's logisticians.

The third approach of High Yield Logistics is the Regional Maintenance Program. By distributing maintenance and repair work around throughout a region's maintenance facilities, the program seeks to optimize a maintenance work within a geographic region. Overall, a cost savings should occur while the Navy is able to ensure higher utilization of personnel and assets. Combined, these efforts were all considered during the development of SDMI.

4. Precision Logistics

Stemming from its emerging operational concepts engendered in the Operational Maneuver from the Sea document, the Marine Corps has developed *Precision Logistics*. Faced with these emerging operational concepts, marine commanders are subject to new challenges. Precision Logistics is focused on the commander's ability to address and meet those challenges by creating logistics process improvements based on strategic, operational and tactical requirements. [Ref. 10]

Central priorities to the Precision Logistics plan are: improved equipment readiness, enhanced distribution, and the development of a robust logistics command and control capability. [Ref. 10] Of interest to the SDMI program here is that the Marine Corps used the D-M-I continuous improvement methodology for its program framework. As we'll show later, this is exactly what the SDMI team utilizes for its program. Additionally, SDMI emulated the Marine Corps 'grass roots' approach to reengineering its logistics system by looking at requisition submission and processing, distribution, repair processes, inventory management and consolidation, shipping modes, etc.

5. Logistics Transformation

The United States Air Force's major initiative for reengineering its logistics processes is *Logistics Transformation*. Much like its sister services, the Air Force is focused on increased performance for the war fighter through adapting best government, commercial, and academic initiatives and opportunities. The desired end-state is a logistics system that is an integrated, process-oriented logistics and product network through focusing on three primary precepts:

- The role of expeditionary aerospace operations stresses a flexible system that is integrated, mobile, and precise to meet evolving requirement of the war fighter.
- Current resource constraints necessitate and Air Force logistics system that provides the required performance and is both affordable and effective.
- Eliminating barriers and optimizing processes will enhance customer confidence.

Finally, Logistics Transformation includes education of its officers and airmen as vital to the success of this transformation. [Ref. 10]

6. DLA

The Defense Logistics Agency has been providing Combat Logistics Support to the military since its creation in 1961. It is an interagency organization that is headed by three-star officer drawn from one of the Services on a rotational basis. In terms of the business world, DLA is ranked number 126 of Fortune 500 companies with an annual sales and services value of more that $17.8 Billion. Employing more than 24,000 civilians and 1,100 active and reserve military personnel, DLA has offices located in 48 states and 28 countries. [Ref. 11]

As with the rest of the military, and much of the business world, DLA has transitioned through a series of downsizing efforts to reduce its once massive infrastructure. It has combined a number of its duplicated/like services and streamlined numerous processes. Currently DLA operates 22 Distribution Centers, supporting 1372 weapons systems, maintaining more than $84.7 Billion in inventory and handling 18 million requisitions annually. Recently, DLA's focus has been on "Giving the War Fighters What They Need…" while maintaining reduced inventories, lower costs, and providing faster reliable service, "from Logistics Mass to Logistics Velocity." Obviously, these numbers indicate the tremendous challenge the SD program faces when dealing with an agency of this size. [Ref. 11]

In addition to the Distribution Centers, DLA maintains several 'Lead Centers' that purchase and manage a variety of supplies and services including fuel, food, clothing, construction supplies, electronics, medical supplies, and distribution and disposal reutilization services. Research conducted for this thesis covered material and services provided by a number if not all of these locations. The following is a brief summary of each location and its primary materiel/service it provides: [Ref. 11]

- Defense Energy Support Center (DESC)- Fort Belvoir, Va. Fuels, gas and electrical power.
- Defense Supply Center, Columbus (DSCC), Columbus, OH. Maritime and land weapon system support.
- Defense Supply Center Richmond, (DSCR), Richmond VA. Aviation support.
- Defense Supply Center Philadelphia (DSCP), Philadelphia PA. Food, clothing, medical, general and industrial supplies services.

- *Defense Distribution Center (DDC), New Cumberland, PA. Operates a worldwide network of 24 distribution depots that receive, store, and issue supplies. The depots are strategically located to enhance rapid distribution of critical military items.
- Defense Reutilization and Marketing Service (DRMS), Battle Creek, MI. Handles property disposal of items from vehicles and office equipment to scrapping of Naval ships and hazardous materials.

Additionally, DLA maintains two headquarters in Europe and the Pacific theater to provide customer assistance, liaison services, war planning interfaces and logistics support to the Commanders in Chief and their service component commands:

- DLA Pacific, Taegu, Korea. Provides Customer assistance and services support to the Commanders in Chief, Pacific Command and his service component commands.
- DLA Europe, Wiesbaden, Germany. Serves as the focal point for tracking all war fighter issues from all DLA activities in Europe and the continental United States.

* This location (DDC) houses the Consolidation and Containerization Point (CCP), which is the primary shipping platform for nearly all material shipped to locations in our study. [Ref. 11]

7. USTRANSCOM

The United States Transportation Command, headquartered at Scott AFB, Ill., was established in 1987 and is one of nine U.S. unified commands. Tasked with the coordination of people and transportation assets, it is the single manager of America's global defense transportation system. The number one priority of USTRANSCOM is responding to the needs of DoD's war fighting commanders. Composed of three component commands: (1) Air Mobility Command, (2) Military Sealift Command, and (3) Military Traffic Management Command, USTRANSCOM is responsible for coordinating missions worldwide using military and commercial transportation assets. [Ref.12]. Currently, Commander, USTRANSCOM is "dual-hatted" as he is commanding both USTRANSCOM and AMC-AF.

Air Mobility Command (AMC-AF), managed by the Air Force, is headquartered at Scott Air Force Base. Capable of providing refueling services and delivery of personnel and material anywhere in the world in a matter of hours, the Air Force uses a number of airframes to support their needs including: C-17 Globemaster III, C-5 Galaxy, C-141 Starlifter, KC-135 Stratotanker, KC-10 Extender, and C-9 Nightingale. Additionally, in the case of national emergencies, the Civil Reserve Air Fleet (CRAF) can provide a fleet of commercial aircraft in order to provide transportation of military personnel and assets. [Ref. 12]

Military Sealift Command (MSC), managed by the Navy, is responsible for worldwide sea-transportation of military material during peace and war. Employing both military and civilian assets including Fast Sealift and Ready Reserve ships, MSC has three primary functions:

- Surge Sealift- Used to move military equipment and supplies from CONUS to theaters of operations.
- Prepositioned sealift- Material that is pre-positioned in strategic locations around the world. Once activated, falls under USTRANSCOM's command.
- Sustainment sealift- Provides continuous logistical support to forward deployed/activated forces. [Ref. 12]

Military Traffic Management Command (MTMC) provides the overland lift services and is the primary traffic manager for USTRANSCOM. The primary mission of MTMC is to provide service to DoD and the mobilization community through responsive planning, crisis response actions, traffic management, terminal operations, integrated transportation systems and deployability engineering. Along with contracting for commercial transportation resources, MTMC manages more than 12,000 shipping containers, 1,350 rail and tank cars and 142 miles of Government–owned railroad lines. [Ref. 12]

8. AMC

Army Materiel Command is the primary provider of logistical support to Army forces. Essentially, "if a soldier shoots it, drives it, flies it, wears it, or eats it, AMC provides it." [Ref. 13] More specifically, AMC's services range from research and development of sophisticated weapons systems to the ordering maintenance stocking and distribution of spare parts. Additionally, AMC acquires all the ammunition utilized by all military services as well as support foreign military interests by conducting sales of equipment and negotiation of agreement s for co-production of U.S. Weapons systems by foreign nations.

Headquartered in Alexandria Virginia, AMC maintains some 149 locations worldwide in over 40 states and 38 countries operated by more than 50,000 military and civilian employees. By focusing on integrating technology, acquisition and logistics, AMC has been proactive in modernizing and developing itself to remain competitive. Finally, part of AMC's mission statement is that they are "heavily involved in making the Army more responsive, deployable, agile, versatile, lethal, survivable, and sustainable." [Ref. 13]

B. SDMI INFRASTRUCTURE

1. Background

Recognizing the transitions military logistics organizations have undergone and continue to face coupled with the visions outlined in Joint Vision 2010 and 2020, such as *Dominant Maneuver* and *Focused Logistics*; the entities involved with SD determined that their process changes should be focused on *velocity* and *consistency*. *Velocity* describes how rapidly operational sustainability can be delivered to the war fighter in peace and in war. Furthermore, the SD team recognized that the war fighting 'customer' has a wealth of exposure and understanding of how the civilian sector business world has grasped effective supply chain management and transportation and used it to its fullest advantage. Finally, taking into consideration the Service's individual approaches to modern logistics such as *Precision Logistics, High-Yield Logistics, Logistics Transformation* and *Velocity Management*, the SD team agreed that; "Our efforts to improve strategic distribution <u>must be a cohesive, integrated effort</u> across the spectrum of material acquisition, transportation movement, and initial in-theater distribution." [Ref. 3]

2. SDMI Defined

This program is breaking new ground, as it is the first single-effort to define, measure and improve the design and overall effectiveness of DoD's worldwide distribution, transportation and supply chain management system. Essentially, it is a charter for an enterprise-level analytical review and redesign in order to optimize DoD's supply chain. Per the SDMI Program Guidance, the following summarizes what SD is supposed to be:

> The Strategic Distribution Management Initiative (SDMI) is a joint effort headed by the Commander in Chief, U.S. Transportation Command (USCINCTRANS) and the Director, Defense Logistics Agency (DLA), in consultation and coordination with the Military Services and other defense agencies, to improve DoD's distribution system. The SDMI is a distribution/sustainment enabler to identify and implement value added distribution services. It provides a forum for coordinating the integration of joint material acquisition, transportation, and distribution process improvement activities among member organizations. Under this initiative, appropriate policy and joint process recommendations will be forwarded through the Military Services to the Joint Staff and OSD for approval. [Ref. 3]

3. SDMI Vision and Mission

The Vision Statement of the SDMI program is:

> An optimized global system providing responsive, reliable, end-to-end distribution service to our customer – both peacetime and wartime. [Ref.3]

The Mission of SDMI incorporates this vision statement into a forward-thinking mentality with regard to distribution requirements. By reviewing and thoroughly analyzing all aspects of civilian and military processes including acquisition, storage, transportation and distribution practices, the SD team plans to incorporate the vast array of lessons learned along with the latest technology to create its desired optimized distribution system of the future. Throughout the process, the overarching vision and mission of SD will be revisited to ensure that all changes are guided toward a "cohesive and integrated effort." [Ref. 3]

4. SDMI Goals and Objectives

The overall goal of the SD program is to provide improved end-to-end distribution to war fighter customers in times of peace and war. The focus will be on improving overall distribution and transportation services and supply chain management across a global system during peacetime operations while ensuring the capability to transition to wartime scenario with ease.

In pursuit of its goals, the SDMI Project Guidance [Ref. 3] lists the following objectives:

- Analysis/optimization of strategic linkages with intra-theater distribution processes to facilitate an integrated supply chain management process.
- A comprehensive analysis of strategic distribution requirements and capacity across the full spectrum of operations. Actions and supporting tasks required of this objective will require:
  - Identification of policy, procedure, and process impediments to optimal distribution chain performance.
  - Identification and improvement of processes in the strategic transportation and distribution system to reduce **Customer Wait Time** (CWT) and ensure credible **Time Definite Deliveries** (TDD).
  - Development and implementation of a capability to ensure **"predictive delivery"** in the supply chain process.
  - **Integration of vendor and contractor shipments** into the defense global distribution system – in peace and in war.
- Coordination with Services and recommendation of policy change initiatives to the Joint Staff and OSD. (SDMI Project Guidance, 2000) [Ref. 3]

Figure II-1is excerpted from the SDMI Project Guidance [Ref. 3] and provides a visual depiction of the inter-relationship and integration SDMI intends for the Services.

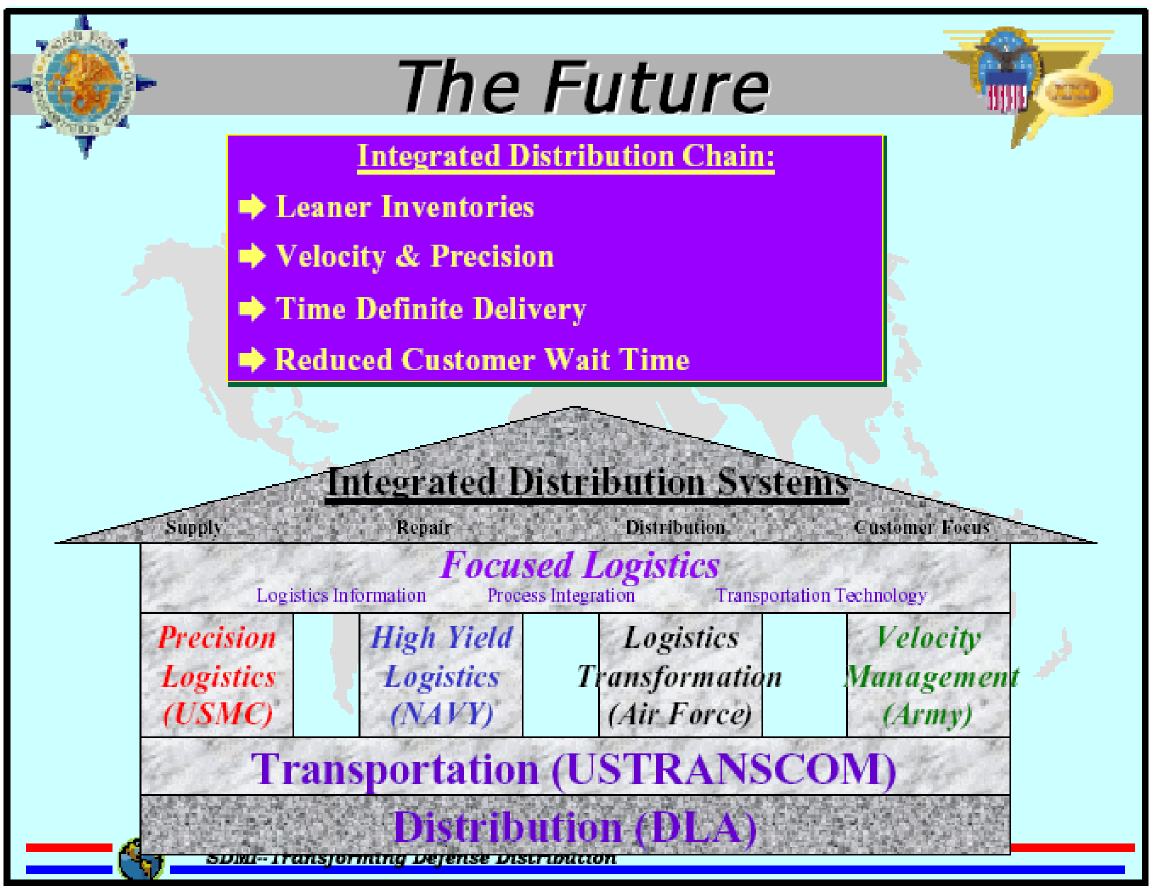

Figure 1. SDMI Integrated Distribution Chain [Ref. 3]

Recognizing that SDMI is but one of the numerous vital programs being implemented throughout the military; the SD team ensured that consideration be given to other relative process improvement programs such as: Joint Theater Distribution, Joint Test and Evaluation (JTD JT&E) and the Joint Logistics War fighting Initiative (JLWI). Coordination and collaboration among these programs and the Services is an important facet of the program as the SD officials recognize that the very intent of the program is to diminish or completely eradicate "stovepipes" and "rice-bowls" among the Services. [Ref. 4]

5. Scope of SDMI

Originally, SDMI was not designed to cover the entire deployment/redeployment process. Rather, the initiative is bounded, starting with detailed analysis of current acquisition procedures, through to the receipt of requested material at a Port of Debarkation (POD). Interim processes to be reviewed under the SDMI program include; "scrutinizing activities used to submit, receive, and fill supply requisitions, conduct transportation movement to a Port of Embarkation (POE), conduct receipt activities at the POE and transportation and receipt at a POD." [Ref. 3] The final stage of the SDMI program analysis is to examine material movement from the POD (or OCONUS Retail Site) to the customer. However, for the purposes of this study, the point at which the material is received at the POD or Retail Site is the ending point for SDMI analysis.

