

Accelerated Logistics



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Streamlining the Army's Supply Chain

Mark Y. D. Wang

Foreword by James A. Champy

Arroyo Center

RAND

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Prepared for the United States Army

Mark Y. D. Wang

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Arroyo Center

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Foreword

The Age of Logistics

Early in the last decade, Michael Hammer and I introduced the idea of reengineering: the process of fundamentally changing the way work is done in order to achieve radical improvements in operating performance. Our approach to process change was broadly applied in the Reinventing Government program led by Vice President Gore. The efforts of RAND in streamlining the Army's supply chain are a stellar example of reengineering.

The work described herein is particularly relevant today. Logistics has become even more important to the performance of an enterprise. It is the new basis of competition in business. It enables government to operate more efficiently and effectively.

Logistics also enables Internet-based services to work economically. This is an age when both information and physical products must move with great speed, at low cost, and with improved service. Much has been done to improve how information moves. Moving products is still a relatively primitive process. This report points to the future of logistics, and for the Army the future is now.

James A. Champy
Coauthor of *Reengineering the Corporation*
and *The Arc of Ambition*

Preface

Started in 1995, the Army's Velocity Management (VM) initiative sought to improve the responsiveness, reliability, and efficiency of the Army's then outdated logistics system. Through the implementation of a simple yet powerful process improvement methodology, the Army has dramatically streamlined its supply process, cutting order and ship times for repair parts by nearly two-thirds nationwide and by over 75 percent at several major installations.

This report tells the story of this remarkable accomplishment. It should be of interest not only to military logisticians, but also to corporations across a wide variety of industries whose survival depends upon their supply chains delivering a sustainable competitive advantage.

On March 19, 1999, this report was presented to Dr. Bernard Rostker, Under Secretary of the Army, and General John Coburn, then Deputy Chief of Staff for Logistics and currently the Commanding General of Army Materiel Command.

The research was conducted in the Military Logistics Program of the RAND Arroyo Center, a federally funded research and development center sponsored by the United States Army. VM research at RAND is sponsored by the Deputy Chief of Staff for Logistics (DCSLOG), Department of the Army. Commanding General U.S. Army Combined Arms Support Command (CG CASCOM) is designated by the DCSLOG the Executive Agent for the implementation of the Army's VM initiative.

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Summary

In June 1998, Vice President of the United States Al Gore and the National Partnership for Reinventing Government presented a team of Army logisticians and RAND analysts the “Hammer Award” in recognition of a great accomplishment: making Army logistics work better and cost less. Through its Velocity Management (VM) initiative, the Army has dramatically streamlined its supply chain, cutting order and ship times for repair parts by nearly two-thirds nationwide and over 75 percent at several of the major Forces Command (FORSCOM) installations.

For decades, the Army logistics system was based on massive stockpiles of supplies and weapon systems, many of them prepositioned “just in case.” While this system was world-class for supporting a Cold War army, it became increasingly less effective and unaffordable for the current force projection army. Started in 1995, the Army’s VM initiative sought to improve the responsiveness, reliability, and efficiency of this outdated logistics system.

The wholesale order and ship process is a critical part of the Army’s supply chain—filling nearly 60 percent of all retail issues for repair parts. During the Velocity Management baseline period from July 1994 to June 1995, order and ship times were lengthy with a long, variable distribution. Army mechanics would wait on average a month for spare parts from distant supply depots in order to repair a “down” weapon system. Delays occurred in all segments of the process, and response times varied from month to month.

VM recognized that achieving dramatic, continuous, and irreversible improvement required a revolutionary shift in thought and action. An organizational structure comprising senior Army leadership, site and process improvement teams, and continuing analytic support from RAND catalyzed the institutionalization of this cultural change, while VM’s Define-Measure-Improve methodology sustained it. At

each installation, simple rules such as “clear the floor each day” helped slash processing delays. The performance of each segment was also measured, with immediate and specific feedback on how to improve. To reduce financial delays, rules to review requisitions were instrumental in streamlining order processing.

The implementation and optimization of scheduled truck deliveries provides an excellent example of how Velocity Management enabled “win-win” solutions. In the past, Army installations received packages through a mix of delivery modes, including small-package air, small-package surface, less-than-truckload, and truckload deliveries. This delivery mix wasted both resources and time, and it made the process more unpredictable. Scheduled trucks addressed the real task—moving a large quantity of materiel from one place to another. Having a reliable high-volume and high-performing distribution system in place has provided the Army with premium-level service that is faster, better, and cheaper.

The VM initiative has led to similar improvements across all segments of the supply process, with participating installations quickly achieving dramatic reductions in order and ship times. The greatest improvements have come from the major Forces Command installations and other installations in the active Army. But most overseas major commands have also made significant progress in reducing order and ship times. Today Army customers nationwide and around the world routinely receive the quick and dependable level of service they have come to expect from a high-performing commercial supply chain.

Acknowledgments

The author wishes to thank many people who have helped make this research possible. Understanding and improving the order and ship process required the assistance of many different organizations and their senior leadership.

James A. Champy's management books on reengineering have motivated many persons involved with VM. His foreword is sure to inspire continued improvement efforts.

The Army DCSLOG was the project sponsor for this research. GEN John Coburn (CG AMC), a member of the Velocity Group (VG) while the Army DCSLOG, has provided support since the conceptual inception of Velocity Management. MG Cannon (ADCSLOG) has helped focus this report with his questions and comments, particularly regarding overseas distribution. Many past and present members of the VG, too many to name, have lent their leadership and experience in supporting Velocity Management.

Many members of the OST PIT, led by Tom Edwards (CASCOM), provided expert knowledge of various processing segments. From CASCOM, Lieutenant Colonel (LTC) Joe Walden, LTC Anthony Fuller, Chief Warrant Officer 5 (CW5) Leo Gibson, CW5 John Lowes, and Harry Johnson (MPRI) have led numerous productive and informative installation walk-throughs. From the Defense Distribution Center (DDC) and Depot at Susquehanna, Pennsylvania (DDSP), BG Barbara Doornink, Captain U.S. Navy (CAPT USN) Joseph Kenney, Pat Kuntz, Pat McCormick, Jerri Taylor, Lt. Col. David Caldwell, and Jackie Noble invited the group to tour depot and Consolidation and Containerization Point (CCP) processing activities. Equally gracious were their counterparts at the Defense Distribution Center in San Joaquin, California (DDJC), including COL John Marx, Bill Handewith, David Ennis, Ron Johnston, and Pamela Kale. David Arensdorf (AMC) pro-

vided historical perspective of changing Army inventory and distribution doctrine.

The data analysis could not have been completed without the assistance of Jim Newell and Robert Nadler from the Army Logistics Support Activity (LOGSA), which provided essential data extracts from the Logistics Intelligence File (LIF).

At RAND, the author drew heavily upon the research contributions of Patricia Boren, David Diener, John Dumond, Rick Eden, John Folkeson, and Kenneth Girardini. Some of the figures and discussion herein are drawn or adapted from previous RAND publications, particularly the following two:

- John Dumond, Rick Eden, and John R. Folkeson, *Velocity Management: An Approach for Improving the Responsiveness and Efficiency of Army Logistics Processes*, DB-126-1-1, 1995.
- Kenneth J. Girardini et al., *Establishing a Baseline and Reporting Performance for the Order and Ship Processes*, DB-173-A, 1996.

In addition, the document benefited significantly from the comments of technical reviewers Mahyar Amouzegar and Eric Peltz. Donna Keyser, a RAND communications analyst, and Nikki Shacklett, a RAND editor, improved the document in many ways. Finally, art director Ron Miller and graphic designer Maritta Tapanainen contributed to the cover design.

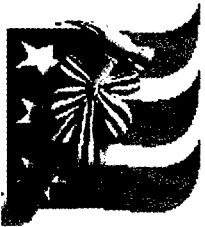
Glossary

AFB	Air Force Base
AMC	Army Materiel Command
ARCENT	U.S. Army, Central
CAPT	Captain
CASCOM	U.S. Army Combined Arms Support Command
CCP	Consolidation and Containerization Point
CG	Commanding General
CONUS	Continental United States
CW5	Chief Warrant Officer 5
DCSLOG	Deputy Chief of Staff for Logistics
DDSP	Defense Distribution Center of Susquehanna, Pennsylvania
DLA	Defense Logistics Agency
DMI	Define, Measure, Improve
FedEx	Federal Express
FORSCOM	Forces Command
GEN	General
GSA	General Services Administration
LIF	Logistics Intelligence File
LOGSA	Logistics Support Activity
LTC	Lieutenant Colonel
LTL	Less Than Truckload
MACOM	Major Command
MG	Major General
MPRI	Professional Services Company in Military-Related Contracting
O&S	Order and Ship
OCONUS	Outside the Continental United States
OST	Order and Ship Time

PIT	Process Improvement Team
SP	Small Package
TRADOC	Training and Doctrine Command
TRANSCOM	Transportation Command
UPS	United Parcel Service
USAREUR	U.S. Army, Europe
USARPAC	U.S. Army, Pacific
USARSO	U.S. Army, South
USN	U.S. Navy
VG	Velocity Group
VM	Velocity Management

Chapter 1

The Accomplishment



The Hammer Award

Established in 1993, the Hammer Award is presented to teams of federal, state, and local employees and citizens who are working to build a better government. The award is the Vice President's answer to yesterday's government and its \$400 hammer. Fittingly, the award consists of a \$6.00 hammer, a ribbon, and a note from Vice President Gore, all in an aluminum frame.

In June 1998, Vice President Al Gore and the National Partnership for Reinventing Government awarded the “Hammer Award” to a team of Army logisticians and RAND researchers for making Army logistics work better and cost less. A highlight of this success has been an accelerated, streamlined Army supply process that delivers spare parts to installations nationwide in a third the time it took to deliver them just three years earlier.

For decades, the quality of Army logistics fell progressively behind best commercial practices. Army mechanics would wait on average a month for spare parts from distant supply depots in order to repair a “down” weapon system. Through the institutionalization of Velocity Management (VM)—a simple yet powerful process improvement methodology—Army customers nationwide and around the world now routinely receive the quick and dependable level of service they have come to expect from a high-performing commercial supply chain.

Figures 1.1 and 1.2 illustrate this dramatic success. The month-to-month presentation of Fort Bragg's order and ship time (OST) in Figure 1.1 shows the spectacular and irreversible effects of VM.¹ Supply cycle times have been reduced to a quarter of their baseline performance times, while distribution costs and process variability have also been reduced.² This is a shining example of how VM has led to faster, better, and cheaper supply processes across all major participating Army installations.

