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Sourcing and Global Distribution of Medical Supplies

Adam C. Resnick, William Welser IV, Keenan D. Yoho

RAND Arroyo Center

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Preface

Concerned with rising Department of Defense (DoD) costs, the Office of the Secretary of Defense (OSD) directed the military medical logistics community to explore opportunities to gain efficiency without sacrificing capability. Since RAND had researched military medical logistics efficiencies in a prior study,¹ the military services and Defense Logistics Agency (DLA) asked RAND to identify efficiencies in the global military medical logistics enterprise. We designed a study that would investigate such logistics efficiencies in purchasing power and information technology; based on our prior research, we included warehousing and distribution in the study as opportunities for efficiency. Because DoD has adopted the commercial Prime Vendor (PV) model for sourcing and distributing medical materiel to medical treatment facilities (MTFs) inside the United States in a system that is understood to be quite efficient, we focused on supply of medical materiel to military organizations outside the continental United States (OCONUS). The military maintains a significant role in supplying such materiel to these organizations and at significant cost.

We aligned the analysis with the most active OCONUS geographic combatant commands (COCOMs): U.S. Europe Command (USEUCOM), U.S. Pacific Command (USPACOM), and U.S. Central Command (USCENTCOM). We nominally addressed U.S. Africa Command (USAFRICOM), and U.S. Southern Command (USSOUTHCOM).

This research was sponsored by the U.S. Army Medical Research and Materiel Command and DLA Headquarters J35, and conducted within the RAND Arroyo Center's Military Logistics Program. RAND Arroyo Center, part of the RAND Corporation, is a federally funded research and development center (FFRDC) sponsored by the United States Army. The Project Unique Identification Code (PUIC) for the project that produced this document is ASPMO09461.

¹ William Welser, IV, Keenan D. Yoho, Marc Robbins, Eric Peltz, Ben D. Van Roo, Adam C. Resnick, and Ronald E. Harper, *Assessment of the USCENTCOM Medical Distribution Structure*, Santa Monica, Calif.: RAND Corporation, MG-929-A, 2010.

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Summary

Introduction

The Department of Defense (DoD) provides medical care to its service members whether they are at their home station or deployed, at locations all over the world. To provide this patient care, DoD must ensure that its health care providers have the proper quantity and quality of medical materiel resources. To accomplish the mission of providing medical care to service members outside the continental United States (OCONUS), DoD procures medical materiel in the United States and ships it to OCONUS treatment facilities and operational units.

Procuring and distributing medical materiel carries a large annual cost: DoD spends approximately \$4 billion on these activities to support care facilities within the United States, and an additional \$750 million to procure and distribute medical materiel for OCONUS.² When the Office of the Secretary of Defense (OSD) directed all military organizations to find efficiencies,³ the Undersecretary of Defense for Acquisition, Technology and Logistics (USD AT&L) directed all military organizations in its reporting structure to initiate studies and analyses to identify potential efficiency opportunities.

In response to the direction from USD AT&L, the Army Medical Research and Materiel Command and Headquarters Operations of the DLA sponsored a project at RAND to investigate opportunities to gain efficiencies in the global military medical logistics enterprise without sacrificing capability. To perform this project, the RAND team surveyed current military medical logistics practices in regions around the world.