6. SDMI Organization

SDMI developed its program centered on four primary groups of stakeholders; they are:

- **Customer**- The "receiving end" perspective of all distribution efforts, in times of peace and war.
- **Suppliers of Material**- Includes those who repair reusable stock as well as those who control organic depot and commercially produced stock assets.
- **Providers to the process**- Including the Services, DLA and USTRANSCOM, as those activities who provide support to customers with timely delivery of required material in support of their mission.
- **Higher Authority**- For the SDMI Program, this refers to the Office of Secretary of Defense (OSD) and the Joint Staff. [Ref. 3]

7. SDMI Management Structure

By combining resident expertise from both USTRANSCOM and DLA, an integrated management structure was formed to collectively manage the SD initiative. Headed by the SDMI Senior Partners, Director, DLA and Deputy Commander, USTRANSCOM, functional committees were designed along the lines of an Air Distribution, Surface-only Distribution and Stockage Management Committees. Each committee is responsible for a detailed and exhaustive review and analysis of the current processes within its particular functional perspective. However, the SDMI guidance was clear in stating that each functional committee should also actively pursue open dialog cross-functionally in order to identify and develop fully cohesive and integrated recommendations. [Ref. 3]

Program oversight is the responsibility of the Senior Partners while the daily operations of the program is managed by an Executive Agent with support from an SDMI Core Team. The Executive Agent coordinates all functions of the program from integrating committee actions, issues and recommendations, to organizing and scheduling SDMI Board of Directors (BOD) meetings. Co-directors are responsible for attending and supporting the interagency BOD meetings and conducting periodic reviews with the Senior Partners and other OSD/Joint Staff logistics steering groups. [Ref. 3]

Management responsibility is assigned to Co-Directors; Director of Operations and Logistics, USTRANSCOM (TCJ3/J4); and Commanding General, Defense Distribution Command (CG DDC) who jointly provide direct daily oversight and management of the program and its activities. Excerpted from the SDMI project guidance, the following list summarizes composition and responsibilities of the primary entities in the SDMI infrastructure:

- **Board of Directors (BOD).** Ensure close integration and cooperation with related distribution process improvement efforts. The BOD will meet quarterly and provide advice and recommendations on opportunities to improve overall defense distribution processes. Board members include flag level representation from OSD, the Services, the Joint Staff, Service Acquisition Organizations, and Component Commands of USTRANSCOM.

- **Executive Agent.** The Executive Agent, acting on behalf of the Co-Directors will ensure integration of SDMI Committee actions, and prepare issues for presentation to the BOD, and DCINCTRANS/Director DLA. The Executive Agent also manages allocation of analytical support to the functional committees to support overall SDMI requirements, and develop/propose issues for further analysis. Manages the daily activities of a dedicated SDMI Core Team, in coordination with CG, DDC.

- **SDMI Core Team.** A small, dedicated core team, consisting of government and contractor personnel, to act in direct support of the Executive Agent. They will serve in a "clearing house" capacity for routine SDMI matters and administer day-to-day SDMI transactions. Specific Core Team responsibilities include the establishment, maintenance, and administration of a SDMI Project Management Plan. Further, they will track the quality of integration efforts of this program's numerous initiatives.

- **RAND Analysis Team.** The RAND analytical team will, in support of the government's Project Monitor, provide analytical support to DLA/USTRANSCOM for use in applying proven reengineering methods to the strategic distribution process. They will respond to the direction of the SDMI Monitor, when performing end-to-end, SDMI integration analysis, and Committee Chairs when conducting more narrowly focused examinations required of the function nodes.

- **Functional Committees/Chairs.** Committees are responsible for examining the distribution processes in their functional areas for determination of where improvements can be made to achieve our SDMI objectives, and to develop improvement proposals, and strategies for implementation of their recommended changes. <u>Each committee is responsible for providing recommendations based on process analysis and fact-based derivations</u>.

[Ref. 3]

As mentioned earlier, these committees while focusing on analysis within their functional perspectives, must also actively collaborate between committees and consider viewpoints of the stakeholders as well. Specific focal points of each committee include:

- Lay out and understand their respective processes, to include all critical nodes; establish specific beginning and end point of each process/sub-process.

- Establish a baseline; develop a means of collecting data/information and collect data/information against the baseline.
- Establish improvement objectives for each process/sub-process and the performance metrics to be used to measure improvement.
- Identify potential changes or improvements that might increase speed and accuracy of distribution management. Formulate strategy and courses of action to test, and implement change, if successfully tested.
- Record and analyze results of pilot implementations; subsequently provide results and fact-based recommendations (recommendations should address expected changes to DoD policy, process and systems).
- Measure and report the results of implemented operational processes; offer correction recommendations as appropriate. [Ref. 3]

Management activities throughout the SDMI program are tasked to administer, analyze, initiate, measure, identify, create and initiate change to current functional processes. Per references 3 and 4, each organizational entity under the SDMI program was given direction and focus which includes:

Stockage Management Committee - Chaired by Deputy Commander DDC.

- Analyze current and emerging product support requirements, processes, and systems associated with supply chain management and distribution for the DOD. Identify product support, distribution problems and improvement opportunities. Recommend changes and courses of action to the BOD, and implement approved changes.

- Model, redesign, prototype, and implement approved changes.

- Develop ideas, approaches, understanding for the explicit use of DLA and Service ICP's. Partner with DLA and Service ICP's to foster product support concepts from an integrated approach in pursuit of OSD goals to include "shift to commercial practices".

- Consider alternatives and facilitate stock positioning recommendations to achieve overall DoD supply chain efficiencies (the committee recognizes that participating ICP's [Service and DLA] are solely responsible for the management of their stocks).

- Establish process to eliminate policy, procedure and process impediments to optimal product support and/or physical distribution.

Surface and Air Distribution Committees

- Chaired by CG MTMC and AMC/DO respectively.

- Analyze current and emerging surface and air distribution requirements, processes, and systems. Identify surface and air distribution problems and process improvement opportunities. Recommend changes and course of actions to the BOD, and implement approved changes.

- Model, redesign, prototype, and recommend changes.

- Improve efficiency and effectiveness of distribution process to the ultimate customer through comprehensive analysis of surface and air distribution requirements including wartime capacity and implement approved changes.

[Ref. 3, 4]

Executive Agent and SDMI Core Team

- Create and orchestrate an SDMI Project Management Plan (PMP).

- Track linkage and analyze/ensure the integration of SDMI initiatives.

- Orchestrate SDMI end-to-end analysis; provide recommendations to Co-directors on future direction.

- Conduct SDMI resource management. Prepare and manage the SDMI budget; redirect program resources within constraints of contracts, agreements, and available funds to mitigate risk and ensure on-time delivery of quality deliverables within budget.

- Provide a communications protocol and ensure dissemination of the SDMI information/actions throughout the DOD.

- Establish and maintain a SDMI repository; establish repository guidelines.

- Coordinate and announce all SDMI executive meetings.

- Provide routine direction to the SDMI management structure, including redirection as required.

- Initiate actions to acquire contract support for the program.

[Ref. 3, 4]

RAND Analysis Team

- Conduct baseline analysis of current SDMI processes; determine current process performance; define relevant processes.

- Accomplish end-to-end SDMI system analysis, seeking current integration gaps and future opportunities.

- Perform diagnostic analysis; identify potential areas for improvement.

- Develop and support a means to measure and report the results of D-M-I actions. Measure flows of material in terms of quantities, customer wait time, volumes, weights, and costs.

- Provide recommendations and implementing strategies to the Executive Agent and Functional Committees.

[Ref. 3, 4]

8. SDMI Analytical Methodology

Focusing on creating change that was integrated and cohesive across all boundaries, the SDMI team sought to select a process improvement procedure that was capable of accurately defining and measuring current supply chain management procedures. They decided on a rational methodology derived from commercial practices and in fact was the format used in the Army's highly effective *Velocity Management* process called the **DMI** methodology where:

D*efine current processes and issues*. Essentially conduct a step-by-step review of all processes and clearly describe these steps.

M*easure current processes using mapping and analysis process controls*. This process involves understand the current processes involved; diagnosing the performance drivers of each individual process; and monitor changes and improvements to those processes.

I*mprove current processes by measuring the impact of proposed process, system, or policy changes*. This step involves designing changes to existing processes or developing entirely new processes; defining goals and milestones for them; and experimenting and implementing the changes.

Figure-2 below, excerpted from the SDMI Project Management Plan [Ref. 4] provides the SDMI vision of how the DMI methodology is supposed to function.

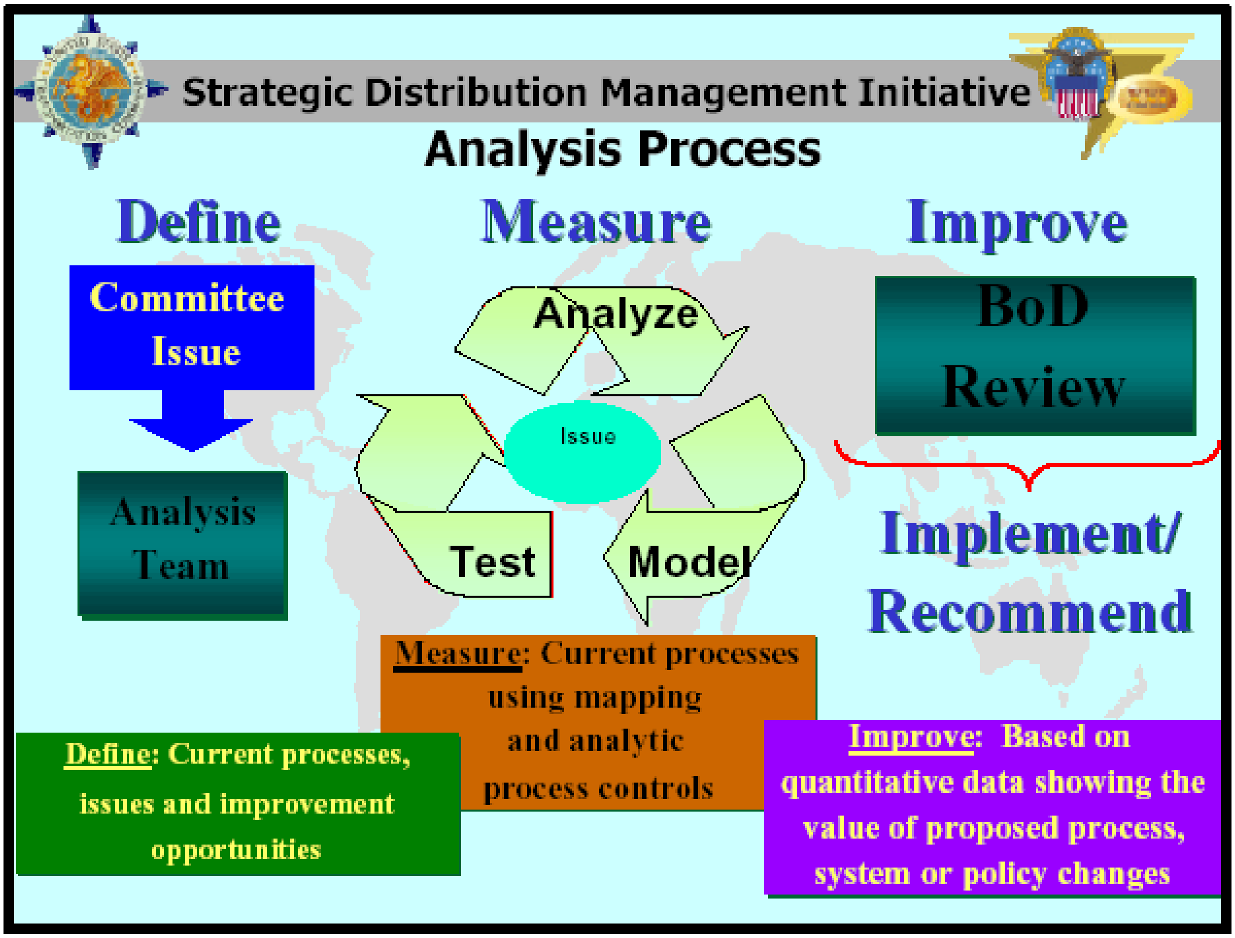

Figure 2. SDMI Management Process- DMI [Ref. 4]

Each committee is expected to thoroughly employ the DMI methodology in its functional analysis. Based on the outcomes, the committees should develop "baseline" processes for their respective fields. Once the baselines are developed, the committees should look for impediments or process degraders that might require review for validity and possible change. Also, the committees should develop specific beginning and end points as part of the process definition. [Ref. 4]

C. BACKGROUND TO RESEARCH QUESTIONS

After studying the SDMI Project Guidance and the SDMI Project Management Plan (references 3,4) and at the same time considering the questions posed at the May 2002 BOD Meeting (reference 2), we generated the research basis for this thesis. The following discussion provides the background to the research questions and is the basis for further analysis in chapters III and IV.

1. Authorized Stockage Lists

During the SD Board of Directors meeting in May 2002, a brief was provided concerning "SD Program Changes" which stated that one particular manner Strategic Distribution was attempting to measure success was through leaner inventories and reduced infrastructure [Ref. 2]. Two recent National Defense Magazine articles are relative to this discussion of inventory levels and mobility. In Sandra Erwin's July 2002 article, she pointed out that the Logistics Transformation Task Force was directed to figure out ways for the Army to reduce its "logistics footprint," to become more deployable and to improve the quality of the logistics services to forces in the field [Ref. 14]. In a similar article published in May 2001, Harold Kennedy postulated that the Army is making an effort to transform itself into a lighter, more deployable force. It also reaffirmed the goal of reducing the "logistical footprint" of its combat units. [Ref. 15]

Similarly, an April 1999 article written by Fritz Crytzer, Supply Policy Division, Office of the Deputy Chief of Staff for Logistics, Department of the Army, stated that, "As Velocity Management initiatives reduce OST, fewer parts are required to be stocked at the ASL level." The article's opening postulation suggests "Recent changes in Army retail supply policy will reduce stockage levels of repair parts in the field and move the Army toward a distribution-based logistics system." The concepts of Time Definite Delivery and "predictive delivery" are tenets that complement and build upon the "distribution-based logistics system." The article also stated, "repair parts inventories at the retail level are being reduced," which also is an expected outcome of the SDMI. [Ref. 16]

2. Inventory Turbulence

The research question on this topic was selected for three reasons, (1) because it is relative to our first two ASL research questions and provides us more insight into the discussion of ASL changes over time, (2) the study of inventory turbulence helps us understand its impact upon the SDMI program in an environment of scarce resources and, (3) the metric of inventory turbulence, and tracking it as a measure of performance, is in keeping with the spirit of the SDMI Project Management Plan's Data Collection and Measurement Plan [Ref. 4].