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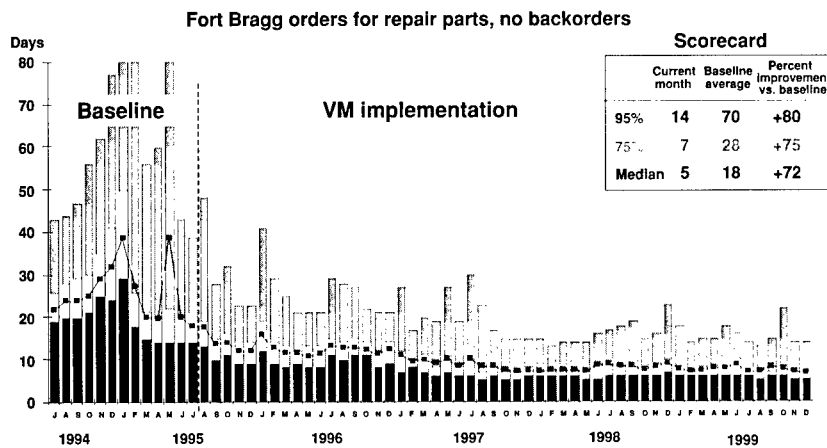


Figure 1.1 Participating Installations Quickly Achieved and Sustained Dramatic Improvements

The two curves in Figure 1.2 show how order and ship times have dropped across all installations nationwide since the VM baseline performance period, July 1994 to June 1995.³ Shown on the lower curve,

¹The overlaid bar chart presentation of order and ship times is explained in detail in Chapter 4 on measuring supply performance. Longer bars show slower, more variable performance, and shorter bars show more responsive and less variable performance.

²The VG defined 1 July 1994 to 30 June 1995 as the VM “baseline” period. See Girardini et al. (1996).

³Backordered requisitions are not included in this report to separate stockage issues from the order and ship process, which moves in-stock items. Having items available for issue is of course critical to customer support, and other efforts within VM are addressing both the acquisition and positioning of DoD stocks.

average order and ship times for requisitions from active⁴ units nationwide had improved by 62 percent in December 1999. Times for overseas air shipments have improved nearly as much, down 43 percent in December 1999. To underscore these achievements, overseas shipments are now received faster than domestic shipments were just two years ago.

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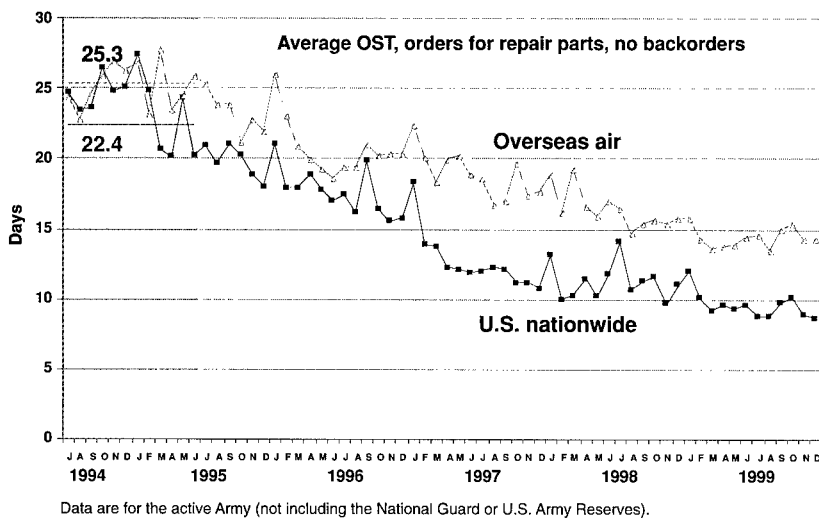


Figure 1.2 Wholesale Order and Ship Times for Repair Parts Have Been Cut by Nearly Two-thirds Nationwide

As a result of the VM initiative, today's Army can boast of a remarkable achievement: accelerated logistics processes capable of supporting Army forces of the future anytime, anywhere. This document reviews the motivations behind VM, and the process improvements that have led to such dramatic results. The next chapter presents a high-level overview of the VM paradigm, including its motivations, leadership and organizational structure, and methodology. Chapters 3, 4, and 5 focus on defining, measuring, and improving the supply

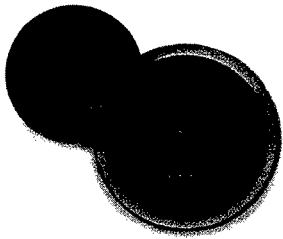
⁴The "active" Army does not include units in the National Guard or U.S. Army Reserves.

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process, nationwide and overseas. The work VM sought to do is hardly complete, however, and the final chapter of the report recommends steps for further acceleration.

Chapter 2

Institutionalizing the Velocity Management Paradigm



The Velocity Management commander's coin displays the Define-Measure-Improve methodology for continuous improvement. These informal and spontaneous awards in recognition of good achievement have been an important method of rewarding initiative and performance across the Army.

A REVOLUTIONARY SHIFT IN THOUGHT AND ACTION

In the past, the Army logistics system was based on massive stockpiles of supplies and weapon systems, most of them prepositioned “just in case” (Figure 2.1).⁵ This system was world-class for the job it was designed to do: support a Cold War army. As this era passed, however, the system became increasingly less effective and unaffordable.

The massive stockpiles and complicated supply chains were slow to move and unresponsive when facing volatile surge requirements. Worse, the supply system had become unreliable to soldiers forced to endure lengthy and variable delays or even lost packages. Declining defense budgets only exacerbated these problems, since reducing the mass of this logistics system uncovered process problems previously

⁵Figures 2.1, 2.2, and the subsequent discussion of the Velocity Management concept and implementation strategy are drawn from Dumond, Folkesson, and Eden (1995).

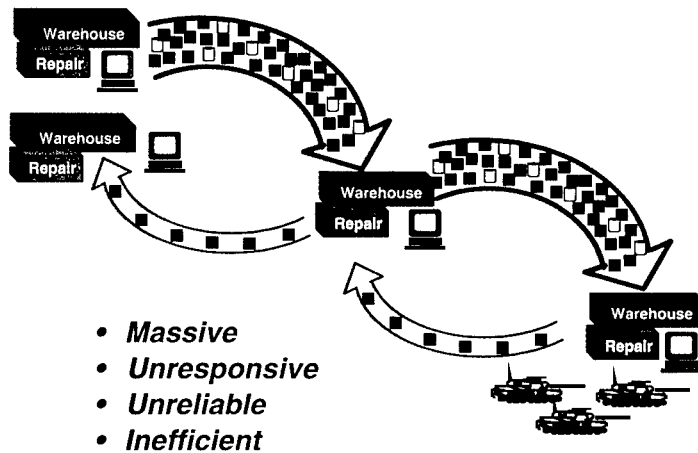


Figure 2.1 The Army Logistics System of the Past

hidden by now unaffordable levels of surplus stocks. Given the increasing inability to predict where conflicts might erupt, prepositioned stockpiles of equipment and materiel were not only costly, they were ineffective.

To counter the inability to predict and forecast requirements, a new strategy emerged for avoiding and reducing the risks of uncertainty (Figure 2.2). In this strategy, military responsiveness is paramount. The ability to respond rapidly to crises, before they escalate to major contingencies, requires a different, “force-projection” Army. The Army’s logistics processes had to change to be more adaptive, scalable, and appropriate for this new era.

The old view of logistics had to be supplanted by the contemporary business view of logistics as a set of customer-focused processes honed to deliver supplies when they are needed, where they are needed. Information and materiel have to be moved faster and more accurately. Cycle times have to be cut as well, by eliminating non-value-adding activities and continuously improving value-adding activities in supply processes. The goal was to manage supplies more effectively and efficiently through velocity and accuracy, rather than an outdated system based on mass.

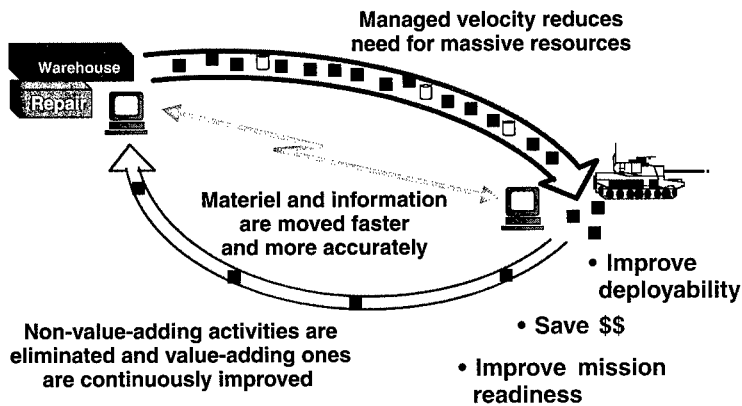


Figure 2.2 Velocity Management Is a New Strategy

Transforming the Army’s supply system required nothing short of a cultural change. As shown in Figure 2.3, the differences between the old and new Army logistics concepts are striking.

Traditionally, logistics was viewed as “piles of things,” managed parochially by separate functional groups, e.g., transporters versus

Characteristic	Traditional Army logistics concept	New Army logistics concept
View of logistics	Piles of “things”	Set of processes to meet customer needs
View of the logistics system	Function (provider) <ul style="list-style-type: none"> • Quartermaster • Ordnance • Transportation 	Process (customer) <ul style="list-style-type: none"> • Order and ship • Repair • Stockage
Metrics	Days of supply Shop repair cycle time	Time, quality, cost Total repair cycle time
Reporting	Average performance	Median performance, variance
Orientation of managers	Compliance oriented Dedicated resources Free issue Inspection/review/control Incremental improvement	Mission oriented Flexible resources Pricing incentives Visibility/system understanding Continuous improvement

Figure 2.3 Achieving Dramatic, Continuous Improvement Requires Institutionalizing a Cultural Change

supply officers. How this system performed was measured by days of supply, or by functions, with reports measuring average performances.⁶ Managers and subordinate managers were more concerned with compliance and control, making sure they could not be blamed for their specific activity, but at the same time also not striving to improve. Indeed, incentives against change are frequently the norm in bureaucratic organizations. As the saying goes, “The nail that sticks up gets hammered down.”

The new logistics concept required that soldiers view logistics as processes, rather than individual functions, or piles of things. More important, the focus had to be the customer and how processes ultimately served customer needs. Managers were presented with incentives that aligned their activities with the end-to-end supply chain goals. The performance of these processes was measured in terms of how well improvements in the times, quality, and costs of these processes enabled soldiers to complete their mission.

CATALYZING CHANGE: LEADERSHIP AND ORGANIZATIONAL STRUCTURE

Major transformations do not occur easily, and VM recognized the need for a strong supportive leadership and organizational structure early in its implementation (Figure 2.4). Given the many functions and organizations involved in each logistics process, senior-level leadership commitment was critical to VM success.