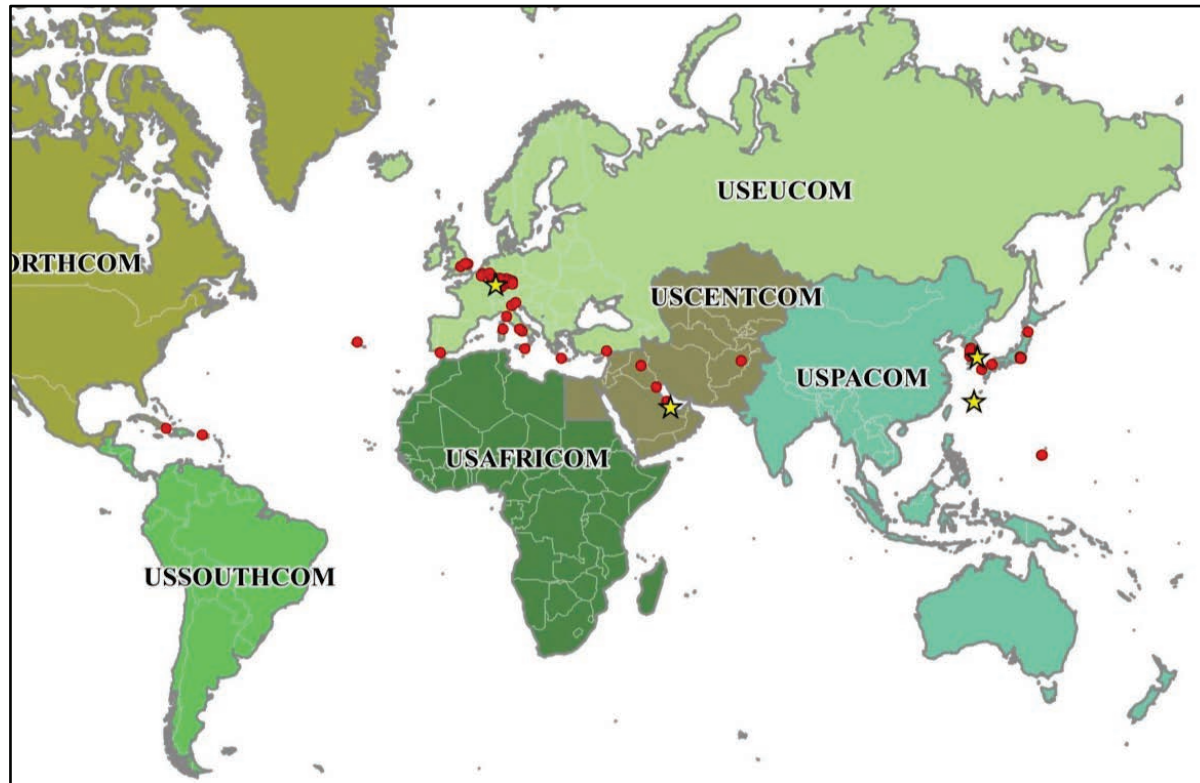
Figure S.1 shows the geographic combatant commands (COCOMs) with their respective boundaries. Red dots in this figure represent OCONUS MTFs and the yellow star icons indicate locations of the OCONUS theater lead agents for medical materiel (TLAMMs).

² Defense Logistics Agency (DLA) Troop Support interview, 2011.

³ DoD, *Defense Efficiencies Initiative* web page, undated.

S.1

Map of Geographic COCOMs, OCONUS MTFs, and TLAMMs



NOTE: USAFRICOM = U.S. Africa Command
USCENTCOM = U.S. Central Command
USEUCOM = U.S. Europe Command
USNORTHCOM = U.S. Northern Command
USPACOM = U.S. Pacific Command
USSOUTHCOM = U.S. Southern Command

Table S.1 profiles the OCONUS lead agents for medical materiel in each of the geographic COCOMs. Air Force Medical Operations Agency (AFMOA) is the lead agent for USSOUTHCOM, and is located in San Antonio, Texas.

Table S.1
Comparison of Theater Medical Logistics Agents

	COCOM	Service	Lines of Stock Held	Inventory Value	U.S. Military Manpower^a	Other Manpower^b
USAMMCE (Germany)	USEUCOM USCENTCOM USAFRICOM	USA	11,000+	\$33.5M	80	319
USAMMC-SWA (Qatar)	USCENTCOM	USA	2,600+	\$13.2M	73	39
USAMMC-K (S. Korea)	USPACOM (USFK)	USA	2,200+	\$2.5M	15	54
TLAMM-P (Japan)	USPACOM	USAF	—	—	4	—

^a U.S. military manpower is active duty and civilian

^b Other manpower is contract and other nation

SOURCE: Command briefings from U.S. Army Medical Materiel Center–Europe (USAMMCE), U.S. Army Medical Materiel Center–Korea (USAMMC-K), U.S. Army Medical Materiel Center–Southwest Asia (USAMMC-SWA) and Theater Lead Agent for Medical Materiel–Pacific (TLAMM-P).

Many military commodities other than medical ones are managed by a DLA global enterprise. The medical commodity has remained a shared logistics enterprise between DLA and the services. We interviewed senior leaders in DLA and in the service medical logistics commands as to why medical logistics continues to be service-led; Table S.2 offers a summary of the reasons mentioned.