Inventory Turbulence often results from periodic additions, reductions, and eliminations (deletions) of repair parts from the SSAs Authorized Stockage Lists. A small portion of these changes to the ASLs occur throughout a given year as adjustments made based on directives, FEDLOG updates, Interchangeability & Substitutability updates, etc. The majority of changes to the ASL occur normally once a year as a result of the annual ASL Review process. Significant changes may also result from stockage level model changes (e.g. EOQ, Demand Analysis, Dollar Cost Banding).

At the end of the ASL Review process, a portion of inventory items are deleted from the ASL. When items are deleted from the ASL, they generally become excess, for which materiel release orders (MROs) are created. These items must be picked or pulled from the location in the inventory, documented, packaged, and shipped to the Theater Central Retention Account for serviceable excess Class IX. The Theater classifies serviceable excess as either NAMI (Non-Army Managed Items) or AMI (Army Managed Items). Non-Army Managed Items excess review is conducted once every three months. Anything that exceeds the Retention Level or twice the RO is either sent back to the Continental United States, to the Consolidation and Containerization Point for redistribution, or to the Defense Reutilization and Marketing Office (DRMO). The Theater Materiel Management Center analyzed their output and found that for NAMI items:

78% of serviceable items less than $100 go to DRMO
22% of serviceable items less than $100 went to CONUS
30% of serviceable items greater than $100 went to DRMO
70% of serviceable items greater than $100 went to CONUS [Ref. 17]

This thesis will consider ASL Inventory Turbulence in its most conservative sense by analyzing the effects of deleting items from the ASL and re-adding the same items within the period of our study.

3. Readiness

We chose to study SDMI's impact on readiness and look at readiness related research questions primarily because we desired to address the Board of Directors tasker #020BOD05 (*Have increases in Readiness been realized due to SD Improvements*?). Even beyond the tasker, we wished to address this topic because it is the ultimate measure of success to the Army in the field as well as throughout the Services. In defining itself, SDMI states, "it is an agile global distribution network…in peace and war…and a partnership that is Readiness focused" [Ref. 1]. Furthermore, a major tenet of Strategic Distribution is that "Supply Chain Improvements Must be Measured Based on Real Customer Outcomes". One means Strategic Distribution stated that it intended to measure success was by "Improved Readiness" [Ref. 18].

We begin our study of readiness by studying fleet readiness trends in the two divisions in United States Army Europe. Fleet Readiness is the archetypical measure and definition of readiness. Improvements in Customer Wait Time, Order Ship Time, Reliability, and Stockage Management are all objectives ***in support of*** the ultimate goal of improving readiness. One would be accurate in saying that *all roads lead to readiness*.

Beyond simply addressing the readiness question head-on, we also intend to look at areas that may lead to possible improvement in readiness. We will compare supply pipeline segmented processes for Defense Logistics Agency and Army Materiel Command items heading into United States Army Europe through the Consolidation and Containerization Point for readiness related requisitions. Additionally, we will look at backorder percentages and related number of days in backorder status for the same fleets we use to answer our readiness question.

D. SUMMARY

This chapter provided a review of the entities that contribute and/or participate in the SD program, or have bearing on our thesis topic. We began with a description of individual primary 'players' and their perspective on the current and future status of military logistics. Next, we provided a brief description of the SDMI program and its basic tenets. Finally, we ended with a discussion on the formulation of the research questions for this thesis. Chapter III will discuss the methodology we used to address our overarching research questions posed in chapter I.

THIS PAGE INTENTIONALLY LEFT BLANK

III. METHODOLOGY

A. INTRODUCTION

This chapter will outline the methodology utilized in considering SD's impact on readiness and inventory levels for the two Army Divisions located in EUCOM over the life of the SDMI Program. To begin with, the chapter will introduce measurement questions that were developed to further support the primary research questions. Next, a description of the research tools and data collection methods will be presented. Finally, the chapter will conclude with a summary of the contents of this chapter.

1. Measurement Questions

In order to fully analyze the primary research questions form Chapter two, we developed several more specific, supporting measurement questions that will enable us to fully analyze the data. These questions help us answer the BOD questions more directly by focusing on particular facets of our primary research questions. The following measurement questions are germane to the primary questions in italics:

Have Strategic Distribution improvements resulted in reduced inventories?

- Have the number of ASL lines stocked changed significantly across the eight Class IX SSAs over the SDMI time period? What specific changes have occurred to DLA supported inventory items?

- Has the depth of DLA sourced items stocked in the eight Class IX SSAs *increased, decreased*, or *remained unchanged* over the SDMI time period?

Is inventory turbulence and its related costs an area for further scrutiny and possible improvement?

- What is the magnitude of turbulence in the eight Class IX Authorized Stockage Lists (using a narrow definition)? What are the costs and ramifications involved?

Are the SD improvements being made ones that make a significant difference to readiness?

- Have Strategic Distribution initiatives/improvements been associated with increased fleet readiness?

What lucrative targets (in terms of requisition cycle time) exist which have a large potential payoff in terms of readiness?

- Is their a difference in how long it takes a Defense Logistics Agency source of supply to cut the Materiel Release Order, ship an item, and get it to the East Coast Consolidation & Containerization Point (CCP) for Priority-02 (high priority) requisitions compared to how long it takes an Army Materiel Command source of supply to accomplish the same task?

- What percent of the Priority 02 (high priority) requisitions for FY01, broken out by Defense Logistics Agency and Army Materiel Command sources of supply, and further broken down by critical weapon system and/or fleet, go into backorder status at their wholesale source of supply? For those Priority-02 requisitions that do go into backorder status, how long is the average backorder in number of days?

B. ANALYSIS METHODOLOGY

This section provides a detailed description of the analysis utilized for this thesis. We begin with a general overview and then follow with a more detailed description of each research area. In order to analyze inventory levels, we limited the research area to a fixed area of operation with relatively constant customers. To address turbulence, inventory levels were compared on a time basis covering the period just prior to the implementation of SDMI through to the present. Depth and breadth of inventory was measured and considered to be an accurate indicator of inventory levels for the purpose of analyzing changes over time.

In considering the question of readiness, we considered high priority requisitions (Priority-02) as being directly linked to readiness as Priority-02 requisitions are typically submitted for items that have rendered weapon systems as non-mission capable. That is, Priority-02 requisitions typically represent a piece of "downed" equipment, which is vital to the mission of a unit. The longer the cycle time in fulfilling those Priority-02 requisitions, the longer time vital equipment is inoperable; ultimately leading to degraded readiness. High priority requisitions are not the only indicator of readiness however; they are *directly* linked to readiness. Further discussion of the priority system will appear in section four of this chapter. To measure cycle times of the Priority-02 requisitions, we analyzed; (1) the time elapsed from a wholesale storage site (i.e. Depot) to the Consolidation and Containerization Point (CCP) for both AMC and DLA materiel; (2) the Order Ship Time (OST) by system; (3) the percentage of Priority-02 requisitions that went into backorder status; and (4) the amount of time those requisitions spent in backorder.

1. Research Site and Data Sources

Based on the tremendous breadth of the SDMI program, we realized that we would be unable to address its impact on readiness and inventory levels on a worldwide scale. We decided that we would need to focus our research on a portion of the system that would serve as a representative "snapshot" of the entire system; for this we chose United States Army, Europe (USAREUR). Furthermore, we chose the Army's two Divisions stationed within USAREUR, 1st Armored Division and 1st Infantry Division.

In order to study the inventory levels over time we analyzed the four Class IX Supply Support Activities (SSAs) belonging to each division. Each division has one Main Support Battalion, two Forward Support Battalions, and one Aviation Support Battalion. Each of these support battalions runs a Class IX Supply Support Activity in support of a maneuver brigade combat team. In the case of the Main Support Battalion, they support the divisional separates including the Air Defense Artillery Battalion, the Signal Battalion, the Multiple Launch Rocket System (MLRS) Battalion, and many other separate battalions and companies. Additionally, the Main Support Battalion (MSB) also serves as primary backup support to the other three SSAs. Thus, in our analysis we considered four SSAs per division and a total of eight SSAs across both divisions.

It's important to point out that the eight SSAs considered in our study are "tactical" SSAs meaning that they must be mobile, able to pickup and move with their supported customers across the battlefield. In fact, in accordance with Army Regulation 710-2, SSAs, "supporting a brigade must be able to move 90% of the ASL in a single trip with their organic vehicles within 30 minutes; the remaining 10 percent should be moved with 4 hours." These elements should strive to attain 100% mobility (6 of 8 of our SSAs are in this category). Main Support Battalion (MSB) SSAs (the remaining two in our study) must be able to deploy with 50 percent in the first shuttle. [Ref. 19]

Each SSA is assigned a Routing Identifier Code (RIC), a three digit alphanumeric code much like a common zip code. Each and every activity in the military has its own individual RIC; SSAs are often referred to by RIC alone. Table 1 lists the SSAs and their associated RICs, which were part of this thesis.

DODAAC	RIC	UNIT
WK4GA8	AMX	B 47 FSB
WK4GAH	ANF	B 501 FSB
WK4BM9	WQR	D 123 MSB
WK4BNX	WQT	B 127 ASB AVN
W90A0E	WQ2	A 299 FSB
WK4GF3	WQ4	B 601 ASB AVN
WK4GE4	WQW	701ST MSB
WK4GD0	WQZ	B 201 FSB

Table 1. Routing Identifier Codes for SSAs (unit)

To study the question of what impact SD was having on inventory levels we determined to study both the number (breadth) of Authorized Stockage List (ASL) lines, as well as the depth of each stocked item in the ASL (also called "eaches"), across the span of the SD time period. The three points in time we selected were February 1999 (pre-SDMI), October 2001 (mid-point in our period of study), and a current picture in June 2002 (a mature SD point in time).

Our source files for inventory analysis were Availability Balance Files (ABF) taken as snapshots in those three time periods. Within these files we were able to focus on three important data fields—*NIIN, RO*, OH and *RIC SOS*.

The NIIN, National Item Identification Number, is a unique nine-character code assigned to each item of supply purchased, stocked, or distributed within the Federal Government. The NIIN is used as the common denominator for an item of supply. Requisition Objective (RO) tells us how much of the item the SSA is planning to stock. The On-Hand (OH) quantity tells us how much of the RO is currently physically on-hand in the SSA. Next, the RIC-SOS, or Routing Identifier Code-Source of Supply, is an indicator of what source of supply at the wholesale level (i.e. GSA, DLA, AMC) the particular item is supported from. Predominantly, most of the items found stocked at the SSAs are from either the Defense Logistics Agency (DLA) or the Army Materiel Command (AMC).

In addressing the question "What is the magnitude of turbulence in the eight Class IX Authorized Stockage Lists and its related costs and ramifications?" we used a narrow definition. We analyzed data from three different years, specifically 1999, 2001, and 2002; then compared each of these years against one another. Our narrow definition of turbulence is: stocked in 1999, not stocked in 2001, and re-added in 2002. Furthermore, we used both RO quantities and OH quantities in addressing any monetary impacts, and use the number of stocked/deleted lines and their associated volume (eaches) to address all other ramifications.

To answer the question "Have Strategic Distribution initiatives/improvements been associated with increased fleet readiness?" we studied data gathered, archived, and provided to us by the Logistics Support Activity (LOGSA). They maintain the Readiness Integrated Data Base (RIDB), which is a Department of the Army (DA-level) database containing consolidated equipment readiness data from active army units. The readiness data is automatically generated monthly from the Unit Level Logistics System (ULLS) Army Materiel Status System (AMSS) and forwarded electronically through the Standard Army Maintenance System (SAMS) to RIDB. The consolidated readiness data in RIDB is used at all command levels up through Headquarters, Department of the Army Staff. We analyzed the same fleets which are later addressed under the backorder percent and number of days analysis which include: M1, M2, HEMTT, M113 APC, MLRS, and M939 Bobtails. Finally, we considered these fleets for both 1st Armored Division and 1st Infantry Division.

Another major source from which we drew data files was document history and archived data housed in Logistics Intelligence File (LIF) records. The LIF data we used in the analysis contained only high priority (Priority-02) requisitions originating from, or routed through, the same aforementioned eight divisional SSAs. Additionally, all requisitions we considered were entered into the Defense Automated Addressing System

(DAAS) and were subsequently routed to a wholesale source of supply. Furthermore, all requisitions considered in the analysis had a Master Inventory Record Posting (MIRP) date in FY01 at the storage SSA, which is the same as saying these items, had a D6S (wholesale receipt) at the SSA in FY01. To say it a third way…these high priority requisitions had all been receipted at the requesting SSA between 1 OCT 00 and 30 SEP 01. A sample LIF data string is shown in Table 2.

docdate	estdate	mrodate	depship	mirp	ost	bkorder	sos	ric	fsc	niin
1058	1058	1107	1108	1114	56	B	AMC	AKZ	2590	01-142-8249
1057	1057	1122	1123	1131	74	B	AMC	B17	1560	01-464-1953
1051	1052	1052	1052	1064	13	0	DLA	S9C	2910	01-376-2266
0209	0209	0293	0293	0300	91	B	DLA	S9I	5315	00-017-9537

Table 2. Abbreviated LIF String

The LIF data provides us dates and information relative to each and every high priority requisition as follows:

- **docdate:** Document Date- the date the requisition was created by the requisitioner, taken from the first four digits subsequent to the DODAAC (Dept of Defense Activity Address Code) on the document number.

- **estdate:** Establish Date- the date the record/requisition was established and/or acknowledged in the wholesale supply system.

- **mrodate**: Material Release Order Date- the date the wholesale source of supply cut a materiel release order for the item(s).

- **depship:** Depot Ship Date- the date the source of supply confirmed shipment of the item to the requisitioner (through the CCP).

- **ccpr:** Consolidation and Containerization Point Receipt**-** the date the consolidation and containerization point (CCP) received the shipment from the wholesale source of supply.

- **mirp:** Master Inventory Record Posting- the "receipt" date entered on the Master Inventory Record Posting (MIRP) at the requisitioning SSA (i.e. D6S wholesale receipt date).

- **ost:** Order and Shipping Time- the number of days elapsed between docdate and mirp.

- **bkorder:** Backorder- an identifier of whether the document went into backorder status or not, "B" in block indicates item is backordered.

- **sos:** Source of Supply- a field indicating which source of supply fulfills the requirement.

- **niin:** the National Inventory Item Number of the item requisitioned.

- **matcat:** Material Category**-** a five-digit alpha-numeric code, the last two placeholders indicating specifically what system the item supports or is an integral part thereof.

There is additional information and data housed within the LIF source data…however the above fields were considered sufficient to conduct the analysis within the intended scope of this thesis.

The LIF data was useful in answering the question: "Is their a difference in how long it takes a Defense Logistics Agency source of supply to cut the Materiel Release Order, ship the item, and get it to the East Coast Consolidation & Containerization Point (CCP) for Priority-02 (high priority) requisitions compared to how long it takes an Army Materiel Command source of supply to accomplish the same task?" Here we focused on the **mrodate-depship-ccpr** elapsed time. We did this for both DLA and AMC separately by dividing the requisitions up by source of supply.

The LIF data was also quite useful in allowing us to address the question: "What portion of these requisitions can be linked directly to critical weapon systems and/or fleets?" We conducted this analysis by breaking the source data down by **matcat** and performing our analysis of (1) percent backorder and (2) backorder time by system.