The Velocity Group (VG) was formed by bringing together the Deputy Chief of Staff for Logistics (DCSLOG), the Deputy Commanding General of Army Materiel Command (AMC), and the Commanding General of the Combined Arms Support Command (CASCOM). These three senior Army logisticians comprised a triad to set forth both the vision and policies necessary to enable bold change and dramatic improvement. Note that the leadership triad was formed by bringing together designated ex-officio positions and not specific individuals. Whoever is the current DCSLOG is a member of the VG, along

⁶There is a maxim that no world-class organization measures itself in averages.

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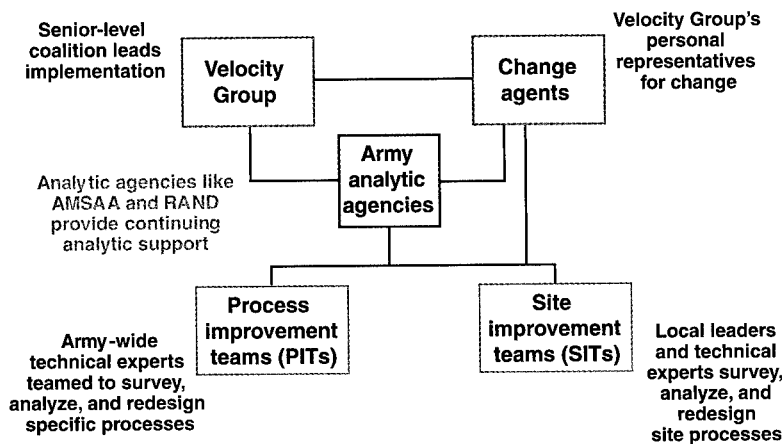


Figure 2.4 Process Improvements Are Driven from the Top, Made by Teams, and Guided by Analysis

with the current AMC deputy and CASCOM commander. Leadership by committee may not always be ideal, but it works well in the military where general officers are reassigned to different positions every two to three years, to gain different experiences during, for example, a European tour of duty or a Pentagon tour. Even though the group has undergone complete changes of officers, focus and momentum can be sustained to drive process changes.⁷

At each installation, site improvement teams (SITs) were created as cross-functional and multi-echelon teams to improve all local processes. As a complementary group, process improvement teams (PITs) were created to focus on individual processes, but across all installations and supply points. Specific individuals were designated “change agents” by the Velocity Group, to focus attention and to ensure that improvement measures were carried out. For practical purposes, change agents are the leaders of the VM PITs. They are general officer-level designates

⁷Sustained leadership commitment is frequently a stumbling point for reengineering efforts, as described in *Reengineering Management*, by James A. Champy. When initiatives achieve short-term or intermediate milestones, managers may feel the improvements are good enough and stop rather than press on to reach the full potential of reengineered processes.

who, in addition to their many other responsibilities, present updates at the quarterly VG board meetings.

RAND Arroyo Center developed the concepts behind Velocity Management and continues to provide analytic support for all three groups.

SUSTAINING CHANGE: VM's D-M-I METHODOLOGY

With strong leadership and a supportive organizational structure in place, establishing an appropriate methodology was important to drive and sustain change. Velocity Management has used the “Define-Measure-Improve” (D-M-I) methodology to lead continuous improvement efforts. This simple, iterative tool has been instrumental in building consensus and leading teams.

As Figure 2.5 depicts, the first step is to define the process.⁸ While many members of the SITs and PITs have expert knowledge on specific functions, it was important to reconcile differing perspectives across organizations. Once a common understanding of the end-to-end process is achieved, then the second step is to measure the process to baseline performance, define metrics, and identify performance drivers. The third step is to improve the process by implementing change, establishing goals, and repeating the D-M-I methodology.

⁸Figures 2.5, 4.4, 6.7, and subsequent discussion on performance drivers in depot and transit segments of the order and ship process are drawn from Girardini et al. (1996).

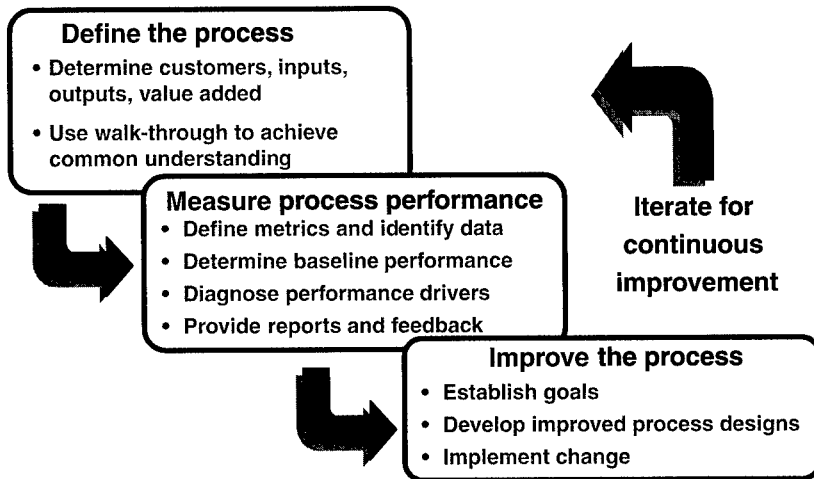


Figure 2.5 The Define-Measure-Improve Methodology Leads to Continuous Improvement

Chapter 3

Defining the Supply Process

The order and ship process, a critical part of the Army's supply chain, is intended to deliver supplies responsively and efficiently so weapon systems can be repaired and combat readiness can be maintained. The demand for repair or service parts is characterized by increasingly unpredictable demand,⁹ and there is a paramount need to support rapid deployments and surge requirements. As a result, this supply chain must not be confused with those supporting more predictable manufacturing operations or the movement of regularly ordered commodities, e.g., resupply of bread and milk to a grocery store.¹⁰ Any supply chain for predictable, regular items would be inappropriate for the military, no matter how lean and efficient. More comparable are corporations that must rely upon highly responsive supply chains to survive rapidly changing environments and unpredictable demands.¹¹

As shown in Figure 3.1, Army retail stocks are stored at and available from several supply points. Thus, when a weapon system requires a repair part, the Army customer (or mechanic) can get it from

⁹The increasing use of digital and high-tech components in weapon systems has increased the unpredictability of failure modes and repair parts needed. In addition, since these items are generally more expensive, a strategy of buying out the problem with large surplus stocks is not affordable.

¹⁰The auto manufacturing processes to build Ford Fairmonts are different from those for trendy German sports cars. Similarly, commodities such as bread and milk are obviously treated differently from fashions or fad products. A discussion on the differences between efficient versus responsive supply chains is presented in Marshall L. Fisher, "What Is the Right Supply Chain for Your Product?" *Harvard Business Review*, March–April 1997.

¹¹Despite seeming dissimilarities, the computer and toy companies must both have highly responsive supply chains. Seventy-five percent of all toys are sold in the month of December, and computer parts depreciate precipitously within short product life cycles. Thus, stock-outs translate to lost sales, and excessive inventories are deadly to fiscal survival. Both industries must forecast accurately and adapt quickly to changing consumer needs.

one of several places.¹² A quarter of the time, the part will be available in the local retail supply, and an additional 10 percent of the time it can be issued through referral from a neighboring retail supply. But the single largest volume of spare parts, nearly 60 percent of all issues, comes from parts stocked at the wholesale system. Issues for stocked items are delivered through the order and ship process.

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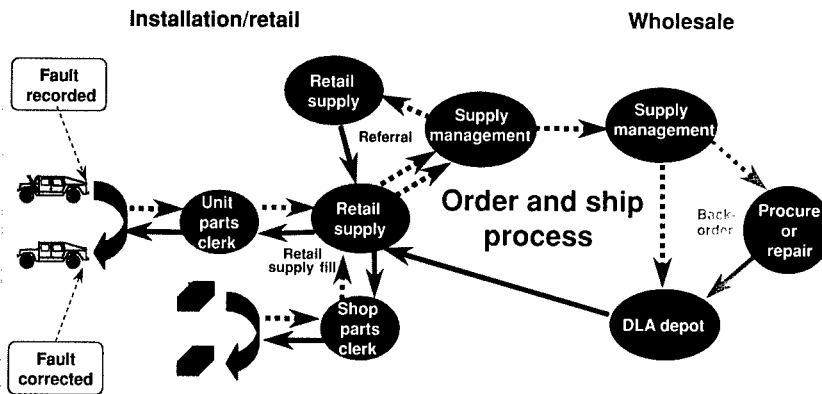


Figure 3.1 The Wholesale Order and Ship Process is a Critical Part of the Army's Supply Chain

The order and ship process cuts across many Army and other DoD organizations. First, a request is passed through several supply management systems to a Defense Logistics Agency (DLA) supply depot. Stocked items at the wholesale system are then picked, packed, and shipped to the retail supply, fulfilling the original request. A few parts are unfortunately backordered at the wholesale system, delaying issues until the item can be restocked.

¹²The customers for the Army's order and ship process are known as supply support activities (SSAs). This document focuses on the requests SSAs initiate, since these activities hold retail stocks that are replenished by the wholesale system. It should be noted that there are lower echelons of supply maintenance activities with supply processes not addressed in this document.

WALKING THE PROCESS

In defining the supply process, it was important to understand how each Army unit requests and receives supplies. Many individuals are familiar with, perhaps even experts on, one or another portion of the Army's supply processes. Reconciling differing viewpoints and understandings of the various process segments is therefore important to help process improvement and site improvement teams work in unison.

To define the end-to-end order and ship process, Velocity Management teams "walked the process," visiting and observing activities at the inventory control points, wholesale supply depots, and many Army bases. They carefully reviewed all information processing, distribution, and materiel-handling segments along the supply process.

Walking the process and not simply sketching organizational flowcharts for how processes "should" work is a critical element of the "define" stage of D-M-I. Nothing generates understanding or insights better than seeing actual processes and speaking with individuals at each activity. For example, an outside observer might find it puzzling that higher-priority requisitions move slower than lower-priority requisitions. Frustrated supply clerks, however, are familiar with this problem: Since high-priority parts also tend to be expensive, requiring authorization, the more expensive the item, the higher rank of officer the clerk must track down for a signature. Signatures in themselves are also a source of delay, since the requisition can only travel as fast as the sheet of paper the signature is on, rather than at the speed of electrons in this networked world. As a result, the highest-priority items have the most cumbersome authorization process before the requisition can be submitted.

Every Army installation and unit does things somewhat differently, even if they have identical missions by doctrine, so process improvements at one location may not address issues elsewhere. At one installation, high-priority requisitions were similarly received slower than lower-priority requisitions, but the walk-through uncovered a very different explanation. A visit to that installation's central receiving point revealed a rather small facility where everyone worked to clear the limited space so the next day's deliveries would have somewhere to go. Consequently, the largest boxes moved first, including low-priority

but bulky clothing and paper products. Smaller boxes, sometimes including express packages containing expensive and high-priority items, waited for the floor to be cleared.