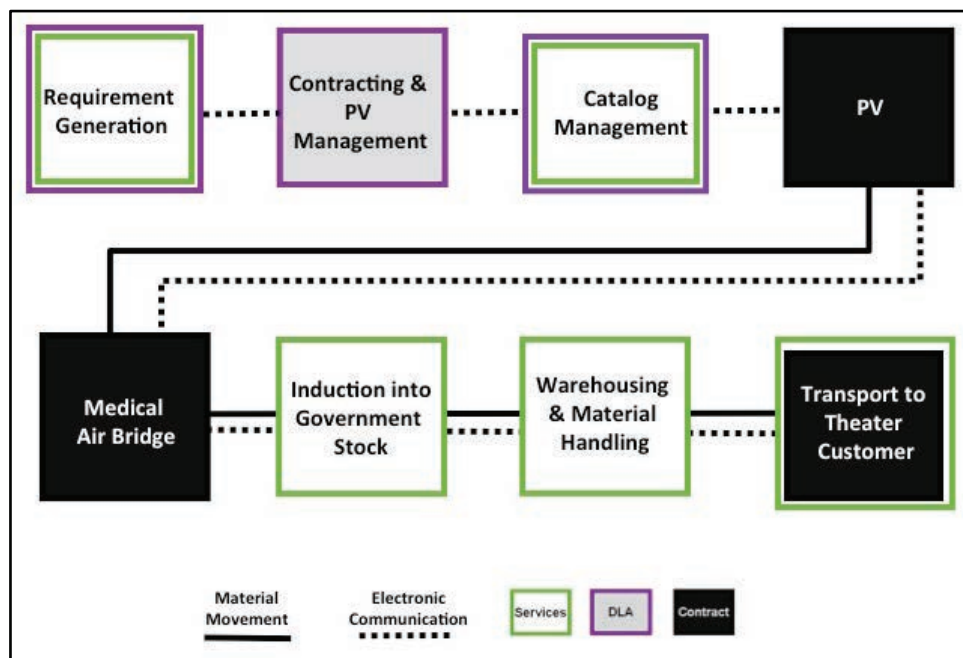
To capture all aspects involved with this service-led mission, we mapped a representative value chain for military medical logistics, and noted organizations responsible for each of the activities (see Figure S.2). The broad areas of the structure include:

- contracting/catalog management
- transportation to first delivery location
- intermediate warehousing
- transportation to final end-user.

Table S.2
Characteristics of Medical Logistics Enterprise

Characteristics	Requirements/Effects
Mission objective is medical care, tolerance for adverse outcomes due to supply is very low	Stockouts at end user are not tolerated for usage items, non-usage items should be expedited
Items are generally commercial	Military may be able to procure quickly, not need to maintain significant inventory
Reparables are updated every one to three years, consumables are updated even more quickly Pace of turnover in consumables catalog	It is burdensome but feasible to develop materiel for reparables and sets (NSNs); it is infeasible with current manpower to develop materiel for consumables.
Require specialty facilities: environmentally controlled, controlled access, etc.	Diverse materiel handling needs: narcotics, vault, perishable, HazMat, pilferable, reparables
Seasonality, mass casualty events, troop surges	variability in demand with high levels of uncertainty
Guidelines placed upon the commodity by federal agencies	Agencies include Food and Drug Administration, OSHA Expertise required to be responsive to recalls, shelf life extension, local procurement

Figure S.2
Military Medical Logistics Value Stream



NOTE: PV = Prime Vendor

Contracting/Catalog Management

In fiscal 2010, DoD spent approximately \$4.7 billion to procure medical materiel. More than 80 percent of this materiel was procured through acquisition programs (PV and Electronic Catalog [ECAT]) managed by DLA using federal pricing agreements. It is generally the case with medical materiel that DoD

- does not make the market for consumption
- generally procures medical materiel that is in wide use by the civilian community
- procures a small portion of the total quantity of items manufactured for U.S. consumption, relative to civilian health care organizations.

The entire U.S. consumption of pharmaceuticals and medical retail items is \$340 billion.⁴ DoD expenditures on medical materiel (composed largely of items that fall under these categories) represent only 1 percent of the total. As a result, we focused our analysis on opportunities for efficiency, other than leveraging DoD's purchasing power to achieve a reduction in materiel.

Each MTF maintains staff to do local procurement. We observe that it may be possible to consolidate the capability to do local procurement among MTFs that are geographically close, thus reducing a need for local presence to meet with local suppliers while gaining efficiency through economies of scale in collocating the balance of procurement staff. MTFs could also achieve efficiency through procurement best practices if it is possible to retain the best experts at local procurement and place more procurement staff in the same location.

In order to make items available for end users to procure from the DLA-managed medical materiel contracts, DoD staff at each MTF and medical material agent add data associated with item stock numbers. This way, the handling characteristics of the items are known when organizations receive the materiel and induct it into inventory. DoD staff also must make sure that the items' purchase prices have been vetted against federally negotiated lowest prices. During this process, DoD has the ability to decide whether to make such items easily available for end users to order. DoD can take advantage this necessary activity by standardizing the process and using it as an opportunity to vet whether newly requested items are truly necessary or whether items already approved for purchase may substitute.

If DoD were to restrict materiel used by deployed units to clinically necessary items and reduce the variety of substitutable items, it could achieve efficiencies in its medical materiel supply chain. The efficiencies would be achieved mostly in warehousing, and somewhat in shipping materiel in the second leg and receiving materiel at the location of the end user.