2. LIF

The LIF is a centralized database providing visibility of supply and transportation actions for requisitions placed on the wholesale system. As materiel moves through the pipeline to Army customers worldwide, automated supply and transportation systems feed the LIF current status on the location of the materiel. The LIF provides quick reference to requisition status, shipping information, and receipt of materiel requisitioned. Finally, the LIF is the database used for reporting Army Velocity Management and Order Ship time performance. As the data ages, it is transitioned into a historical database.

3. Material Category Structure Code

A Material Category (or MATCAT) Structure Code is a five-position alphanumeric code that details the materiel category structure detail for management of Army inventories. For the purpose of this thesis, we are mostly concerned with the 4th and 5th positions in this code. The fourth position codes are alphanumeric and for Army items, these codes identify special or specific groups of items. The fifth position codes are alphanumeric as well and link the requested items to "parent" weapon systems or end items. By combining these codes in positions 4 and 5, we are able to identify a specific weapon system/end item or homogeneous group of items. [Ref. 20]

4. Uniform Materiel Movement and Issue Priority System

Uniform Materiel Movement and Issue Priority System (UMMIPS) is a vital portion of the materiel requisitioning procedure in the military by setting the priorities for the issuance and movement of materiel based on input from the requesting activity. The requestor must use a system designed to prioritize requests by importance of the activity and the Urgency of Need (UND). Each requesting activity is assigned a Force/Activity Designator (F/AD) from 1 to 5 (highest to lowest) based on its level of importance, and an Urgency of Need Designator (UND) form 1 to 15 (Highest to lowest). This thesis deals, in a large part, with the study of high priority requisitions originating from or through the eight divisional Supply Support Activities. All such requisitions we analyzed have Priority Designators (PD) of 02, or Priority-02. The priority designators are determined by the combination of the assigned Force/Activity Designator (F/AD) and the Urgency of Need Designator (UND), depicted in Table 3 below.

The units concerned in our study are all F/AD II units.

	Urgency of Need Designator (UND)		
Force Activity Designator (FAD)	**A**	**B**	**C**
I	**01**	**04**	**11**
II	**02**	**05**	**12**
III	**03**	**06**	**13**
IV	**07**	**09**	**14**
V	**08**	**10**	**15**
	A = Unable to Perform Mission **B = Impairing Mission** **C = Routine**		

Table 3. Priority Designator Matrix

As previously stated, all requisitions in our study were PD-02. These requisitions had a UND of "A", which translates to: immediate installation on, or repair of, mission essential materiel and without which the force is unable to perform assigned operational missions. Stated in more common terms, UND of "A" usually results from a soldier utilizing the equipment technical manual and reading over to the "Not Mission Capable If…" column. If the parts associated with the "Not Mission Capable" fault are not on-hand, they are then considered UND "A" and result in ordering via a PD-02 requisition. Once ordered through the Logistics Automated System, the system/equipment is generally considered as Not Mission Capable-Supply (NMCS) until the necessary parts are receipted and maintenance work begins, whereupon the equipment enters into Not Mission Capable Maintenance (NMCM) status. [Ref. 21]

C. SUMMARY

This chapter outlined the research methodology utilized during the conduct of this thesis. It began by restating the objective of the study and the primary research questions. Next, more-detailed and specific measurement questions were generated and identified to narrow the research and give credence to the analysis and findings. Then, the chapter covered the details of the data elements and how the information aided us in conducting the analysis. Chapter IV will present the analysis and results of applying this methodology.

IV. ANALYSIS AND RESULTS

A. INTRODUCTION

This chapter presents the analysis of the data using the methodology described in chapter III. Again the research objectives of this thesis are restated for clarity.

1. Research Objectives

This research analyzes the effects of the SDMI program on two Army Divisions and their Class IX SSAs in EUCOM. Our primary objective is to determine the effect SDMI has had on inventory levels and readiness. In addition to addressing and answering the BOD's questions, our alternative objectives include examination of barriers to improving velocity that still exist while focusing on lucrative targets that may impact readiness.

B. DATA ANALYSIS

1. ASL Lines (Breadth) and Depth (Inventory)

Table 4 presents the findings for all eight SSAs from 1999-2002 and addresses the number (breadth) of lines stocked over time. The table is broken down into two parts: (1) "All Sources of Supply" considers every single stocked NIIN regardless of its source of supply, and (2) "DLA-Specific" portion of the table addresses only those stocked NIINs that have a DLA source of supply. The table indicates a tremendous increase in the number of lines stocked across all eight SSAs. The DLA-specific items make up the lion's share of increases across the board with the increases ranging from a low of 49% to a high of 467%, with an average increase of 98%.

		ALL SOURCES OF SUPPLY			DLA SPECIFIC				
		# Lines Feb 99	# Lines Oct 01	# Lines June 02	# Lines Feb 99	# Lines Oct 01	# Lines June 02	# INC	%INC
AMX	47 FSB	555	2386	2283	335	1923	1899	1564	467%
ANF	501 FSB	978	2439	2539	671	2020	2082	1411	210%
WQR	123d MSB	2592	3131	3174	2054	2578	2608	554	27%
WQT	127 ASB	645	1398	1203	440	1078	974	534	121%
WQW	701 MSb	3312	3471	3620	2008	2910	2992	984	49%
WQ2	299 FSB	1291	2194	2439	958	1805	2008	1050	110%
WQZ	201 FSB	1451	2710	2829	1146	2386	2477	1331	116%
WQ4	601 ASB	504	806	869	355	673	719	364	103%
All SSAs					**7967**		**15759**	**7792**	**98%**

Table 4. Changes in Stockage Levels Over Time

Table 5 presents the findings for all eight SSAs from 1999-2002 and addresses the depth of stocked lines over time. The depth of an ASL item is a measure of how many “eaches” of each line or NIIN is stocked at the SSA. As the table indicates, all eight SSAs experienced a significant increase in the depth of DLA items stocked in their ASLs, with the percentage increase of DLA items in the ASLs over the 1999-2002 time period ranging from a low of 13% to a high of 285%, and the net change across all Authorized Stockage Lists being a 69% increase in depth.

DEPTH OF DLA ITEMS 1999-2002					
RIC	**SSA**	**# EACHES 1999**	**# EACHES 2002**	**RAW CHANGE**	**% CHANGE OVER PERIOD**
AMX	47 FSB	2209	2833	624	28%
ANF	501 FSB	8120	13408	5288	65%
WQR	123 MSB	34593	38982	4389	13%
WQT	127 ASB	2712	5284	2572	95%
WQW	701 MSB	17360	28658	11298	65%
WQ2	299 FSB	14114	22907	8793	62%
WQZ	201 FSB	8940	34418	25478	285%
WQ4	601 ASB	1674	5026	3352	200%
TOTAL		**89722**	151516	**61794**	**69%**
*Must have been stocked in 1999 and 2002 to be considered for depth change					

Table 5. Changes in Depth

Table 6 supports and confirms findings relative to ASL Depth. Because Table 5 is, in essence, an “eaches” analysis, there is the possibility that a relatively small amount of lines that increased exponentially had a disproportional influence upon the findings. Table 6 therefore accentuates the findings in Table 5 by confirming that 64% of all ASL lines in the eight SSAs saw increases over the 1999-2002 period.

ASL LINES OVER 1999-2002 PERIOD				
RIC	**SSA**	**PERCENT INCREASE**	**PERCENT DECREASE**	**PERCENT REMAINED CONSTANT**
AMX	47 FSB	63%	20%	17%
ANF	501 FSB	65%	8%	27%
WQR	123 MSB	57%	31%	12%
WQT	127 ASB	56%	10%	34%
WQW	701 MSB	70%	19%	11%
WQ2	299 FSB	41%	35%	24%
WQZ	201 FSB	80%	8%	12%
WQ4	601 ASB	81%	12%	7%
TOTAL		**64%**	**20%**	**16%**

Table 6. Analysis of Changes in all Lines

The findings very directly answer the question the BOD asked “Are Strategic Distribution improvements resulting in reduced inventories?” The answer is no, at least as far as these eight SSAs are concerned. We have not seen inventory levels or depth reduced; in fact, we see the complete opposite. One would expect that because SDMI has focused on Time Definite Delivery over the past few years, leading to more "predictive delivery" in the supply chain process, that we should see a reduction in number and/or depth of ASL lines. Customer confidence was supposed to rise, and lead to decreasing inventory levels.

Contrary to the notion of the Army creating leaner inventories discussed in the two National Defense Magazine articles mentioned in Chapter 2 (references 14 and 15), the enormous increase in number of lines and the similar increase in the depth of lines have compounding negative effects. As the number and depth of lines increase, we tend to see a growing "logistics footprint" which is contrary to what they are trying to achieve. With significant increases in the number and depth of ASL lines come additional requirements for storage facilities, more requirements set upon an already overburdened Stake and Platform (S&P) trailer fleet, more reliance on external support to transport the items across the battlefield and more burden placed upon materiel handling equipment. Most importantly, we see an increased workload upon soldiers and leaders managing the increased stock in their warehouses.

Furthermore, along with the increased number and depth of lines, come increases in inventory holding costs, which include *physical holding costs* and *opportunity costs*. Physical holding costs includes extra storage space requirements (warehousing, shelving, materiel, bins, ISU-90s etc.) along with the cost of the additional items either becoming obsolete, pilfered, or lapsing into *excess position* and possibly losing these items during to the auto-excess process. Potentially more significant than the *holding cost* is the *opportunity cost*; every dollar invested in inventory is money that cannot be spent elsewhere.

Perhaps even more important is the opportunity cost as it relates to the soldier's and leader's time. Do the additional lines and depth of stock warrant the extra man-hours involved in managing the extra stock? With the increased lines and depth comes increased activity, more items (volume) to receipt, store, issue, and deliver. Moreover, the SSA conducts 100% wall-to-wall inventories and other percentage inventories on a periodic basis. The enormous increase in number and depth of lines results in additional burden during these periodic inventories. Additionally, the opportunity cost of performing these tasks related to increased number and depth of lines, is less time focusing on and managing processes that probably have higher value and return, such as managing repairable exchange, processing high priority requisitions, and managing referrals.

2. Inventory Turbulence

To restate our conservative definition of turbulence, we analyzed items that were stocked in February 1999, subsequently dropped by October 2001, and then these very same items had been picked back up (re-stocked) in the ASLs by June 2002. We found a very large number of items that met this conservative definition of turbulence.

Table 7 shows the percent of total lines experiencing turbulence. We see that 6.1% of the ASL lines across the eight SSAs experienced turbulence. Table 8 shows the percent of total "Eaches" experiencing turbulence. We see from this table that nearly 12% of the total "Eaches" experienced turbulence. The monetary costs associated with deleting the 691 lines (and 10,680 Eaches) from the eight SSAs and subsequently re-adding them was $3.9 Million. This figure is based on the Requisition Objective quantity. In an attempt to be more conservative, it is better to base the monetary calculation using On-Hand (OH) quantities, since the SSAs are rarely at 100% of the Requisition Objective. Using February 1999 on-hand quantities for the lines concerned as a basis, the SSAs more realistically experienced monetary losses of $3.3 Million. We want to emphasize at this point that these figures, in terms of ASL turbulence and associated monetary costs, are very conservative. A study of turbulence using the more traditional definition would have included an analysis of decreases and increases to stock over time and considered the overall "churn" of the ASL.

SSA	# LINES EXPERIENCING TURBULENCE*	% OF TOTAL LINES EXPERIENCING TURBULENCE
AMX	29	5.2%
ANF	89	9.1%
WQT	30	4.7%
WQR	204	7.9%
WQW	113	3.4%
WQ2	127	9.8%
WQ4	32	6.3%
WQZ	67	4.6%
TOTAL	691	6.1%

*Based on a narrow definition of Turbulence--meaning these lines were deleted from ASLs and subsequently re-added. A study of Turbulence in its broader definition would have included decreases and increases to stock over time.

Table 7. Number of Lines Experiencing Turbulence

SSA	# EACHES EXPERIENCING TURBULENCE*	% OF TOTAL EACHES EXPERIENCING TURBULENCE
AMX	443	20.1%
ANF	943	11.6%
WQT	149	5.5%
WQR	4,135	12.0%
WQW	1,955	11.3%
WQ2	2,190	15.5%
WQ4	280	16.7%
WQZ	585	6.5%
TOTAL	10,680	11.9%

*Based on a narrow definition of Turbulence--meaning the "Eaches" associated with these Lines were deleted from ASLs and subsequently re-added. A study of Turbulence in its broader definition would have included decreases and increases to stock over time.

Table 8. Number of Eaches Experiencing Turbulence

Even with the strict monetary arguments aside, the effects of the inventory turbulence are profound. Looking at Table 7 again, we see that 691 lines (stocked NIINs) are involved. Relative to the lines, Table 8 shows that 10,680 eaches (i.e. eaches, assemblies, packages, boxes) were involved. These items had to be picked, processed and packed by SSA personnel, while some of them even required materiel handling equipment (MHE) use. These items had to be uploaded onto trucks heading to the Theater Central Retention Account (CRA) for serviceable excess Class IX materiel. After being transported to the CRA the items had to be received, documented and stored.

As discussed in Chapter II, many of these items ultimately end up being transferred to DRMO or being retrograded back to CONUS.

What's important to point out here is that after all of this effort to purge these items from the SSAs, the items were re-added to the SSAs Authorized Stockage Lists the very next year. As discussed earlier, the SSAs bought them back at full Army Master Data File (AMDF) price. Thus the monetary impact is that the individual SSA must re-purchase these items. But in addition to that, there is plane, ship, truck, and MHE capacity being used up in order to re-position the assets to their original SSA stockage point. Quite literally, an asset could have been shipped in 1999 to an SSA and been put in stock, deleted between 2000 and 2001, sent down to the Theater CRA, and ultimately retrograded back to CONUS, put back in wholesale stock, re-added to the SSA ASL in 2002, consequently reordered, and made a trip across the Atlantic a third time to be put back into SSA stock. Finally, the SSA would have paid for the same item twice.

One perspective of considering the effects of this inventory turbulence is in terms of an economic outlook introduced by Frederic Bastiat, which he calls: "*What is Seen* and *What Is Not Seen*." In introducing his essay, he states, "an act…produces not only one effect, but a series of effects. Of these effects, the first alone is immediate; it appears simultaneously with its cause; *it is seen*. The other effects emerge only subsequently; *they are not seen*." [Ref. 22]

Like Bastiat's mantra, the "act" in our case is the deletion of items from the ASL and then re-adding them in the subsequent year(s). Its effect can be *seen* by looking at an ASL listing, the items are no longer there when deleted and are there when re-added. What are all-too-often given little consideration are the effects of "*what is not seen*." As discussed above, the act of deleting items from the ASL creates a series of effects, or the "what is not seen" such as: soldiers pulling, packing, and shipping the materiel, loading trucks, hauling cargo, receiving and storing, redistributing, in some cases retrograding back to CONUS, etc.

Some might argue that this is what we pay soldiers to do…or this is good training and use of trucks, but such reasoning reminds us of Bastiat's "*Broken Window* Fallacy." [1]

It is not seen that, since the warehouse soldiers are performing activities relative to the turbulence, they will not be able to spend time on other activities that have higher value. Such reasoning also can be made about truck capacity, manager's time, use of storage space in the local warehouse and at the excess warehouse, etc.

Furthermore, this line of reasoning parallels the idea of opportunity cost and dealing with scarcity. All kinds of decisions involve opportunity costs, not just ones about how to best spend money. Time is another scarce resource for the soldier's who work at an SSA. At any given time, some of the SSA workforce is deployed, training, at an appointment, sick or in their quarters, away at school, or on maternity leave, resulting in scarce personnel resources. Likewise, material-handling equipment (MHE-i.e. forklift) trained and licensed operators, trucks, and storage space are limited resources. The combined effects of all of these factors lead to the opportunity costs and the effects of *what is not seen* and are rather profound in terms of managing and dealing with inventory turbulence.