BASELINE ORDER AND SHIP TIMES

Figure 3.2 shows the time distribution of the order and ship process during the VM baseline period, July 1994 to June 1995.¹³ The horizontal axis shows OST measured in days, and the vertical axis displays the percentage of total requisitions with that OST. The distribution has a broad peak between one and three weeks for most requisitions. Minor peaks spaced seven days apart show the effects of weekly and weekend batched processes, i.e., requisitions received over the weekend would be processed on Monday. Times for these peaks needed to be reduced in order for gross performance to improve.

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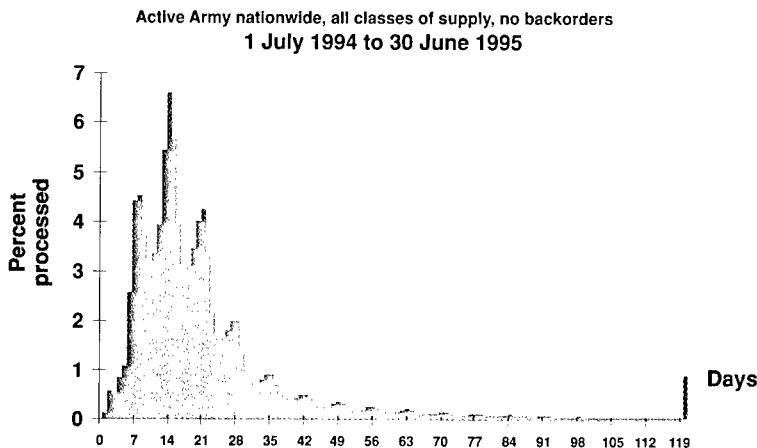


Figure 3.2 Four Years Ago, Order and Ship Times Were Lengthy with a Long, Variable Distribution

¹³This figure and the subsequent discussion of the Army's order and ship time performance during the baseline period are adapted from Girardini et al. (1996).

The long and variable tail to the distribution, stretching several months, presented an even greater problem (receipts taking longer than 119 days are grouped at the far right of the chart as a short peak of requisitions received at 120 days). Even though it represents a small fraction of the total requisitions (i.e., only 1 percent of the total requisitions had OST of greater than 119 days), the tail clearly drives many of the Army's counterproductive behavior patterns. It only takes one or two "bad experiences" to cultivate behaviors such as hoarding supplies or multiple ordering of parts in the hope that one will arrive quickly.

The negative repercussions of variable delivery times on the repair of weapon systems and ultimately on combat readiness are clear. If an inoperable tank requires ten repair parts, many of them should arrive within a couple weeks. Another couple of parts may take a month to arrive. The mechanic must wait until the tenth and final part arrives, however, probably more than two months later, before repairs can be made.

Given the major role of the order and ship process in the Army's logistics supply chain and the enormous problems associated with it, the VM initiative targeted this process before any others. Subsequent VM initiatives have aimed at improving other aspects of the Army's logistics system, such as its repair processes and stockage postures.

Chapter 4

Measuring Supply Performance

Defining a process is only the first step toward improvement. The second step is to establish metrics that will align performance with customer-focused process improvements.¹⁴

IMPROVING ARMY METRICS FOR OST

To measure the Army's logistics performance properly, the VM team developed a percentile bar-chart presentation of order and ship times to portray not only times for the peak, but also for the tail of the distribution (Figure 4.1). On the lower horizontal bar, the black region represents the time required to receive half the requisitions for repair parts, (17 days during the VM baseline period). The intermediate yellow region shows the additional time required to receive 75 percent of the requisitions (25 days during the baseline). The final gray region is the time to receive 95 percent of the requisitions (56 days during the baseline). A red marker is also placed at the mean (22.4 days during the baseline), recognizing the Army's historical preference for and familiarity with measuring average performance.

This percentile bar-chart presentation allows managers and customers to quickly see and understand overall performance and process variability. Longer bars indicate poor performance, and shorter bars indicate improved performance. Longer black and yellow bars showed that gross performance was poor. Longer gray bars meant performance was unpredictable and variable.

¹⁴It is no accident that the word "Measure" is slightly larger than either "Define" or "Improve" on the VM Commander's coin. It is impossible to go on a diet without an accurate scale.

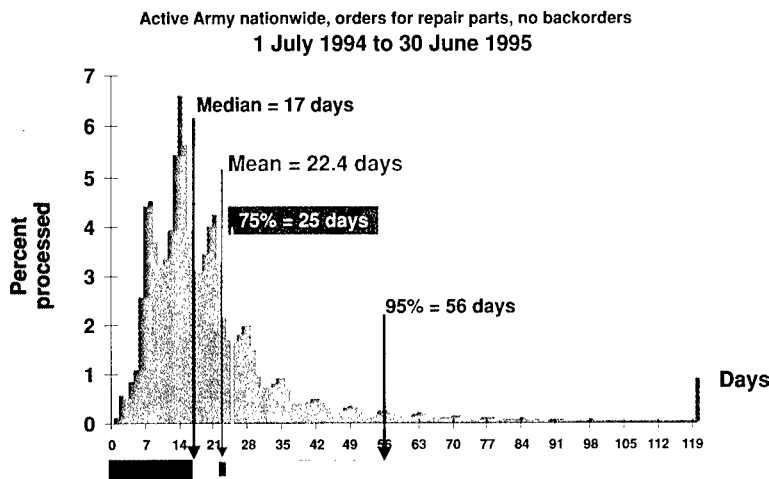


Figure 4.1 Percentile Presentation of Order and Ship Times Shows Process Variability During the VM Baseline Period

Figure 4.2 displays Fort Bragg's monthly OST during the baseline period. The average time and 95th percentile variability differed by a factor of two or three. This means that soldiers waiting for repair parts had no ability to plan repair schedules or to maintain the combat readiness of their weapon systems. They simply waited and waited as frustrated customers of an unreliable and unresponsive supply system.

MEASURING SEGMENTS OF THE OST PROCESS

During the VM baseline period, delays occurred in all segments of the order and ship process. Figure 4.3 rotates the percentile bar-chart presentation, so tall vertical bars represent worse performance.

The longest process delays (i.e., the highest vertical bars) appeared in the initial segment, order, and the final segment, transit, crossdock, and receipt processing. Ironically, at each installation these segments were largely under Army control. But even the largely administrative

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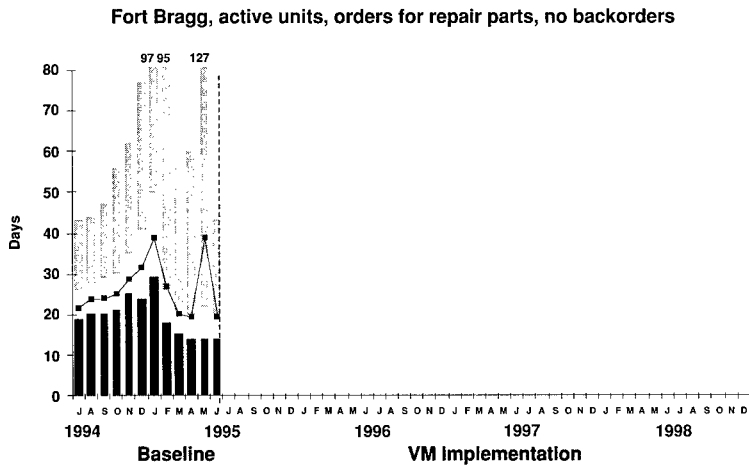


Figure 4.2 During the Velocity Management Baseline Period, Order and Ship Times Varied Month to Month

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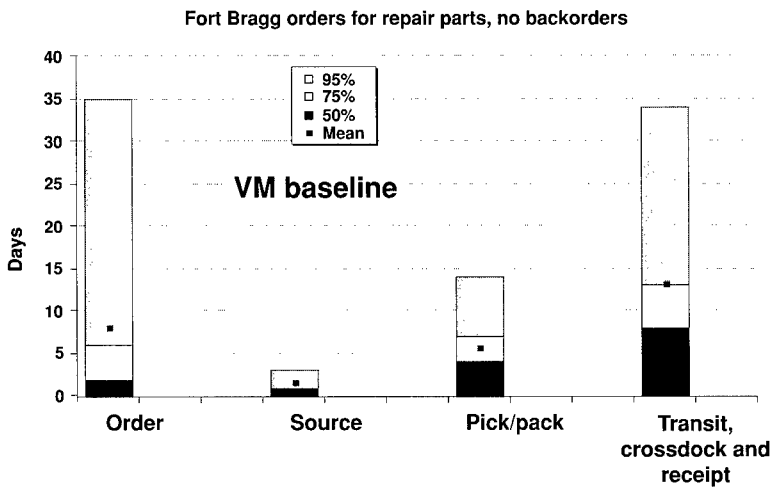


Figure 4.3 During the VM Baseline Period, Delays and Process Variability Occurred in All Segments of the Process

and automated sourcing segment showed room for improved performance.

Having properly defined the process, VM teams now had valuable clues about problematic activities. Delays in ordering were due to financial holds and manager reviews of individual requisitions. Delays in transit, crossdock, and receipting shipments were caused in large part by a cumbersome mix of shipping modes.

The VM team examined the mix of shipment modes from each supply depot at Fort Bragg in more detail. Small packages were sent by a premium air service such as FedEx, and larger packages were sent by surface carriers like UPS. If the shipment were large enough it might justify an entire truck, otherwise less-than-truckload (LTL) providers were used. Fort Bragg received hundreds of packages a day, and delays resulted from receiving a blizzard of small packages, unsorted, unscheduled, and from multiple sources. Figure 4.4 presents different pick, pack, and hold, and transit and receipt times for each shipping mode.