3. SD Impact Upon Readiness

We analyzed the readiness of the fleets using historical monthly readiness data for the period from 1999-2002 provided by LOGSA.

Observation of the mean readiness levels, before and after the implementation of SDMI, indicated differences between Infantry and Armored Divisions, and between weapon systems. That is, it appeared that SDMI may have affected different weapon systems differently (sometimes it went up, and sometimes it went down). Consequently, a 2 X 2 X 6 Analysis of Variance (ANOVA) was conducted to examine the changes in readiness levels across three factors:

[1] In Bastiat's broken-window fallacy, someone breaks a window. It's unfortunate, but there is a silver lining. Money spent to repair the window will bring new business to the repairman. He, in turn, will spend his higher income and generate more business for others. The broken window could ultimately create a boom. But, wait a minute, Bastiat cautions. That's based only on what is seen. You must also consider what is not seen. What is not seen is how the money would have been spent if the window had not been broken. The broken window didn't increase spending…it diverted spending.

(1) Pre and post SDMI (two levels),

(2) Infantry and Armor Division (two levels), and

(3) Weapon System (six levels)

An ANOVA indicates a statistically significant three-way interaction in readiness between the period prior to the implementation of SDMI in Europe (Dec 99 – Mar 01, SDMI-E) and the period when SDMI was in effect Apr 01 – Jul 02, based on the division and weapon system (F=3.568;df=5,23;p=.004). This essentially says that to understand the impact of SDMI on readiness, you need to look at individual weapons systems, and divisions separately. Readiness sometimes increased (e.g. the mean readiness for M939 Bobtails increased from 93.03 during the Pre-SDMI-E period to a mean readiness of 93.44 in the SDMI-E period, an increase of .41 of a percent). But, in some cases, it decreased (e.g. the mean readiness for MLRSs decreased from 97.031 during the Pre-SDMI-E period to a mean readiness of 94.562 in the SDMI-E period, a decrease of 2.47 percent). However, as shown in Table 9, Cell Means Tests show that in no case did readiness show a statistically significant improvement in an individual weapon system when comparing the Pre-SDMI-E period to the SDMI-E period. [Ref. 23]

		Infantry Division			**Armored Division**			**Overall**		
		Pre-SDMI	SDMI	t-value*	Pre-SDMI	SDMI	t-value*	Pre-SDMI	SDMI	t-value*
M113 APC	Mean	93.06	92.69	-0.3501	91	90.38	-0.5866	92.03	91.53	-0.6690
	Std Dev	2.08	2.55		6.7	3.32		4.99	3.14	
BOBTAIL	Mean	95	94.19	-0.7664	91.06	92.69	1.5423	93.03	93.44	0.5446
	Std Dev	1.26	2.2		3.34	1.74		3.19	2.09	
HEMTT	Mean	91.69	94.31	2.4790	90.38	88.94	-1.3625	91.03	91.63	0.7948
	Std Dev	1.45	1.7		2.36	3.04		2.04	3.65	
M2 IFV	Mean	97	95.56	-1.3625	96.06	94.69	-1.2963	96.53	95.12	-1.8814
	Std Dev	1.21	1.26		1.65	2.47		1.5	1.98	
M1	Mean	94.63	93.56	-1.0692	91.94	94.56	2.4790	94.03	93.66	1.0036
	Std Dev	1.82	3.01		1.69	2.48		2.2	2.76	
MLRS	Mean	98.63	97.06	-1.4855	95.44	92.06	-3.1981	97.03	94.56	-3.3038
	Std Dev	2.03	3		4.02	6.69		3.52	5.7	

*Measured against a critical t (tukey) of 2.998. The test was a one-sided t-test using an alpha of 0.05. None of the t-values exceed the *critical t*, we therefore conclude that there is no evidence that Strategic Distribution Initiatives have increased fleet readiness.

Table 9. Cell Means Test Results

We can therefore conclude that there is no evidence that SDMI-E has increased readiness in the two Divisions (F=2.056; df=1, 23; p=.152).

In further support of the findings above are the exponentially smoothed time series for the fleets. While essentially a qualitative analysis, this technique was chosen because it allowed us to smooth a time series, and thereby provided us with an impression as to the overall long-term movement in the data. Exponentially smoothed time series for the M1, M2, and M113 fleets are depicted in figures 3 through 5. The exponentially smoothed time series was run over a 31 month time period, which began in January 2000, and ran through July 2002. January 2000 was selected as the start because nearly all metrics associated with gauging SDMI performance use CY2000 as a baseline/base-year, and January 2000 is the beginning of that base year. The "Alpha" used in each exponentially smoothed time series was determined by obtaining the linear optimization solution through minimization of the Mean Squared Error (MSE). Looking at figures 3 through 5, one can see that there is no evidence of an upward trend in readiness.

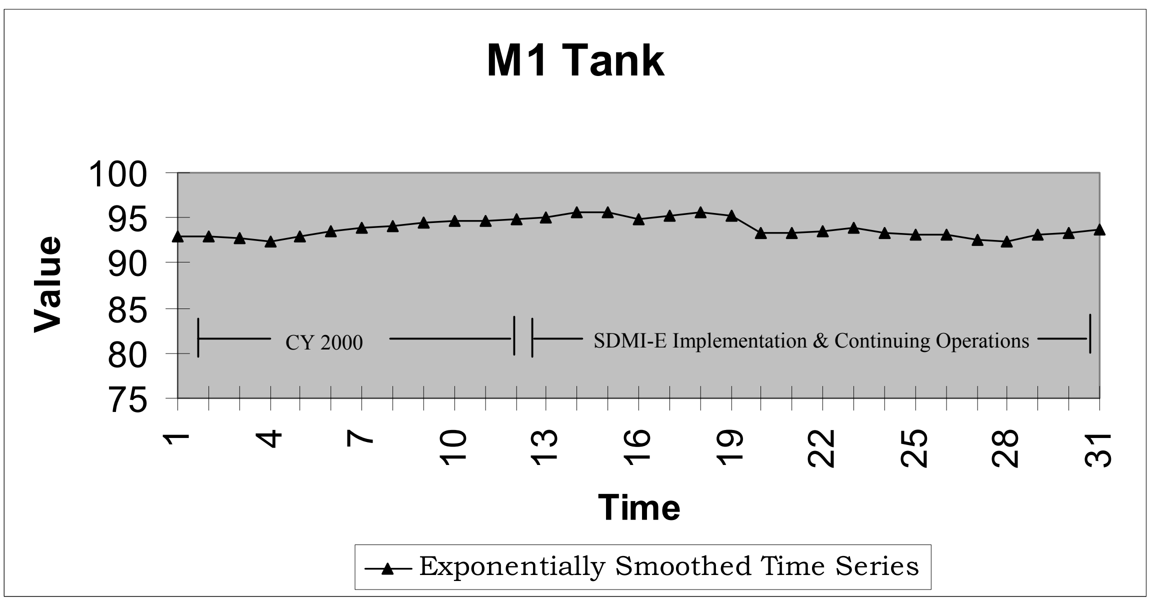

Figure 3. Exponentially Smoothed Time Series-M1 Tank

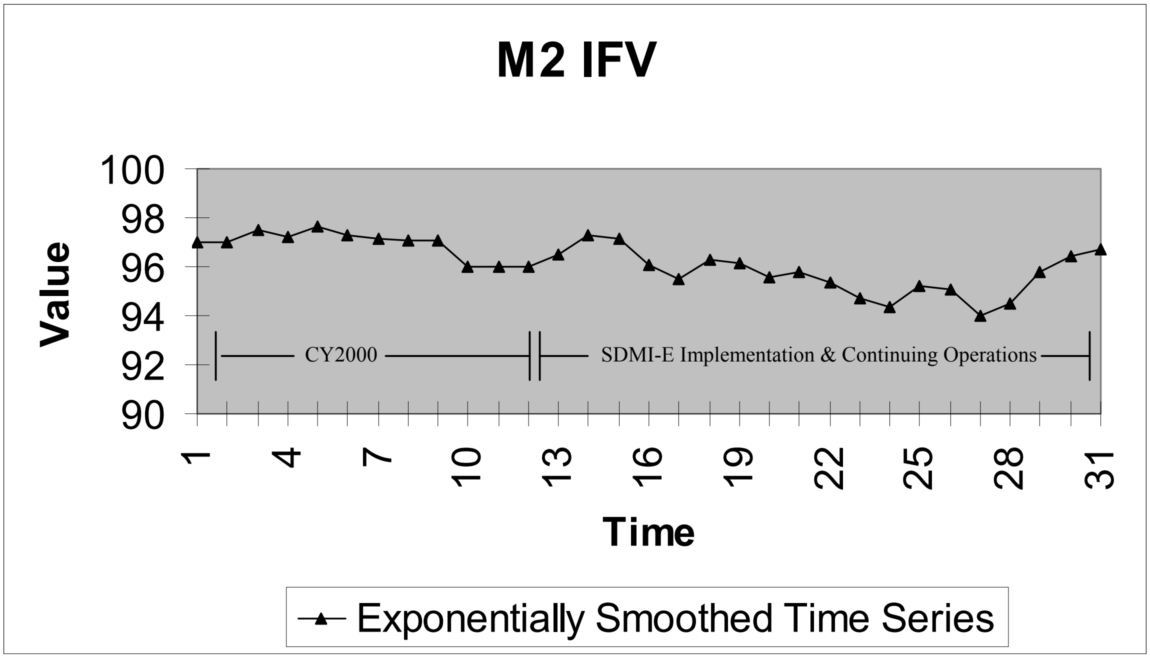

Figure 4. Exponentially Smoothed Time Series-M2 Infantry Fighting Vehicle

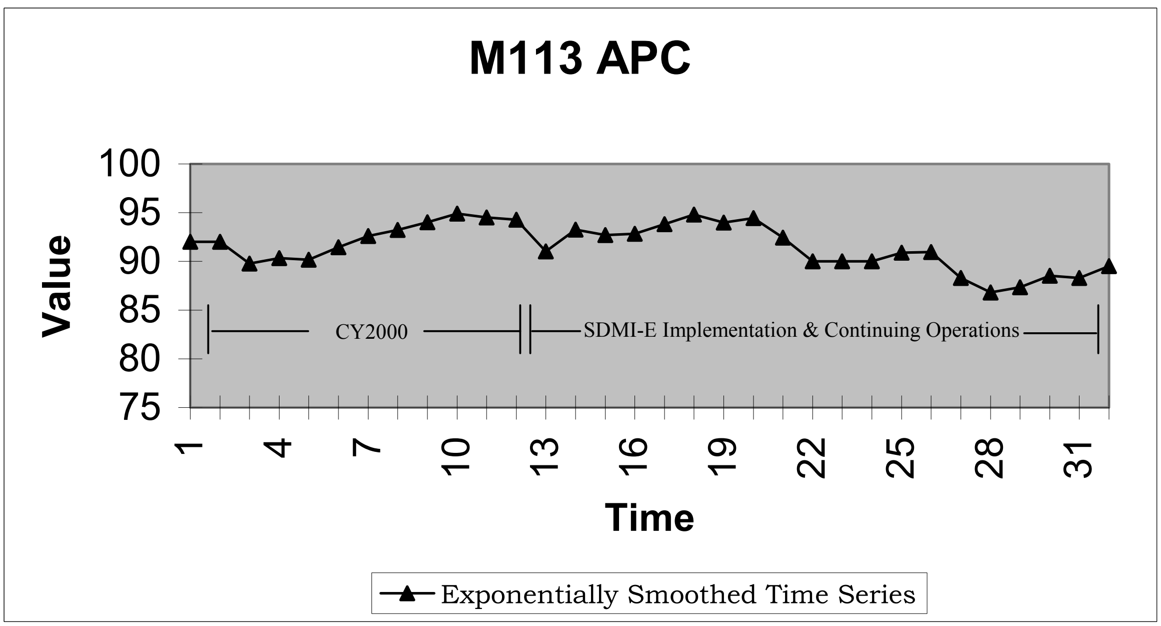

Figure 5. Exponentially Smoothed Time Series-M113 Armored Personnel Carrier

Again, based on both the Analysis of Variance (ANOVA), and the Exponentially Smoothed Time Series figures, we conclude that there is no evidence that Strategic Distribution initiatives have increased fleet readiness in these divisions.

4. Comparison of DLA and AMC MRO-DEPSHP-CCPR Time

To begin with, we studied all Priority-02 requisitions in FY01 ordered through/by the eight SSAs, which were ultimately entered into the DAAS system and were routed to a wholesale source of supply. Using this source data, we measured OST for high priority requisitions, analyzing AMC and DLA separately. In this analysis, we considered OST without backorders (refer to section B, part 4 of Chapter III for OST definitions).

The mean OST times are 12.1 days for AMC and 10.3 days for DLA, a difference of 1.8 days. A two-sample t-test shows this difference to be statistically significant ($p<0.00001$). Figures 6 and 7 show the difference by comparing the probability and cumulative distributions. Furthermore, the difference is confirmed by comparing percentiles (Table 10), which show that the AMC distribution is consistently 1 or more days longer than its DLA counterpart.

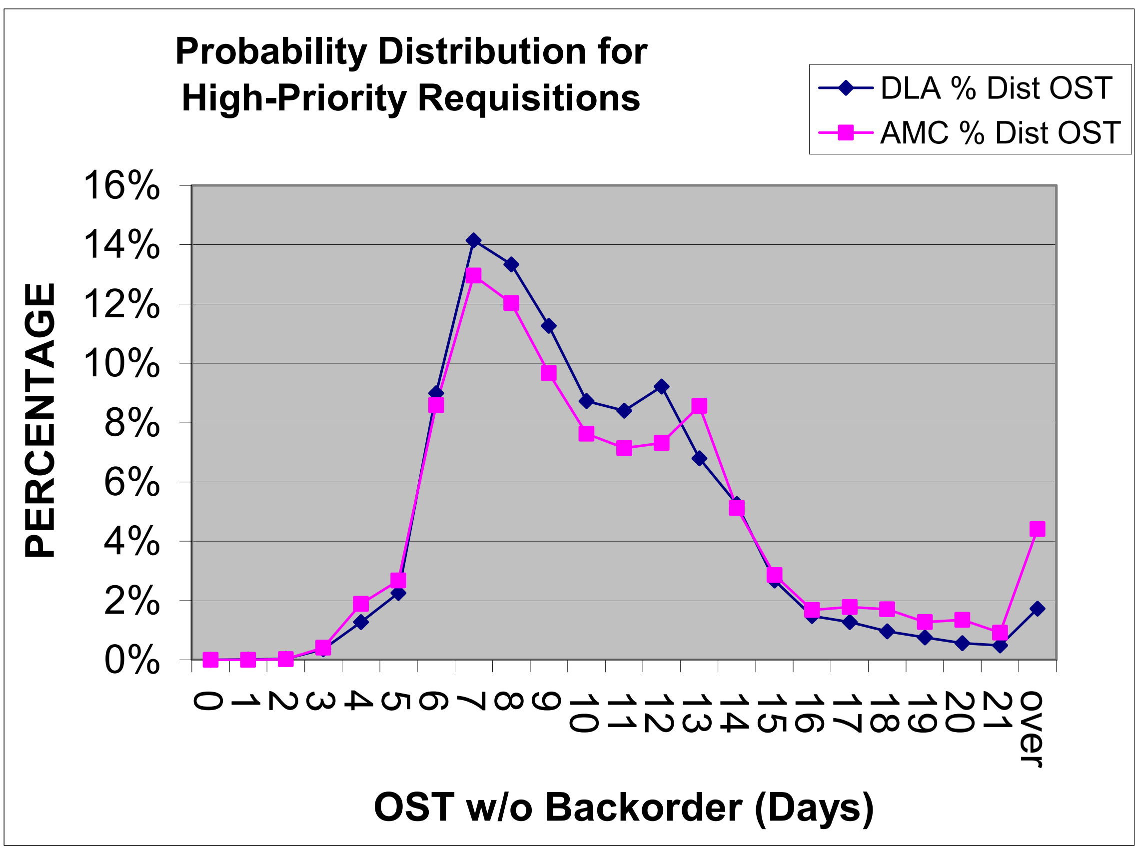

Figure 6. Probability Distribution-OST

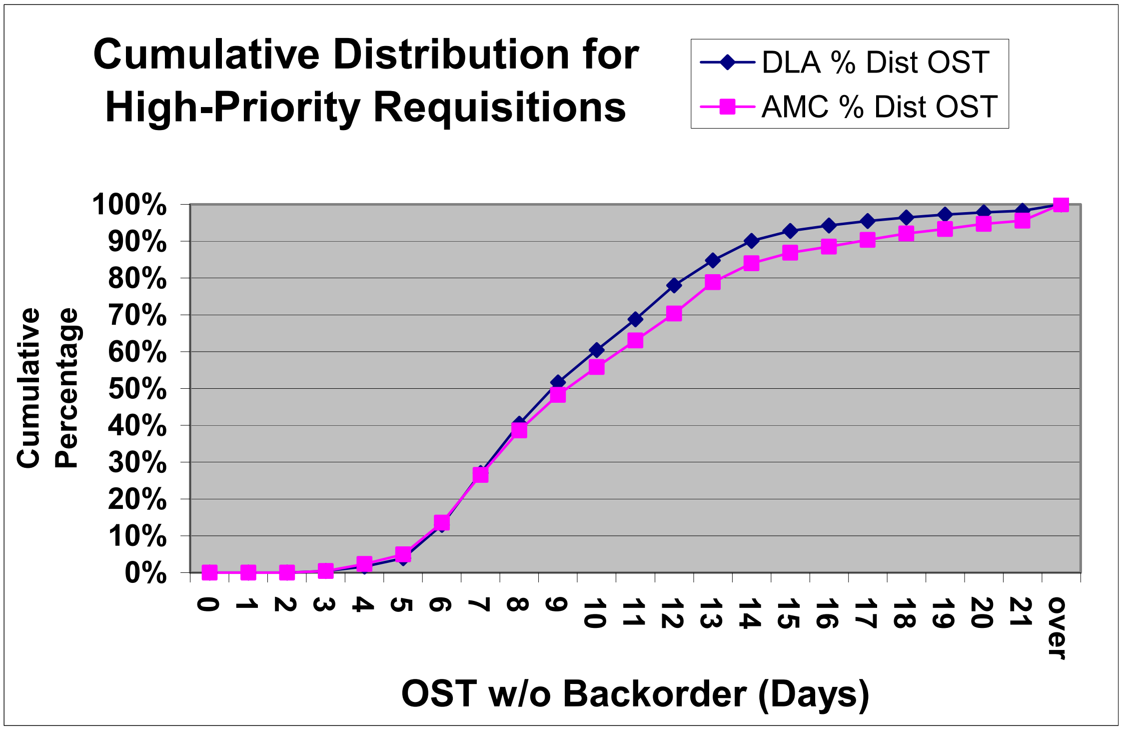

Figure 7. Cumulative Distribution-OST

OST W/O BACKORDERS TIME		
Percentile	**DLA**	**AMC**
50th	9 day	10 days
75th	12 days	13 days
95th	17 days	21 days

Table 10. OST without Backorder Time for Pri-02 Requisitions

Analysis shows that a significant portion of the OST time difference is attributable to MRO-CCPR time. The mean times for MRO-CCPR times are 2.9 days for AMC and 2.2 days for DLA, a difference of .7 days. A two-sample t-test for unequal means shows this difference to be statistically significant ($p<0.00001$). The source of the difference can be seen by comparing the probability and cumulative distributions shown in figures 8 and 9 below. Comparisons at the 50th, 75th, and 95th percentiles (see Table 11) confirm what is evident from the distributions: that AMC's MRO-CCPR time is one (1) day longer than DLA's throughout a significant portion of the distribution.

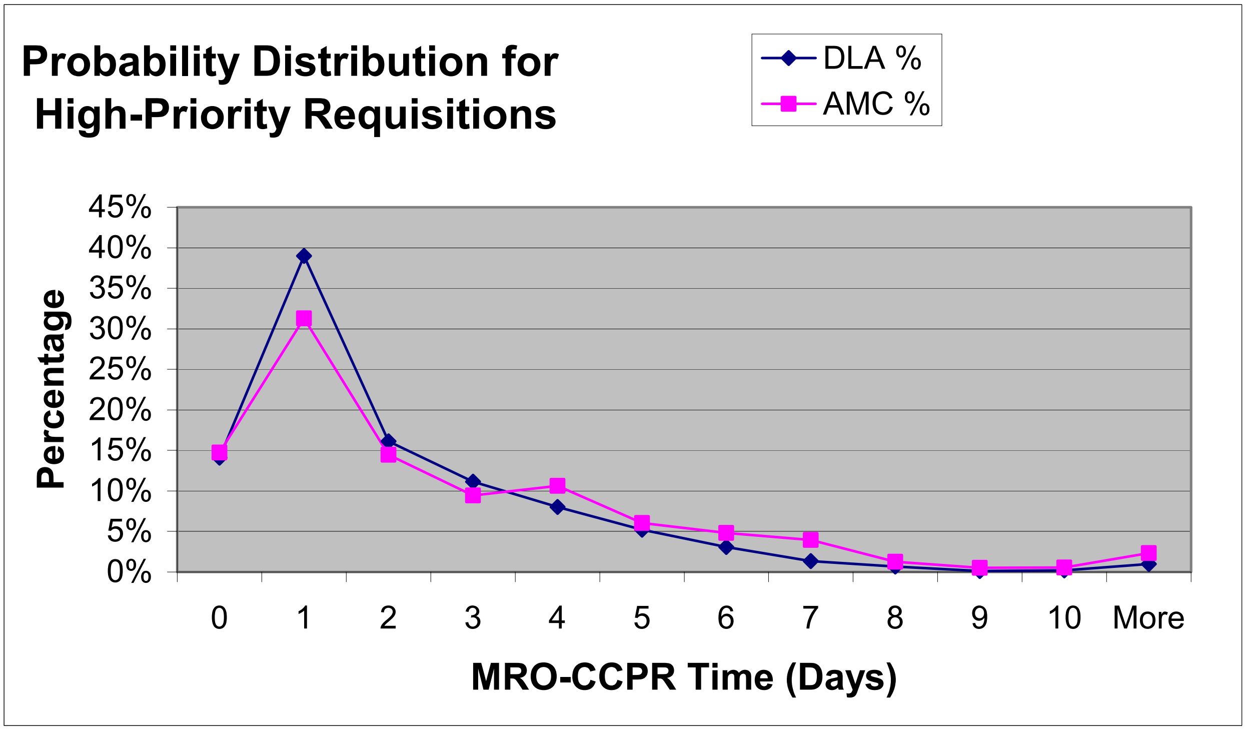

Figure 8. Probability Distribution-MRO-CCPR

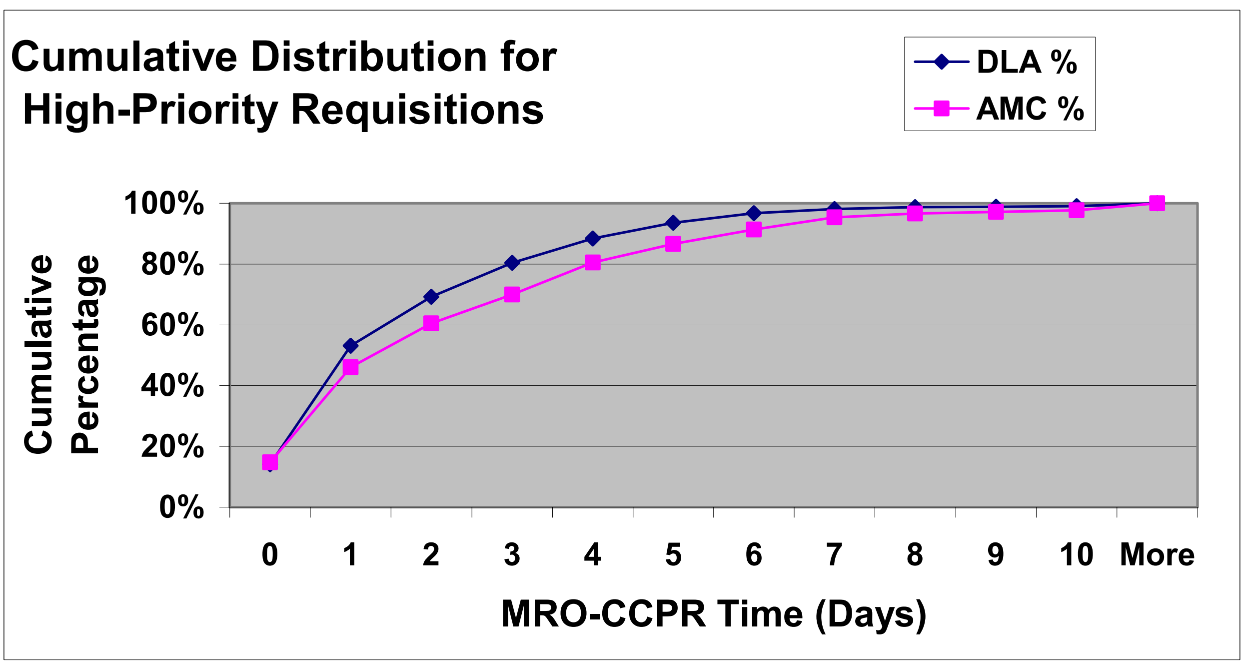

Figure 9. Cumulative Distribution-MRO-CCPR

MRO-CCPR TIME		
Percentile	**DLA**	**AMC**
50th	1 day	2 days
75th	3 days	4 days
95th	6 days	7 days

Table 11. MRO-CCPR Time for Pri-02 Requisitions

As we have seen already, OST for high-priority requisitions without backorder for AMC is 1.8 days longer on average. Analysis of this data shows that the majority of the difference in OST is in the MRO-CCPR time.

The 1-day difference is split almost exactly evenly between MRO to Shipment time and Shipment to CCP Receipt time. In other words, it takes AMC sources of supply about ½ day longer to accomplish each of these tasks. This 1-day difference, on average, again is for high priority requisitions that are rendering equipment Non-Mission Capable. When one looks at fleet readiness, one sees fleets barely missing their 90% goals consistently by small margins (i.e. 89%, 88%, 87%). From our experiences, there are numerous fleets that bust this readiness threshold because of 1-day or a few days of a system being non-mission capable. This 1-day becomes even more significant when it affects a low-density fleet such as having only 18 MLRS per division. In cases where such fleets are concerned, every single day makes a difference. This is the case because such fleets have a smaller denominator of the readiness equation.

5. Source of Supply, Percent Backorder, and Backorder Time Analysis

Table 12 presents findings by system, and suggests that for all systems considered in our study, the ratio of high priority items supported by AMC was significantly greater than DLA. For example, considering M1 Tanks, AMC supported 3.5 times as many high priority requisitions compared to DLA. These are for high priority requisitions that can be directly linked to the M1 Weapon System by its MATCAT indicator. Again, these are PRI 02 requisitions that are rendering equipment Non-Mission Capable. Looking across all seven systems included in our study, AMC supports 2.7 times more high priority requisitions compared to DLA.

	DLA %	AMC %	RATIO OF HI-PRI ITEMS SUPPORTED AMC : DLA
M1 Tank	22%	78%	**3.5 : 1**
M2 IFV	29%	71%	**2.4 : 1**
AH-64	43%	57%	**1.3 : 1**
M113 FOV	40%	60%	**1.5 : 1**
HEMTT	39%	61%	**1.6 : 1**
M939 FOV	21%	79%	**3.8 : 1**
MLRS	18%	82%	**4.6 : 1**
ACROSS ALL SEVEN SYSTEMS	27%	73%	**2.7 : 1**

Table 12. Ratio of PRI-02 Items Provided by AMC vs. DLA

It is clear then, that if the desired goal of SD is to focus on and improve readiness…then, as much if not more, time and resources must be spent analyzing, optimizing, and removing barriers to velocity where AMC items are concerned.

Nevertheless, both DLA and AMC support high priority requisitions specifically tied to weapon systems. One of the tenets of the SDMI Project Management Plan is to knock down barriers to improving velocity [Ref. 4]. A major barrier to improving velocity and, hence Customer Wait Time, is the percent of high priority requisitions going into backorder; and once in backorder, the amount of time these requisitions spend in backorder status. These requisitions have direct links to readiness since they affect the numerator of the readiness equation shown below:

$$\frac{\textbf{Available Days}}{\textbf{Possible Days}}$$

As the backorder days lengthen…available days become "smaller", thus reducing the fraction…. ultimately reducing the readiness rate.

% OF HI-PRI REQUISITIONS GOING INTO BACKORDER*		
SYSTEM	**DLA**	**AMC**
AH-64	**14%**	**63%**
M1 Tank	**17%**	**18%**
IFV	**14%**	**50%**
HEMTT	**52%**	**19%**
M113 FOV	**11%**	**52%**
M939 FOV	**40%**	**50%**
MLRS	**78%**	**18%**
***MATCAT SPECIFIC REQUISITIONS**		

Table 13. Percent of High Priority Requisitions Going Into Backorder Status

Table 13 above represents the percent of high priority requisitions going into backorder by system; simply considering the backorder percentages, one can easily surmise that herein lies a "lucrative target." It is clear that when we see backorder percentages as high as 63%, 52%, and 40% for high priority requisitions that these rates are directly affecting readiness of the fleets.

Tables 14 through 20 display the mean backorder time (in days) by system and source of supply, and also display the aggregate means. Additionally, it is useful to consider the backorder time at the 50th, 75th, and 95th percentiles. These tables complement Table 13 by building upon, representing, and providing further details of the percentage of requisitions that "do go into backorder."