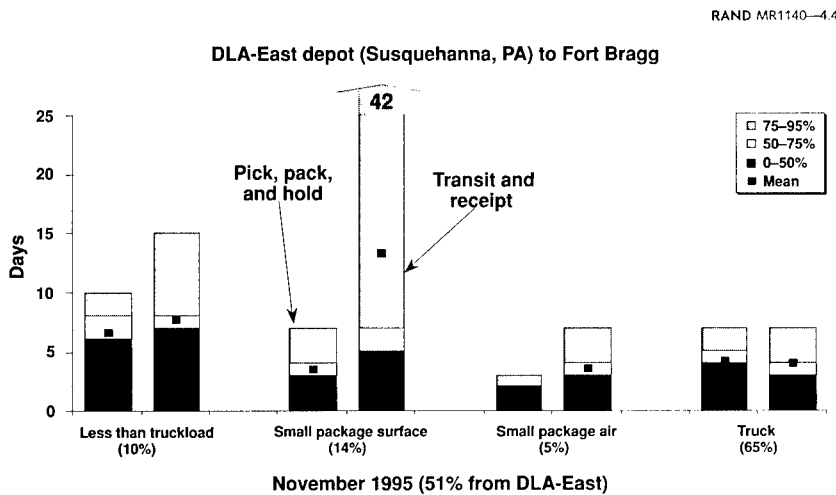


Figure 4.4 The “Optimizing” of Shipping Modes on a Package-by-Package Basis Made the Process More Unpredictable

Essentially, shipping modes were optimized on a package-by-package basis, with the resulting mix of processing and transit times contributing to unpredictable overall performance. This is because processes to move individual packages may not work efficiently at higher volumes. In fact, high-volume commercial operations such as Walmart or McDonalds do not resupply their retail stores with FedEx or UPS deliveries. They use scheduled dedicated Walmart and McDonalds trucks. In other words, just because FedEx can ship one package overnight to a single customer does not mean that using FedEx is the most efficient way to move a large quantity of material from one place to another.

As we will show in the following chapter, implementation of scheduled truck deliveries from primary depots to customers has been instrumental in improving the Army's overall supply performance.

Chapter 5

Improving Order and Ship Times

Many VM process improvements have contributed to reduced order and ship times. These include:

- *Leadership commitment*
 - *Scheduled truck deliveries*
 - *Simple rules*
 - *Higher fill from chief depot*
 - *Measurement with feedback*
 - *Direct delivery to customers*
 - *Streamlined reviews*
-

Many VM process improvements and initiatives together have led to dramatically reduced order and ship times. As mentioned earlier, leadership commitment ensured participation and cooperation across organizational boundaries. At each installation, simple rules such as “clear the floor each day” helped slash processing delays. The performance of each segment was also measured, with immediate and specific feedback delivered on how to improve. To reduce financial delays, rules for reviewing requisitions promptly were instrumental in greatly streamlining order processing.

IMPLEMENTATION OF SCHEDULED TRUCK DELIVERIES

One of the most effective process improvement initiatives was the implementation of scheduled truck deliveries. Scheduled truck deliv-

eries have resulted in a reliable and high-performing distribution system through which high-volume shipments are delivered directly from primary depots to customers.

Proper leverage of this system required that stocks be made readily available from primary depots. Improved stock positioning at each installation's chief depot allowed shipments to be sent by truck in the first place and for fill rates to improve in the second. Customers could also avoid the hassles associated with receiving stocks from multiple sources.

In the past, many installations had a central receiving point, where shipments were sorted and rerouted to customers. With the implementation of scheduled trucks and customer-oriented depot processing, much of this sorting could be done earlier in the supply chain. As a result, deliveries could go directly to the customer, bypassing unnecessary on-post processing. In addition, trucks were packed in reverse order so that scheduled deliveries could be made to several on-post customers.¹⁵

SUPPLY PROCESS IMPROVEMENT AT FORT BRAGG

The supply process improvement achieved at Fort Bragg illustrates the positive impact that scheduled truck deliveries have had on high-volume Army customers across all major Army installations.

Given that Fort Bragg is only a one-day drive from DLA-East, its primary depot, truck deliveries offered essentially premium-level transit times for all shipments (Figure 5.1). Further, long-term contracts for daily scheduled truck service were cheaper than aggregated package-by-package charges. The ability to schedule deliveries from the depot greatly aided in receipt processing, since shipments could be sorted and delivered directly to the customer, bypassing processing at a central re-

¹⁵Major General Wright (ret.), then Commanding General/Commandant of the U.S. Army Quartermaster Center and School, liked to say that trucks should be reverse packed with breakfast, lunch, and dinner so troops could eat their way forward.

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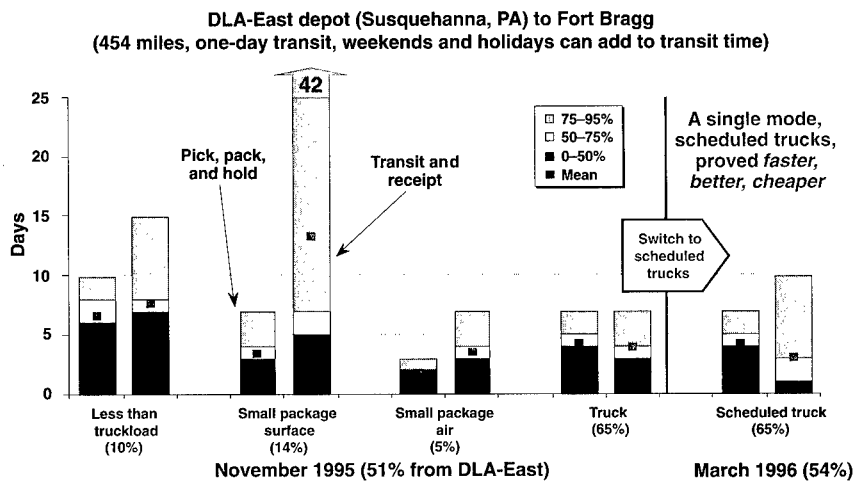


Figure 5.1 The Army Developed Strategic Partnerships with Providers

ceiving facility. For all of these reasons, establishing a single delivery mode proved faster, better, and cheaper.

At times a supply truck may leave the depot only partially full, appearing to underutilize its total capacity. Improving stockage at the primary DLA depots can help better utilize this capacity by putting more shipments on each truck. However, excess capacity should be viewed as an asset, since demand surges can be accommodated with no change in the supply process or in distribution costs. Ultimately, it is important to have the ability not to delay all packages already on the truck when a few extra shipments need to be squeezed in.

With a single reliable channel in place, improved coordination of receipt processing with scheduled truck deliveries led to further reductions in OST (Figure 5.2). The primary depot was able to fill a higher percentage of customer orders, increasing the volume and cost-effectiveness of scheduled truck deliveries. Depot pick, pack, and hold

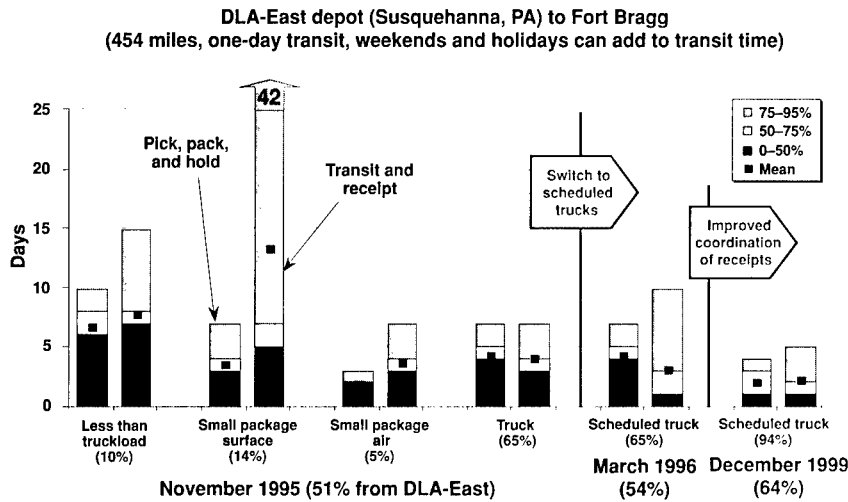


Figure 5.2 Fort Bragg Has Worked with DLA-East to Improve the Scheduled Truck Channel

cut-off times were established so trucks could drive to and arrive at Fort Bragg at specified times.

The hard work and dedication of the soldiers at Fort Bragg complemented these initiatives. On post, routes were set up to eliminate wasted driving time between customer drop-off points, and cargo in the truck was staged to match the delivery route. Drop-off times were set at each location, where a crew of soldiers stood ready to unload truck cargo with the efficiency of a race car’s “pit crew.”

Note that these changes benefit the trucking service as well as the soldiers. For the driver, there is less time wasted driving and waiting at unprepared delivery points. For the soldiers, their responsibility to receive shipments is confined to a short period every day, rather than waiting for deliveries which may or may not arrive. Afterwards, they are free to resume their other duties.

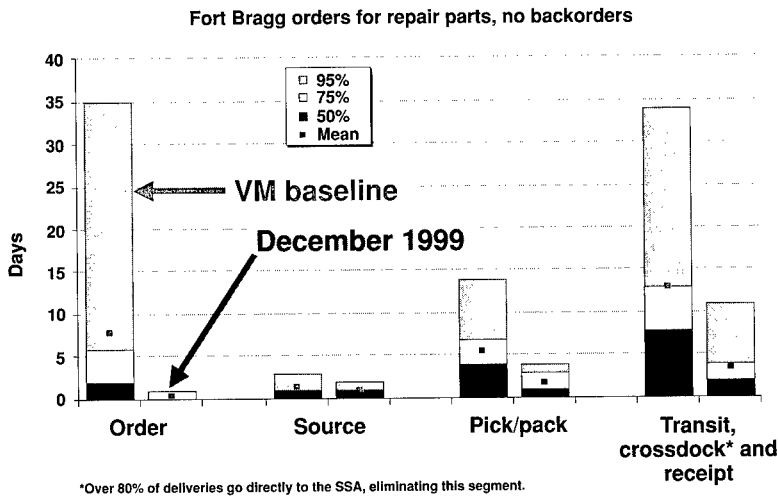


Figure 5.3 Every Segment Showed Strong Improvement

Figure 5.3 revisits Fort Bragg in December 1999. All segments of the supply process now show extreme reductions in speed and variability.

As might be expected when every segment improves, reductions in overall times and process variability have been equally dramatic. The month-to-month presentation of Fort Bragg’s OST in Figure 5.4 highlights once again the spectacular and irreversible effects of VM. Supply cycle times have been cut by 75 percent of their baseline times, while distribution costs and process variability have also been reduced.