M1 BACKORDER TIME (DAYS)			
	AMC	**DLA**	**AGGREGATE**
Mean	51	83	58
	Percentile		
50th (Median)	21	35	26
75th	56	119	66
95th	251	343	258
*PRI 02 Requisitions only and by MATCAT			

Table 14. M1 Backorder Time

AH-64 BACKORDER TIME (DAYS)			
	AMC	**DLA**	**AGGREGATE**
Mean	56	55	56
	Percentile		
50th (Median)	21	60	21
75th	64	71	66
95th	255	254	255
*PRI 02 Requisitions only and by MATCAT			

Table 15. AH-64 Backorder Time

HEMTT BACKORDER TIME (DAYS)			
	AMC	**DLA**	**AGGREGATE**
Mean	12	50	32
	Percentile		
50th (Median)	6	27	14
75th	14	86	40
95th	93	181	156
*PRI 02 Requisitions only and by MATCAT			

Table 16. HEMTT Backorder Time

M113 BACKORDER TIME (DAYS)			
	AMC	**DLA**	**AGGREGATE**
Mean	28	83	35
	Percentile		
50th (Median)	7	86	10.5
75th	32	119	41
95th	192	216	209
*PRI 02 Requisitions only and by MATCAT			

Table 17. M113 Backorder Time

M939 BACKORDER TIME (DAYS)			
	AMC	**DLA**	**AGGREGATE**
Mean	65	152	80
	Percentile		
50th (Median)	21.5	76.5	23
75th	79	300	105
95th	301	335	330
*PRI 02 Requisitions only and by MATCAT			

Table 18. M939 Backorder Time

MLRS BACKORDER TIME (DAYS)			
	AMC	**DLA**	**AGGREGATE**
Mean	19	97	58
	Percentile		
50th (Median)	8	40	24.5
75th	23	209	48
95th	85	305	305
*PRI 02 Requisitions only and by MATCAT			

Table 19. MLRS Backorder Time

IFV BACKORDER TIME (DAYS)			
	AMC	**DLA**	**AGGREGATE**
Mean	64	66	65
	Percentile		
50th (Median)	26	40	26
75th	84	84	84
95th	316	232	308
*PRI 02 Requisitions only and by MATCAT			

Table 20. IFV Backorder Time

The SDMI Project Management Plan's Data Collection and Measurement Plan refers to backorder rates as a quality metric [Ref. 4]. To build upon that, since backorder rates gives birth to backorder 'days', which ultimately affect customer wait time, we have a time metric at work as well. Since the two metrics are interrelated, and because the backorder percentages and backorder days are so profound and are directly linked to readiness, SD would likely gain by pursuing this "lucrative target."

Furthermore, if several high priority requisitions are submitted for a Non-Mission Capable piece of equipment, it is most likely that a backordered item is one that is going to determine when the system comes back online. Looking at many of weapon systems in our study, the typical (median) backorder ranges between 21-26 days, which means that the backorder time alone is eating away at readiness significantly in at least one month, and if the backorder span is across two report periods, then can potentially even affect two different reported months.

Re-considering the data in Table 13 and Tables 14-20, one has to wonder how the fleets make their readiness goals as often as they do. We know in some months, these fleets just do not achieve the readiness goal. In our opinion, the frequency of failing fleets would be much greater if it wasn't for workarounds such as controlled substitution, controlled exchange, "scrounging"[2], and effective use of the local Cannibalization Point. Controlled substitution is when serviceable components from unserviceable and economically un-repairable items are removed for immediate reuse to restore a similar item or weapons system to fully mission capable status. In cases of Controlled Exchange, the commander authorizes exchange when a valid requisition is submitted to replace the unserviceable item and when the required components are not available before the required delivery date. Cannibalization, from the Army's perspective is defined as the authorized removal of components from equipment designated for disposal and has been "stricken" from the fleet. Other factors that help fleets jump the readiness hurdle include effective use of Operational Readiness Float (ORF)[3] and astute management of NMCM time.

As stated earlier, the backorder rates and time associated with these systems have a direct negative affect on readiness. However, the backorder rates and time have "costs" other than readiness. An Air Force Magazine article titled *What About Army Aviation?* [Ref. 24] states Army sources claim that the "apparent healthy state of frontline aviation forces is at least partly illusion. Widespread use of "controlled substitution" is masking a deep and serious readiness problem that must be addressed." Similarly, a GAO report titled *Parts Shortages Are Impacting Operations and Maintenance Effectiveness* concluded that "parts shortages created inefficiencies in maintenance processes and procedures that have lowered morale of maintenance personnel." Additionally, it stated, "to compensate for the lack of spare parts, maintenance personnel use [controlled] substitution of parts." The study concluded that the principal reason for workarounds such as controlled substitution is the non-availability of serviceable repair parts. [Ref. 25]

[2] Scrounging is slang used commonly among supply and maintenance personnel and is used to refer to resorting to the "good 'ole boy" network. Tactics include calling other motor pools, canvassing friends and colleagues for required parts, making spare part "trades" or "quid pro quo" deals, etc.

[3] ORF is a quantity of selected end items or major components of equipment authorized for stockage at CONUS installations and overseas support maintenance activities, which extends their capability to respond to materiel readiness requirements of supported activities. It is accomplished by providing supported activities with serviceable replacements from ORF assets when their like items of equipment cannot be repaired or modified in time to meet operational requirements.

Although units do rely on controlled substitution to overcome the non-availability of parts, the practice does not resolve spare parts shortages[4]. Furthermore, while the use of controlled exchange may keep specific critical equipment mission capable, it is not an efficient practice. This practice requires at least twice the maintenance time of normal repairs because it involves removing and installing components from two pieces of equipment instead of one, as Figure 10 depicts. Moreover, when a mechanic removes a part from a piece of equipment to place on another piece of equipment, the risk of damaging the weapon system and/or the "good part" in the process is magnified. The GAO report also suggested that controlled substitutions "have negatively affected morale because they are sometimes seen as routinely making unrealistic demands on maintenance personnel." The report also echoes a statement made by the Army DCSLOG[5] that, "the added workload degrades maintenance soldiers' morale." In August 1999, GAO also reported that the majority of factors cited by personnel as sources of dissatisfaction and reasons for leaving the military were work-related circumstances such as the lack of parts and materials to successfully complete daily job requirements.[6]

---

[4]Aviation Logistics Study 99: Controlled Substitution Study, Jan 7, 2000. The Army study further states that the three primary reasons for the practice of controlled substitution are to (1) keep operational rates up (2) circumvent log lead times for requisitioned parts, and (3) have parts available when funds are limited at the end of the fiscal year.

[5]Statement made by Lieutenant General Charles S. Mahan, Jr. Deputy Chief of Staff for Logistics, U.S. Army, to the Subcommittee on National Security, Veterans Affairs, and International Relations, House Committee on Government Reform, May 22, 2001.

[6]Military Personnel: Perspectives of Surveyed Service Members in Retention Critical Specialties (GAO/NSIAD-99-197BR, August 16, 1999)

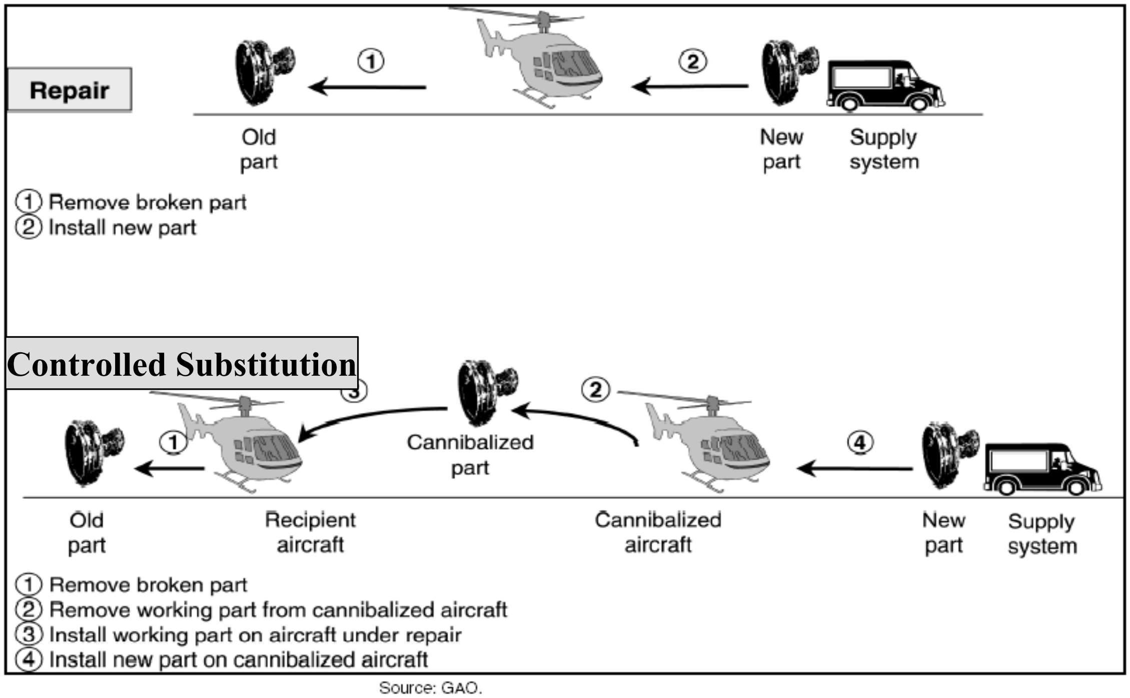

Figure 10. Repair vs. Controlled Substitution

Another topic not covered in this thesis but equally important concerns the problems that arise from controlled substitution in terms of reliability. When a part is subjected to controlled substitution, effectively a "used" part, one that has not been reconditioned is installed. Once this is done, the reliability of that part and essentially the weapon system has been compromised as the expected reliability of that part is reduced. This point supports the notion that controlled substitution is merely a short-term fix and not a solution.

Effective NMCM time is yet another area that contributes to the "masking" of the parts shortages problem. Like instances of controlled substitution, once the repair parts do arrive, the repair process (actual maintenance) may need to be quickly performed at any time, day or night, to meet operational commitments or readiness goals. In such cases, the maintenance personnel must continue working until the job is done. The maintenance teams often "surge" to meet goals and requirements. In many cases, the supply system delivers repair parts on a Friday, and with fleets edging around the readiness goals, they can ill afford the additional two or three days of downtime the weekend would bring. Therefore, maintenance personnel end up working jobs late into the evening on Friday in such cases or over the weekend in order to help "save" a fleet.

The wholesale backorder rate and time can be a significant factor leading to this predicament.

Still another workaround is use of the local cannibalization point. Many of the same drawbacks relevant to controlled substitution are applicable here. Mainly, that additional maintenance time is involved in pulling the part required from the cannibalized system and installing it on the downed equipment. Additionally, there is also a good deal of administrative time involved in using the cannibalization point. Leadership has to scrub the Cannibalization Point listings, drive to the Cannibalization Point, see if there are any relative serviceable parts, if so…then remove them and drive back to the motor pool to install, in hopes that it will function properly on the downed equipment. In cases where the Motor Sergeant or Maintenance Foreman are performing such tasks, the opportunity cost of doing this is less time supervising scheduled unit maintenance and managing critical maintenance tasks for the unit (services, motor stables, etc.)

In summary, the magnitude of backorder rates for these weapons systems and their respective backorder time have costs in terms of readiness of the fleets. Moreover, there are "costs" associated with the high backorder rates and time other than readiness, including increased maintenance time, degraded maintenance soldiers' morale, increased administrative time, and increased demands on maintenance leadership time which is already at full capacity. Therefore, to restate the opening postulate, SDMI has much to gain by pursuing this "lucrative target."

C. SUMMARY

This chapter presented the results of the data analysis using the methodology described in Chapter III. It provided a detailed analysis for each of the research areas covered by the primary research questions as well as the measurement questions. Chapter V will present the Conclusions and Recommendations.

V. CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

A. INTRODUCTION

This chapter provides an overview of the research conducted in the course of compiling our Thesis. It draws on the analysis contained in the previous chapter to develop conclusions about SDMI and its affect upon Inventory Levels and Readiness. It then provides recommendations based on the authors research and concludes with recommendations for future research.

We would like to begin by stating that we believe that Strategic Distribution is a good program that has achieved significant success. We believe that improvements are being made in the performance of the DoD supply chain as a result of Strategic Distribution. Though outside the scope of our research, we have every reason to believe that published achievements of SDMI have merit. For example, in an article titled *Strategic Distribution: Transformation Now*, it stated "Customer Wait Time had been reduced from a pre-SD average of 15 days to 11 days for European Command units." The article further asserted that "for sea deliveries to European military customers, customer wait time has been reduced, on the average from over 55 days to less than 40 days…a 27 percent reduction" and that "A customer wait time reduction of one day equates to about $4 million savings to U.S. taxpayers." These are remarkable accomplishments and are fully in keeping with the original SDMI goals and objectives. [Ref. 26]

The successes of SDMI stand by themselves and give credence to the program. Nevertheless, neither the anticipated decreases in inventory levels nor the increases in fleet readiness have yet been realized. Simply reducing customer wait time may not markedly impact readiness. Getting mud flaps, camouflage nets, copying paper, seat cushions, etc. to the customer faster is not going to affect readiness. It **is** good that such items are moving faster and processes are being optimized that save money. However, if we hope to impact readiness through supply and distribution, then we must focus on improving customer wait time for readiness type items and items that are linked directly to our combat fleets.

B. CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

1. Conclusions

a. The Expected Reductions in Inventory Levels Were Not Realized Following the Implementation of SDMI in Europe.

Not only did we not see inventory levels reduced, we actually saw a marked increase in inventory levels across the eight supply support activities. For DLA-specific ASL Lines, there was an average increase of 98%. Relative to the number of ASL lines, the depth of the DLA items in the ASLs saw an average increase of 69%.

b. Inventory Turbulence is Using Up Scarce Resources and Offers an Opportunity for Improvement as a Lucrative Target in Terms of Potential Savings in Time, Cost and Quality.

Inventory turbulence in the Supply Support Activities is problematic and sub-optimized. The effects of the turbulence use up scarce resources available to each SSA, such as time, manpower, materiel handling equipment, processing capacity, trucks, etc. Moreover, the practice (intended or unintended) of deleting ASL lines and subsequently re-adding them attaches to itself the appearance of capriciousness and a lack of constancy. We are unable to determine whether the turbulence, as described here and in chapters 2-4, is a matter of oversight or an intentional development. We suspect that it is largely, if not completely, unintentional and is caused by factors such as yearly Demand Analysis, changing stockage criteria, and/or implementing new ASL models. Regardless of whether it is intentional or unintentional, inventory turbulence results in significant monetary and opportunity costs.

c. There is No Evidence That SDMI has Increased Fleet Readiness.

Based on the historical monthly readiness data we obtained from LOGSA, and the analysis we conducted in chapter IV using Exponential Smoothing and Analysis of Variance techniques, we conclude that there is no evidence that SDMI has increased fleet readiness in the two divisions.

d. *The Defense Logistics Agency Moves High-Priority Items to the Consolidation and Containerization Point Consistently 1 Day Faster Than the Army Materiel Command, Which Ultimately Translates Into Getting the High-Priority Items to the Customer Faster (OST One or More Days Faster for Items Coming from DLA Sources).*

Many will say that this is a comparison of apples and oranges. DLA deals mainly in consumables, while AMC deals with reparables and major assemblies. Although this is a logical line of reasoning, one should not leave it at that. Considering the SDMI methodology to Define, Measure, and Improve (D-M-I), we attempted to Define and Measure this segment of requisition cycle time in the context of a comparison of two strategic suppliers to the Army. The third phase (Improve) is addressed in the Recommendations section that follows. Since AMC supports nearly 3 times as many high priority type items as DLA, it is desirable that AMC pick and move those high priority items to the CCP at least as quickly, if not more swiftly, than DLA. Whether this is feasible or not is beyond the scope of this thesis.

e. *Backorder Rates and Associated Time Spent in Backorder Status for High-Priority Requisitions are Lucrative Targets for Both AMC & DLA.*

The rate of high priority items going into backorder is high. The related days spent in backorder are also very high. Coupled together, these two factors negatively impact the readiness of fleets. Besides the negative affect upon fleet readiness, the parts shortages also lead to undesirable "workarounds" such as controlled substitution and cannibalization which, when looked at in detail, are inefficient practices. Essentially, backorder rates and backorder times are huge barriers to velocity.