EXTENDING THE IMPROVEMENTS NATIONWIDE

Scheduled truck deliveries have been implemented in many places besides Fort Bragg. The straight lines on the map in Figure 5.5 show all current scheduled truck routes. The dark semicircles at 550 miles from

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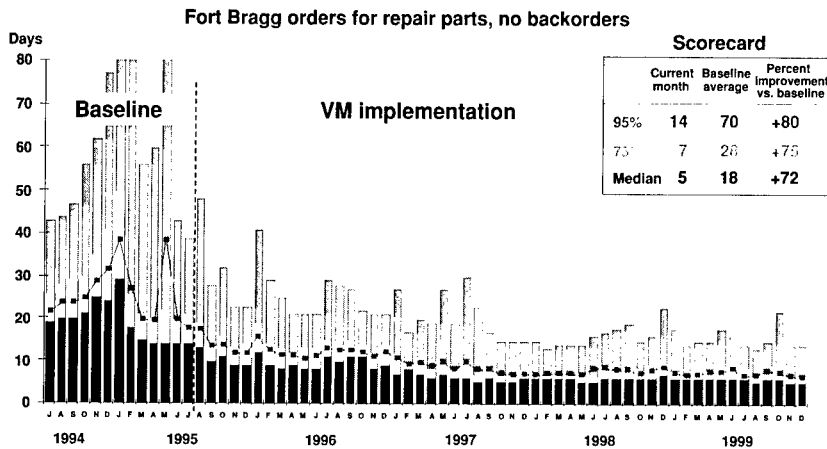


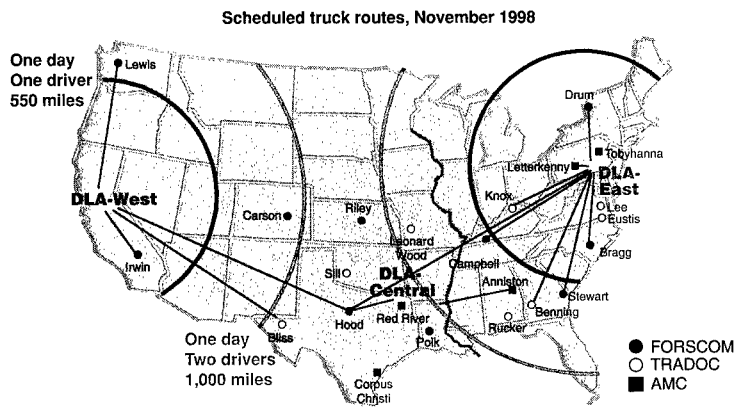
Figure 5.4 Participating Installations Quickly Achieved and Sustained Dramatic Improvements

the coastal DLA supply depots show the approximate distance a truck can drive in one day with one driver. This distance extends to 1,000 miles when two drivers are used. Essentially, all U.S. installations can be reached by one- or two-day truck deliveries.

The east and west coast DLA supply depots divide responsibility for the United States by the Mississippi River. Installations west of the river are the primary responsibility of DLA-West, and installations east of the river are sourced from DLA-East. The DLA-Central facility plays an important role for items managed by Army Materiel Command (AMC).

As Figure 5.6 shows, the increased use of scheduled truck deliveries has contributed directly to reduced OST nationwide. The percentage of requisitions shipped by scheduled trucks is shown on the lower red portion of the bars. This percentage has dramatically increased since the implementation of VM. The requisitions shipped by all other modes are shown on the upper black portions, along with the means of OST, which remain generally a week slower than scheduled truck deliveries.

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NOTE: Distances are as the crow flies. Actual driving distances will be somewhat more.

Figure 5.5 All Installations Nationwide Can Be Reached by One- or Two-Day Truck Deliveries

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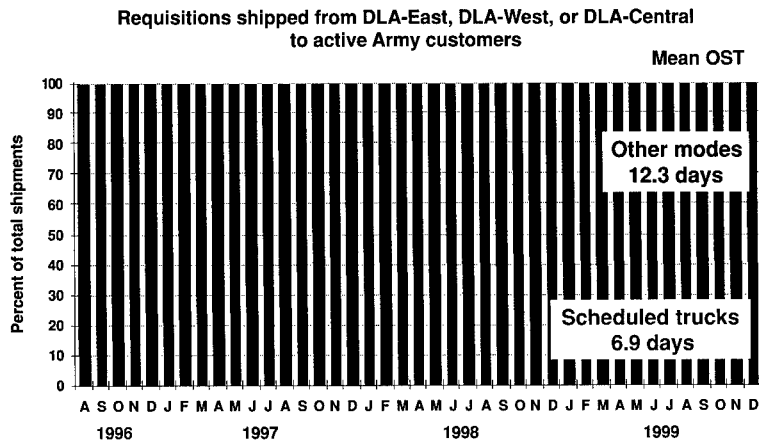


Figure 5.6 Increasing Scheduled Truck Deliveries Has Contributed to Reduced Order and Ship Times

The positive effects of VM have been felt at all active Army installations nationwide, and measurable benefits have been achieved in overall active Army performance. The green line in Figure 5.7 shows again the time distribution for requisitions during the VM baseline period. The blue line is the distribution for current requisitions in November 1999. The mean and all percentile times have been cut in half or more. In particular, the long and variable tail so prominent during the baseline period, and the root of many supply problems, has been nearly eliminated.

As a result, every installation within the Army's Forces Command (FORSCOM)—a group which has embraced and adopted VM initiatives—has made remarkable progress in reducing OST (Figure 5.8). For each installation, the left bar shows the lengthy and variable performance during the VM baseline period. The right bar shows the streamlined times in December 1999.

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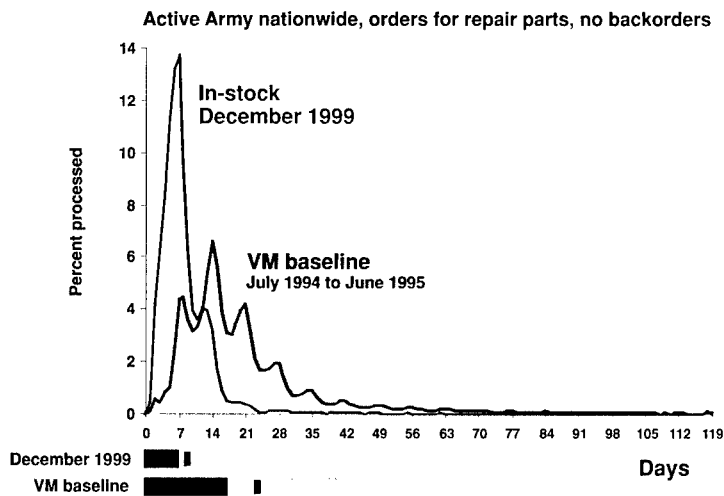


Figure 5.7 The Current Order and Ship Process Is Much Faster and More Predictable

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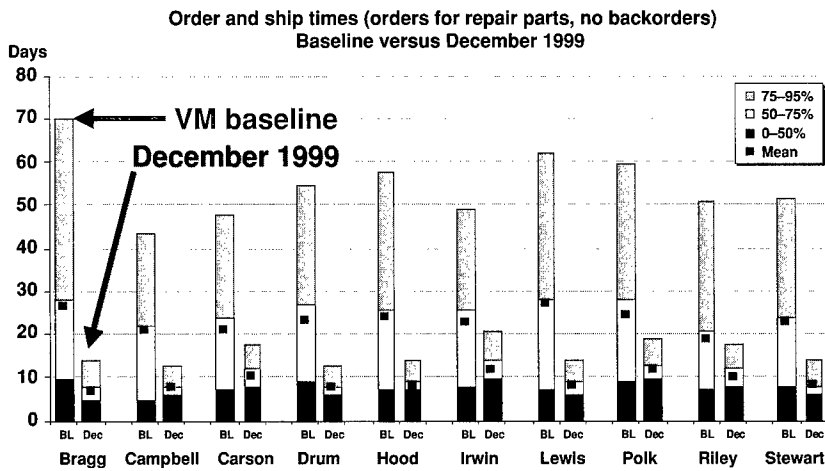


Figure 5.8 Major FORSCOM Installations Have Made Substantial Progress

Every month, different Army FORSCOM installations take the honor of achieving the best-performing OST. The friendly competition between posts to reduce times has greatly aided in sustaining supply process improvement nationwide.

EXTENDING THE IMPROVEMENTS WORLDWIDE

The Army has five major overseas commands (MACOMs), which in addition to the U.S. Army Pacific, Europe, and Korea include U.S. Army Central and South.¹⁶ Similar to U.S. installations nationwide, all overseas commands have made significant progress in reducing OST since the VM baseline period (Figure 5.9). U.S. Army Pacific has made the greatest improvement, from having the slowest and most variable performance during the baseline, to the second fastest and least variable OST in December 1999.¹⁷

¹⁶U.S. Army Central includes Kuwait and Saudi Arabia. U.S. Army South includes Panama and Honduras.

¹⁷Median OST for U.S. Army South had been under 20 days for much of 1999. Current performance may reflect transitional difficulties as it moves headquarters locations from Panama to Puerto Rico.

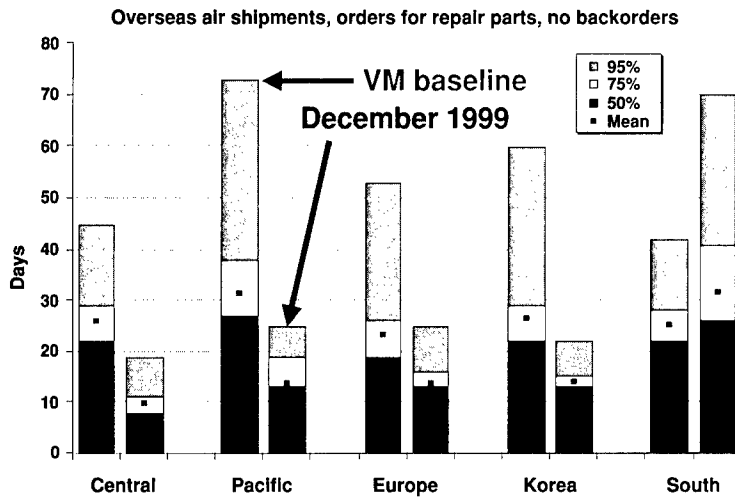


Figure 5.9 Most Overseas Major Commands Have Made Significant Progress

Many of the process improvements that benefited Army troops stateside have also paid dividends for overseas troops. For instance, streamlined processing by national supply managers and at the depots directly benefits troops everywhere. And as soldiers have rotated from VM installations in the United States through overseas tours of duty, they have carried with them the VM mindset and methodology for improving performance. For instance, as “loggies” leave Fort Campbell to spend a year in Europe or Korea, these overseas MACOMs typically experience immediate reductions in request-and-receipt delays through more disciplined processing.