2. Recommendations

a. *Collaborate on and Establish an Integrated Vision of SDMI and its Intended Effect Upon Inventories. The Streamlined "Vision" and its Associated Goals Must Have "Buy-in" at the Strategic, Operational, and Tactical Levels of Decisionmaking.*

Through SDMI's focus on Time Definite Delivery, leading to more "predictive delivery" in the supply chain process, there was an expectation that the number and/or depth of ASL lines would be reduced. Customer confidence was supposed to rise, and lead to decreasing inventory levels. This was the vision at the "Strategic" level. However, at the operational and tactical levels, the logic and reasoning behind inventory decisions appear to have had a different focus.

The multiple levels of planning and decisionmaking must be in concert with each other. The same outcomes and expectations must be shared throughout the supply chain. Likewise, there must be "buy-in" on the published goals and objectives all the way down the supply chain. The vision must be strategically, operationally, and tactically streamlined.

We must work towards the Joint Vision 2020 goal of reducing the logistics footprint [Ref. 6]. The focus must be on stocking items that directly contribute to readiness (oftentimes referred to as readiness drivers). Authorized Stockage List (ASL) accommodation shouldn't take a prominent position as a primary metric; that is, the goal should not be to try and accommodate every possible customer requirement. Examples such as mud flaps, seat cushions, fenders, camouflage nets, etc, add very little, if any, real value to an ASL. These type items belong in strategic depots and warehouses that DLA and AMC run. The metric of customer wait time and concept of time definite delivery should continue to be optimized so that we can get these items faster and more predictably. Why?…because we don't want to have to stock them and drag them across the battlefield. Stock *readiness drivers* in the ASL, let improvements in Customer Wait Time and Time Definite Delivery take care of the rest.

b. Coupled with the Recommendation Above, Decide Upon a Stockage Model and "Stick With it". Enforce the Model's use and Build-in Effective Turbulence Screening Tools Into the Model.

We say "coupled with the recommendation above" because an integrated and streamlined vision must be agreed upon as a natural first step. A particular stockage model should be decided upon for a given division and the model should be kept in use as a chosen "model". This is not to say that 10 years later we shouldn't migrate to a more proven model available in the future. The fundamental thesis is that we should not change stockage models from year to year (e.g. Demand Analysis in 2000, EOQ in 2001, Dollar Cost Banding in 2002, etc.). However, this probably only explains some of the turbulence as described in this thesis. A portion of turbulence may still remain within any given stockage determination model. Therefore, the second part of our recommendation is to build screening tools into the model if they don't already exist. For example, the model could "flag" ASL lines as deletions during last years' ASL Review…which would prompt a manager hopefully to question "why are we considering re-adding this line again?" or similarly, the model could "flag" ASL Lines as additions during last years' ASL Review…which would likewise prompt a manager hopefully to question, "Why are we considering deleting this line…we just added it last year?"

c. In Order to Realize Noticeable Increases in Readiness, Aggressively Pursue The Reduction of Backorder Rates and Associated Time Spent in Backorder for High-Priority Type Items.

We believe that this area is one of the most significant barriers to improving velocity. Since these items are directly linked to readiness, and can be traced directly in support of particular fleets, this is an especially lucrative target to pursue. Moreover, because these metrics (backorder rate and time) have a direct link to the readiness equation, *Available Days/Possible Days*, attacking this problem has one of the greatest potential savings in terms of time. This in turn, will "save or sustain" the above *Available Days* numerator, leading to increasing readiness rates. Still more, targeting this area for aggressive improvement will also create very desirable side effects. Finally, attacking the "parts shortage" problem will help reduce the necessity to rely upon undesirable "workarounds" such as controlled substitution, cannibalization, and scrounging…all inefficient practices.

d. Army Materiel Command Should be an Active, Participating Member of the Strategic Distribution Team. Likewise, the Strategic Distribution Team Should Embrace the Army Materiel Command as a Vital Member Of the Team.

Nowhere in the course of our intensive research and development of our thesis did we find evidence that Army Materiel Command was included as a critical team member. No Army Materiel Command representatives could be found under any of the "member" or "contact" listings (e.g. not represented as a Core Team Member or on any of the "Committees"). Additionally, we could find no evidence that Army Materiel Command attended, played a role in, or contributed to quarterly Board of Directors meetings or recurring In-Progress-Review meetings. As discussed in Chapter IV, Army Materiel Command supports nearly 3 times the amount of high-priority type requisitions that are linked directly to weapon systems readiness. It is clear then, that if we want to influence processes and items that lead to improvements in readiness, and craft improvements to the supply chain that make a difference in the field, that Army Materiel Command must play a significant role. We therefore recommend that Army Materiel Command, as a vital member of the integrated supply chain, take an active role and be provided full membership on the Strategic Distribution Team.

e. Apply Lessons Learned and SDMI "Tenets" to the Army Materiel Command Piece of the Supply Chain. Seek Optimization of Army Materiel Command MRO-CCPR Time as an Initial Lucrative Target.

In the end…both DLA and AMC are moving "stuff." A root cause analysis should be conducted to identify any potential improvements for this important segment of requisition cycle time. In the course of the analysis, one should seek to incorporate the lessons learned from DLA and the implementation of SDMI over the past several years. Lessons learned in the areas of picking parts, optimizing the scheduling of trucks, and reducing variability by focusing on Time-Definite-Delivery may facilitate this process and help realize important improvements to the supply chain distribution network.

3. Limitations

In order to make the conclusions above, there are a number of limitations that must be considered. Our analyses were either based on cross-sectional data, or were before-after comparisons made without control variables, so it is impossible to address the issue of causation. For example, while we found no increase in readiness associated directly with SDMI, we cannot say that SDMI had no impact on readiness: it may be that but- for SDMI, readiness levels would have gone down. However, it is plausible to say that the anticipated increase in readiness due to SDMI was not realized.

As discussed in Chapter II, there are many causal factors that changes inventory levels at the SSA; SDMI is but one of them. Because we could not control for all of those other factors, it is not possible to draw a direct link between SD efforts and changing levels of inventory at the SSA's. It is plausible, however to state that the intended decreased inventories have not yet been realized.

With regard to the *Contributing Organizations* to SD and their individual approaches to logistics, there seems to be a common underpinning that something is being overlooked. Most services and organizations seem to be focused on doing their best to fine-tune the logistics system they currently use. In essence, we keep trying to cure an illness without truly addressing the cause of the illness. There are a great many factors driving the current logistics situation; one of which is reliability of equipment. To quote our thesis advisor, instructor and former Assistant Commander for Logistics and Fleet Support in the Naval Air Systems Command, Don Eaton, Rear Admiral U.S. Navy, (retired), "Reliability isn't everything…it is the only thing." [Ref. 27] His point is a valid one… we as logisticians spend our time dealing with mal-developed inventories based on highly exaggerated reliability figures of merit. Many of the Services' logistics "mission statements" support that mentality. What is vital here is that often the root cause of equipment failure is its inherent reliability. Systems fail sooner than they should, while operators and maintainers are forced to support higher actual failure rates rather than originally designed failure rates. Then, under-performing equipment is blamed on the logistician's inability to support those exaggerated MTBF figures.

Several new programs hint at this mentality such as Reliability-Based Sparing (RBS). Essentially, higher reliability factors are designed into systems and repair parts, maximizing system inherent reliability, and then the system can support a demonstrated and proven reliability. To the war fighter, this means they are provided with equipment that performs at or better than specified parameters. Maintainers are provided the right set and amount of reliable repair parts to maintain the equipment, and the equipment is repaired and mission capable. Logisticians are provided with accurate reliability data to base their inventory structures on and can subsequently provide better support.

While we have discussed a few recommendations discussing how increased readiness might be achieved through optimization of supply chain processes and segments…the real payoff in readiness is achieved through increasing reliability. Reliability must be built into systems during the acquisition phase of the life cycle. An article in the Army Logistics magazine pointed out that "sustaining adequate readiness through increased reliability is a multifaceted contributing factor to achieving the Army's vision. Increased reliability of weapons platforms contributes directly to greater combat effectiveness; the most lethal weapon is useless if a single mission-critical component malfunctions and causes the weapon to be unavailable." The article continued by highlighting the fact that numerous second-order effects result from improved reliability. For example, "fewer equipment failures mean reduced demand for repair parts, which means fewer stocks are needed to maintain readiness and fewer personnel are needed to manage those stocks." [Ref. 28]

The collective effect of increased reliability is commensurate with JV 2020's vision of an "appropriately-sized and potentially reduced logistics footprint." [Ref. 6] Further supporting the above article's premise are two theses submitted on the subject of reliability by Gregg Dellert and Michael Ryan, (references 29 and 30). Research conducted and presented in both of these theses strongly supports the premise that readiness is inextricably and very strongly related to reliability of systems and critical system components. [Ref. 29, 30]

4. Topics for Further Research

The following research topics warrant further study:

- Using a broader definition of turbulence, conduct an in-depth analysis of monetary and opportunity costs in the ASLs.
- Further, controlled analysis of the differences between DLA and AMC in terms of shipping times from the Depots to the CCPs.
- Determine and/or compare SD impacts on customers in other theaters and Services.
- Identify and capture the lessons learned from the SD program and research the potential for applying them to other Strategic Providers in the defense supply chain.

LIST OF REFERENCES

1. Hill, Scott, SDMI Orientation Briefing, United States Transportation Command, 28 November 2001. Power Point presentation. <https://business.transcom.mil/J4/SDMI/sdmi_home/sdmi_home/SDMI_Orientation_Briefing_28_Nov_01.ppt>

2. Strategic Distribution Board of Directors Meeting minutes, May 2002. <https://business.transcom.mil/J4/SDMI/sdmi_home/meetings/BoD.html>

3. Deputy Commander in Chief, USTRANSCOM, Director, Defense Logistics Agency. Strategic Distribution Management Initiative (SDMI) Project Guidance. USTRANSCOM/DLA, 17 July 2000.

4. United States Transportation Command and Defense Logistics Agency, Executive Agent for. Strategic Distribution Management Initiative (SDMI) Project management Plan. USTRANSCOM/DLA, 27 February 2001.

5. Chairman, Joint Chiefs of Staff. Joint Vision 2010, 1996. 06 August 2002. <http:/www.milnet.com/milnetr/pentagon/jv2010.pdf>

6. Chairman, Joint Chiefs of Staff. Joint Vision 2020, US Government Printing Office, June 2000.

7. Dumond, John [et al] Velocity Management: the Business Paradigm that has Transformed the U.S. Army; RAND Corporation, 2001.

8. Assistant Deputy Under Secretary of Defense (Logistics and Materiel Readiness), Performance Measures, 14 August 2002, <http://www.acq.osd.mil/log/logistics_materiel_readiness/organizations/sci/html/cwt.htm>

9. Whittemore, Ariane; GAO Hearings, 29 May 2002 <http://www.acq.osd.mil/log/logistics_materiel_readiness/organizations/lpp/assetts/product_support/GAO_Hearings/whittemore5.htm>

10. Deputy, Under Secretary of Defense (Logistics), FY2000 DoD Logistics Strategic Plan, 1999. 14 August 2002, <http://web.deskbook.osd.mil/reflib/mdod/001da/001dadoc.htm>

11. Defense Logistics Agency (DLA), An Overview of the Defense Logistics Agency. 16 August 2002, <http://www.dla.mil>

12. United States Transportation Command (USTC), United States Transportation Command History. 16 August 2002, <http://www.transcom.mil/history/summary.htm>

13. Army Material Command, What We Do. 16August 2002, <http://www.amc.army.mil/about_amc/whatwedo.html>

14. Erwin, Sandra. Logistics Transformation: Army Vows to Make it Work; National Defense Magazine, July 2002.

15. Kennedy, Harold, Army Trying to Expedite Flow of Supplies to Troops; National Defense Magazine, May 2001.

16. Crytzer, Ira (Fritz). Changing Repair Parts Supply Policy; Army Logistics Magazine, March/April 1999.

17. 200TH Materiel Management Center, Theater Logistics Layout & Single Stock Fund; Single Stock Fund Power Point Brief, 14 August 2001. <http://www.200mmc.21tsc.army.mil>

18. United States Transportation Command, Program Changes; Strategic Distribution Program Changes Power Point Brief, 2-3 May 2002. <https://business.transcom.mil/J4/SDMI/sdmi_home/meetings/BoD/>

19. United States Army, Army Regulation 710-2, Inventory Management Supply Policy Below the Wholesale Level, 31 October 1997.

20. United States Army Materiel Command Catalog Data Activity, CDA Pamphlet 18-1, User-Level Code Reference Guide for the ARMS Monthly, AMDF, and I&S History File. 01 June 1991.

21. United States Army, Regulation 725-50 Requisitioning, Receipt and Issue System, 15 November 1995.

22. Bastiat, Frederic, Selected Essays on Political Economy. The Foundation for Economic Education, Inc. 1995. Trans. Seymour Cain. Ed. George B. de Huszar. Library of Economics and Liberty. 12 September 2002. <http://www.econlib.org/library/Bastiat/basEss1.html>.

23. Toothaker, Larry, E. (1993) Multiple Comparison Procedures, Sage University Paper series on Quantitative Applications in the Social Sciences, 07-089. Newbury Park, California: Sage.

24. Winograd, Erin Q. What About Army Aviation?; Air Force Magazine, July 2001.

25. United States General Accounting Office, Army Inventory- Parts Shortages are Impacting Operations and Maintenance Effectiveness; GAO-01-772, July 2001.

26. Ross, Timothy, CAPT, USN. Strategic Distribution: Transformation Now; Defense Logistics Agency. Undated, <www.dla.mil/focusondla/stratdist.htm>

27. Eaton, Don R. RADM, USN (Ret.). MN4470 Lecture notes, 10 July 2002, Naval Postgraduate School, Monterey California.

28. Edwards, Thomas J.and Price, Richard W. *Readiness: Year 2000 and Beyond*, Army Logistics, March April 2000.

29. Dellert, Gregg M. An Analysis of the Impact of Reliability on the Operating and Support Costs and Operational Availability of the RAH-66 Comanche Helicopter, Master's Thesis, Naval Postgraduate School, Monterey, California.

30. Ryan, Michael E. The Reliability Challenge: Common Pitfalls and Strategies for Maximizing Inherent Reliability Performance of Weapon Systems; Master's Thesis, Naval Postgraduate School, Monterey, California.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, VA

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, CA

3. RADM(Ret) Don Eaton, Code 36
   Naval Postgraduate School
   Graduate School of Business and Public Policy
   Monterey, CA

4. Professor Ken Doerr, PhD, Code 36
   Naval Postgraduate School
   Graduate School of Business and Public Policy
   Monterey, CA

5. MG Hawthorne Proctor
   Defense Logistics Agency
   Fort Belvoir, VA

6. MG Terry Juskowiak
   United States Army Combined Arms Support Command
   Fort Lee, VA

7. COL Constantine Speros Vakas
   Defense Logistics Agency
   Fort Belvoir, VA

8. Stephanie Pennello
   Headquarters, Army Materiel Command
   Alexandria, VA

9. Trish Young
   Headquarters, Transportation Command
   Scott Air Force Base, IL

10. Frank Galluzo
    Military Traffic Management Command
    Alexandria, VA

11. Charlie Nye
Defense Distribution Center
New Cumberland, PA

12. Thomas Masselink
Headquarters, Department of the Army
Washington, DC

13. LTC Anthony Fuller
Headquarters, Department of the Army
Washington, DC

14. Vince Trinka
Defense Logistics Agency
Fort Belvoir, VA

15. Alan Estevez
Office of the Secretary of Defense
Washington, DC

16. LCDR Jeff Schmidt
Naval Postgraduate School
Monterey, CA

17. CPT Devon NuDelman
Naval Postgraduate School
Monterey, CA