Improving OST for overseas shipments is a challenge because the overseas order and ship process has many additional materiel movement segments (Figure 5.10). After the supply depot, the overseas process moves packages to a DLA facility, which builds air freight pallets or surface containers and then moves them through airports or sea-ports respectively. The coordination and efficiency of these additional

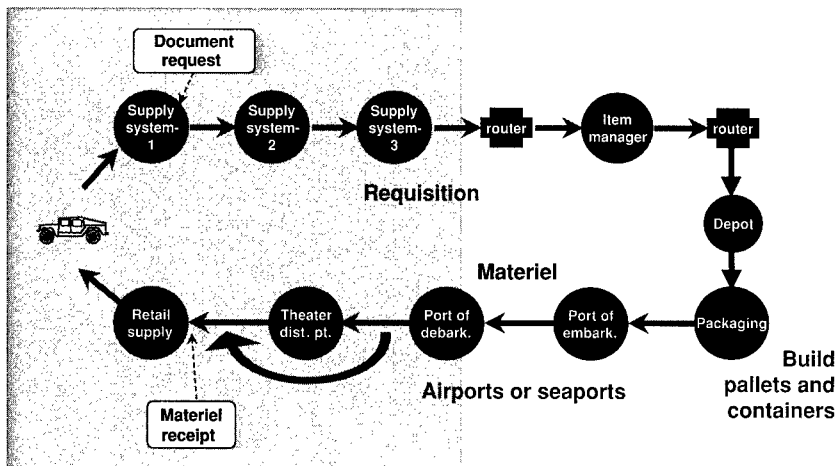


Figure 5.10 The Overseas Order and Ship Process Adds Many Additional Materiel Movement Segments

processing segments determines the OST responsiveness of each overseas command.

The coastal supply depots that support the eastern and western halves of the country also facilitate the overseas distribution strategy (Figure 5.11). DLA-East has primary responsibility for shipments to Europe, the Middle East, and Central and South America. On the other coast, DLA-West provides support for commands in Korea and the Pacific.

The same depot processes that fill scheduled truck deliveries also build pallets and containers. As a deployment platform, this distribution system is designed to rapidly reroute packages to deployed destinations. To be effective, however, the supply depots must be stocked appropriately to support deployed activities. Thus stockage improvements become a priority for both DLA and AMC managers.

Extending the scheduled truck mentality overseas has proved valuable for establishing customer-oriented metrics and simple rules to

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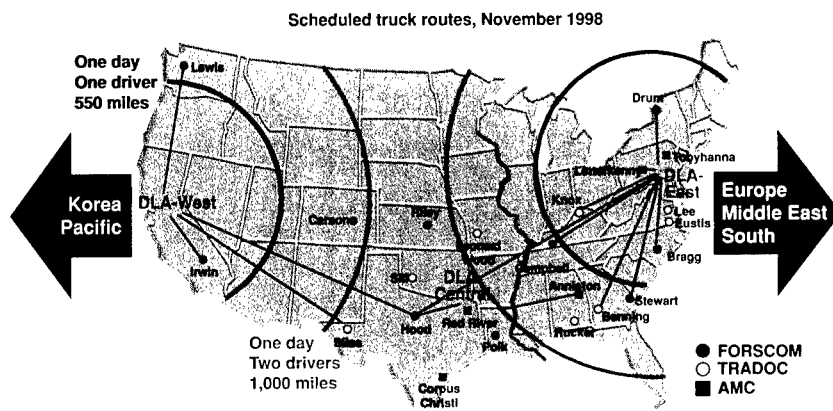


Figure 5.11 National Area-Oriented Depots Also Facilitate the Overseas Distribution Strategy

align process improvement efforts. The performance goal remains the same—to build reliable air and surface channels that can move supplies overseas with velocity and accuracy.

Chapter 6

Steps for Further Acceleration

The VM paradigm for improving order and ship times while reducing costs is a continuous effort of process improvement. Next steps include:

- *Improve wholesale stock positioning to reduce shipments from non-primary depots*
 - *Improve sealift times and leverage the cost differential with overseas airlift*
 - *Extend VM to the National Guard and U.S. Army Reserves*
 - *Integrate efforts to improve other Army logistics processes*
-

Velocity management is not a destination. It is a mode of travel. Consequently, the effort to improve Army logistics is certainly not complete, and order and ship time performance can be further reduced. Several steps for further acceleration are highlighted above, although this is not an exhaustive list of process improvements.

IMPROVING WHOLESALE STOCK POSITIONING

Improving wholesale stock positioning remains a high-leverage action for worldwide reduction in order and ship times. Currently, DLA-West is able to fill only 54 percent of Korea's requisitions (Figure 6.1). An additional 21 percent must come from DLA-East, and the geographic implications are clear. All requisitions filled from the east coast delay OST because they are shipped cross-country to be consolidated with other packages going to Korea. The delay may only be a

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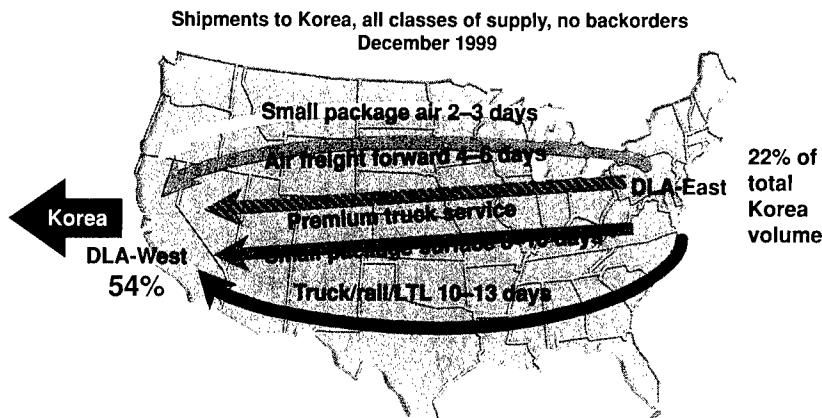


Figure 6.1 A Significant Number of Korea Requisitions Are Sourced from DLA-East

few days if packages are shipped cross-country by a premium small package air service. The delays increase when a deferred air freight, small package surface, or truck service is used.

The speed at which those requisitions sourced from DLA-East move cross-country is shown on the lower curve in Figure 6.2. Recall that this transit time only applies to one-fifth of Korea requisitions. Given the similarity of the lower curve with Korea's mean OST shown in the figure, we can conclude that this small fraction strongly influences overall performance.

Korea is not alone in receiving only half of its requisitions from DLA-West; all primary customers of DLA-West must receive half their requisitions for DLA-managed items elsewhere (Figure 6.3). In addition to Army troops based in Korea and the Pacific, this affects installations in the western half of the United States, including Fort Lewis, Fort Irwin, Fort Carson, Fort Hood, and Fort Riley. Due to a lack of stockage breadth at DLA-West, items not on hand must be sourced from other supply depots.

Installations on the eastern half of the United States and troops in the Middle East, in Central and South America, and in Europe face a

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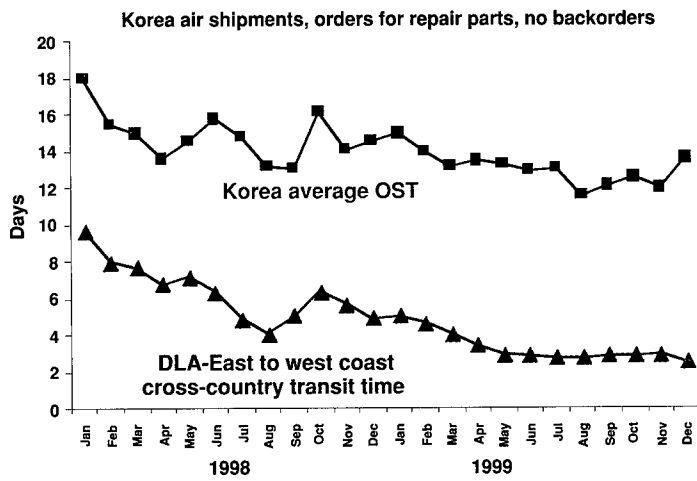


Figure 6.2 Korea Order and Ship Times Are Strongly Influenced by Cross-Country Transit Times

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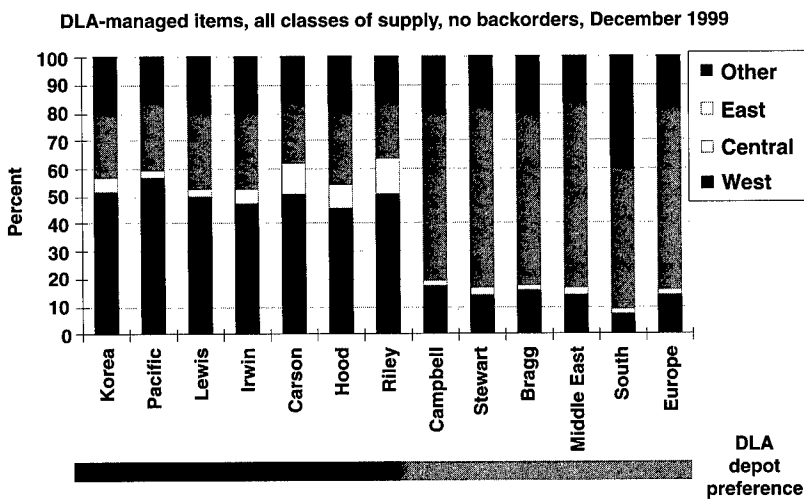


Figure 6.3 DLA-West Customers Receive Half Their Requisitions Elsewhere

different situation. As primary customers of DLA-East, they benefit from greater stockage breadth at their primary depot. Each installation and MACOM receives 70 percent of its requisitions from DLA-East. This additional volume aids greater efficiency and cost-effectiveness with scheduled truck deliveries in the states. Having stocks already at DLA-East means fewer delays for overseas deliveries, since DLA-East is located near the east coast facility, which is specially designed to consolidate air pallets and surface containers for minimizing overseas sorting and handling by deployed troops.

The situation for AMC-managed items is even more fragmented (Figure 6.4). AMC uses a three-depot strategy, with installations such as Fort Hood and Fort Riley in the middle of the country sourced from the Defense Distribution Depot at Red River, Texas (DLA-Central). Unfortunately, all overseas major commands and installations in the states must receive parts from at least four different depots.

One major reason for having different stocks at different locations is AMC's policy for depot-level reparable (DLRs). When repaired,

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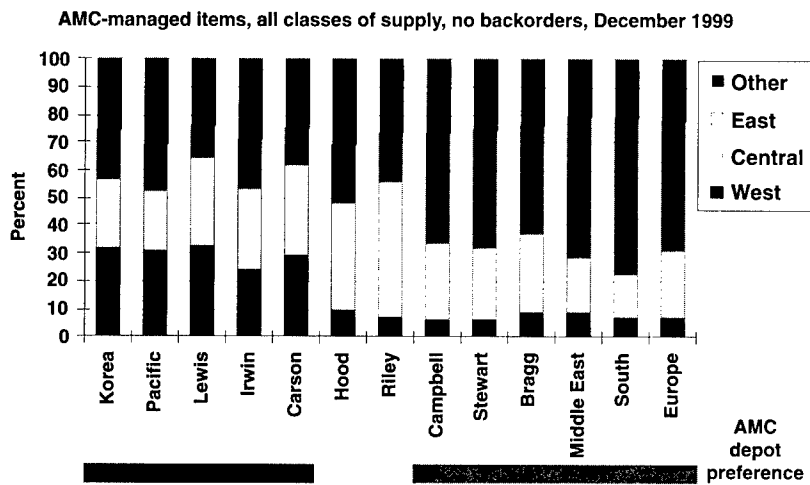


Figure 6.4 Army Materiel Command's Three Area-Oriented Depot Strategy Further Fragments Sources of Supply

these items are not moved back to the primary West, Central, or East depots. The repaired parts remain at each facility to save on immediate shipping costs at the expense of future distribution dollars. This trade-off works against high-volume and high-performing distribution systems such as scheduled trucks, which work best for point-to-point deliveries.

IMPROVING AIRLIFT-SEALIFT BALANCE IN SUPPORTING DEPLOYED ARMY CUSTOMERS

To share the motivations of current research, RAND Arroyo Center and several DoD agencies are working to develop a bold strategic distribution vision for the roles that airlift and sealift will play in supporting deployed Army customers. It involves several elements, which together are designed to lead to faster supply processes and less-expensive transportation costs, another win-win process improvement.

Figure 6.5 shows the weight distribution of U.S. Army Europe shipments: A small number of unique items account for a large fraction of Europe's airlift weight. Clearly this weight distribution is heavily skewed, with most of the weight coming from the tail of the distribution.

This result raises an interesting question: *Can a few specific items be removed from the airlift channel and redirected to the less-expensive sealift channel to dramatically save transportation costs?*

With sealift costs between five to ten times cheaper per pound than airlift costs, millions of transportation dollars can be saved by flying fewer air pallets and fewer planes. Of course, since the less-expensive sealift channel is also slower, whatever items are redirected off the airlift channels must be prepositioned so customers don't receive degraded service. Ideally, candidate items would not only be heavy, they would be cheap and regularly ordered to minimize expensive overseas stockpiles.

If the mix of airlift and sealift can be changed to save millions of transportation dollars, these savings might then be used to improve distribution from stateside depots. Establishing time-definite delivery

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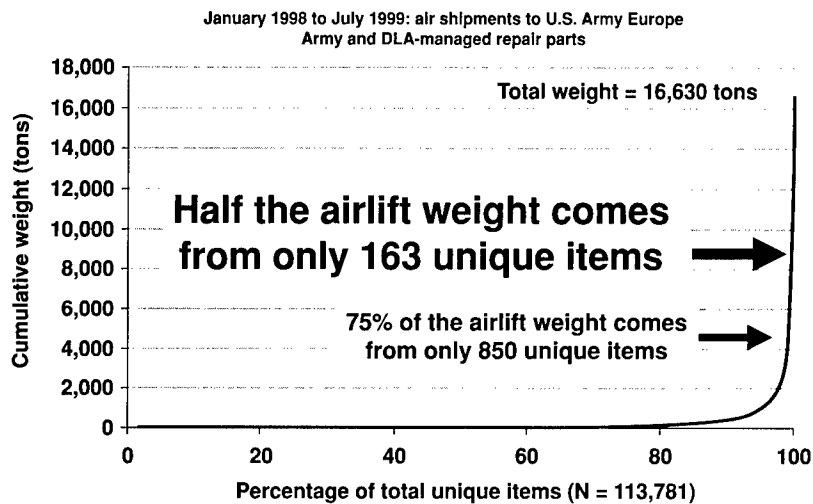


Figure 6.5 Airlift Expense Is Driven by a Very Small Percentage of the Total Items Ordered by the U.S. Army in Europe

schedules had been thought unaffordable, given the risk of underutilizing airlift cargo capacity. However, having first saved millions, OST can be reduced on all overseas shipments, whether forward positioned or not.

EXTENDING VM TO THE NATIONAL GUARD AND U.S. ARMY RESERVES

Overall Army supply performance is sometimes portrayed as not being high-performing or world-class. Figure 6.6 shows this statement to be misleading. Closer examination of the different components that make up the total Army clearly shows that supply processes for active forces at FORSCOM, TRADOC, and AMC installations have benefited enormously from VM. Early during the implementation, VM focused on active Army installations, since they generate two-thirds of the requisition volume and play critical roles in military readiness and deployment.

RAND MR1140-6.6

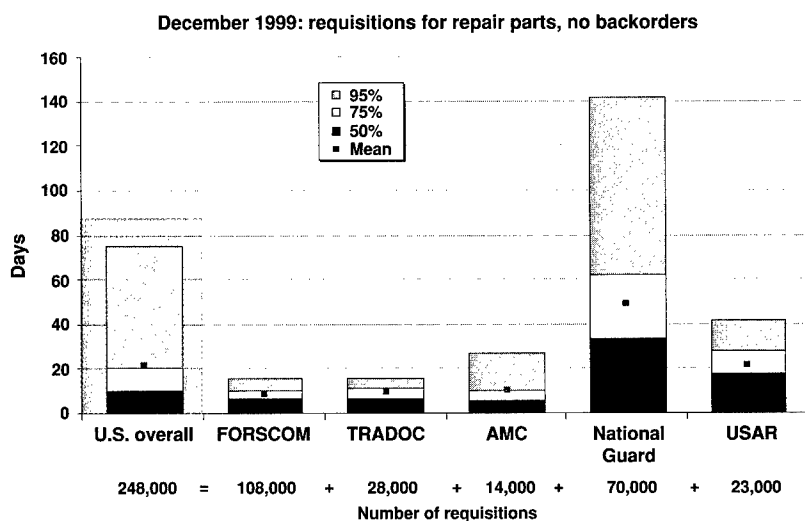


Figure 6.6 For the Overall Nationwide OST to Drop Further, Reserve Components Need to Improve

The Army’s reserve components, the National Guard and U.S. Army Reserves, have lagged behind in reducing OST times. Delays due to financial reviews and infrequently batched receipt processing are the main causes of these problems. Some of these issues are tied to the different methods that states use to allocate funding. In the worst cases, all requisitions must wait for infrequent budget allocations before receiving approval for purchase. Until the performance of the Army’s reserve components improves significantly, aggregated measures of Army OST performance are likely to remain misleadingly poor.

Even though their absolute performance is still poor, it is encouraging that OST for the reserve components have improved dramatically in the last six months (Figure 6.7). Significant reductions in request and receipt processing have led to these improved performances. Applications of the DMI methodology have revealed that the reserve components face challenges very different from those confronting their active counterpart units, e.g., states fund and equip their units differently.

RAND MR1140-6.7

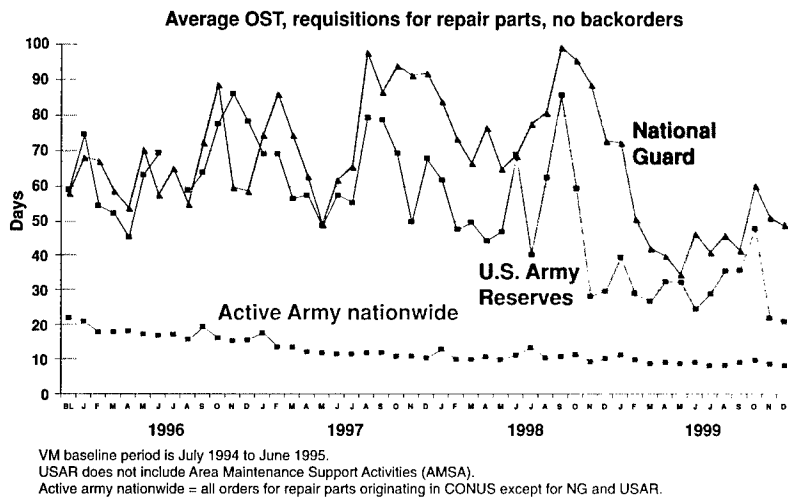


Figure 6.7 National Guard and U.S. Army Reserves Order and Ship Times Have Improved Dramatically in the Last Year

Given the history of variable performances, substantial VM work remains to institutionalize a culture of continuous improvement across the reserve components.

INTEGRATING EFFORTS TO IMPROVE OTHER ARMY LOGISTICS PROCESSES

Efforts to improve OST must be integrated with efforts to improve other logistics processes, since they are all interdependent. For instance, the order and ship process helps not only weapon system repairs, but also repair of subassemblies such as transmissions and engines (i.e., reparables). Once repaired, these subassemblies are then made available for issue, improving stockage postures. As noted earlier, proper stockage postures and positioning are crucial to an effective and efficient order and ship process. By integrating efforts across processes, each individual effort acquires more relevance, and greater overall benefits can be gained.

Velocity Management has recognized and addressed this interrelated, interdependent aspect of Army logistics (Figure 6.8). Indeed, the order and ship process is only one of several critical logistics processes on which VM has focused.

RAND MR1140—6.8

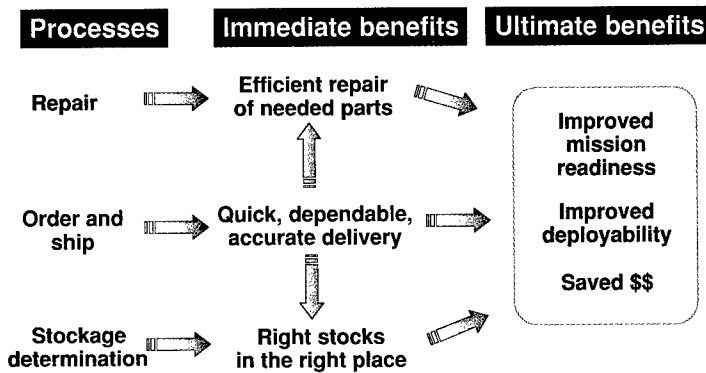


Figure 6.8 Velocity Management Has Focused on These Critical Logistics Processes

This report has discussed the dramatic improvements in OST that have led to quick, dependable, and accurate delivery of repair parts globally. Reduced OST has led to immediate benefits in repair processes, since less time is spent waiting for parts. Besides greater availability of reparables, it also benefits the Army's stockage determination processes, since more responsive replenishment reduces the need for massive stockpiles held "just in case." Ultimately, better repair processes, faster supply processes, and more appropriate inventory management lead to improved mission readiness, improved deployability, and a more cost-efficient military.

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Mark Wang (Sc.D., Physics, Massachusetts Institute of Technology) is a RAND physical scientist working in the Military Logistics Program of the Arroyo Center, a federally funded research and development center sponsored by the United States Army. Since joining RAND in 1994, Dr. Wang has advised government leaders on supply process improvements that reduce bureaucracy and costs while enhancing customer service and operational responsiveness. This work has included conducting field research in Operation Joint Endeavor base camps in Bosnia-Herzegovina and presenting results at the Pentagon and West Point Academy. This report presents results from the project he leads on improving the Army's order and ship process. Dr. Wang's research interests also include identifying opportunities for leveraging strategic sourcing and commercial information, and communications technologies to support logistics processes.