⁴ Kaiseredu.org, U.S. Health Care Costs, Background Brief, web page, undated.

Transportation to First Delivery Location

For PV-sourced materiel, transportation from the supplier to the first delivery location in the United States is provided by each PV within the distribution fee established by the PV contract. In the United States, all MTFs and some operational units are designated as routine ordering facilities (ROFs), and can place orders to PV and ECAT suppliers that will be delivered within negotiated delivery times, generally one to two days, depending on customer location. The majority of operational units that are not ROFs typically set up accounts with MTFs at their installations, order materiel to be delivered to those MTFs, and pick it up locally.

Outside the United States, most MTFs and all medical materiel agents are designated as ROFs. Most land-based operational units are not, however, and must set up accounts with ROFs through which to receive PV materiel.

The PV contracts for medical materiel mandate that materiel must be delivered in seven days from the time of order. But there are extensive clauses in place that restrict the circumstances under which PVs are held to the seven-day delivery standard. Ordering facilities must provide PVs with predicted item orders one month in advance. Even if they order fewer items, ordering facilities may be charged for the entire predicted amount, and PVs are not required to meet delivery performance standards for quantities of items ordered in excess of 110 percent of the predicted amount. Further, when an ordering facility requests an item that it has not previously ordered, the PV has 90 days to begin filling item orders. Table S.3 describes the effective PV delivery standards.

Shipping from PVs to first destination is done via contracts negotiated by the U.S. Transportation Command (USTRANSCOM). The Category A (Cat A) transportation contract is generally used to ship medical materiel. Under this contract, commercial carriers pick up materiel at PV locations in the continental United States (CONUS) on the East and West Coasts and transport it by air to OCONUS locations. Medical materiel is also shipped via the World Wide Express (WWX), but that method is used less often than Cat A because WWX only accepts packages under 150 pounds and does not permit hazardous materials or other items with special handling characteristics. Because the shipping rate in the Cat A contracts is comparable to or lower than other DoD rates for commercial shipping, we conclude that there is no efficiency to be gained in the activity of shipping items via air to locations in USPACOM and USEUCOM.

For end users and intermediate distribution points, inconsistency in item delivery time from the PV to the first delivery location makes it difficult to order materiel as needed. Moreover, greater amounts of materiel must be held in inventory to buffer against delivery time variance. By contracting for more consistent or flexible delivery of medical materiel, the medical logistics enterprise could gain efficiencies by reducing inventories while maintaining materiel availability.

Table S.3
Exceptions to the Seven Day Delivery Standard

Circumstance	Delivery Schedule
Customer orders items in quantities larger than projected	37 days
Customer orders items infrequently (no order for a part or item in 90 days)	90 days*

SOURCE: Defense Supply Center Philadelphia, Medical Surgical Prime Vendor GEN IV SOLICITATION, SPM2DS-09-R-001, August 3, 2009.

NOTE: PVs are allowed 90 days to re-establish support for the items, after which PVs are held to the seven- or 37-day delivery standard.

If DoD could pool usage projections across all its end users, this may allow for monthly variation in orders from individual units, while maintaining a fairly smooth aggregate rate of demand as a basis for projected order quantities, which would compel the PV to deliver materiel with the quicker performance standard.

Warehousing

DoD stores medical materiel locally at unit locations, and centrally at DoD warehouses. In the United States, supply from PVs can reach purchasers in one or two days, so units that order directly from these suppliers do not need to maintain very large inventories. Outside the United States, where supply lead times are longer, units must maintain larger inventories to meet demands over these time periods. In addition to storing materiel at the end-user locations, DoD maintains inventories intermediate warehouses in order to provide faster deliveries to end users than can be had from the original suppliers directly.

The first notable opportunity for efficiency is transporting materiel directly to end users when possible and eliminating “double-touching” at intermediate warehouses. When materiel flows to end users through DoD intermediate warehouses, DoD personnel and other nations must receive the materiel, place it in inventory, pick the materiel, and issue it to the end user. DoD will save costs by eliminating these intermediate activities.

Based on an analysis of manpower assigned to functional divisions, we estimated that 55 percent of the costs associated with operating USAMMCE result from the mission to receive, warehouse, and issue materiel, with the balance of USAMMCE costs associated with its other missions, such as optical fabrication and equipment maintenance. Because 40 percent of USAMMCE issues are to MTFs in Europe, we estimate that if USAMMCE decreased its distribution mission by an amount equal to

$$(0.55) \times (0.40) \times (\text{cost to operate USAMMCE})$$

the savings would be about \$4 million annually. Applying the same logic to USAMMC-K, we estimate DoD could save approximately \$2 million annually. Partially due to the high shipping costs incurred delivering medical materiel to USCENCOM, we also recommend closing

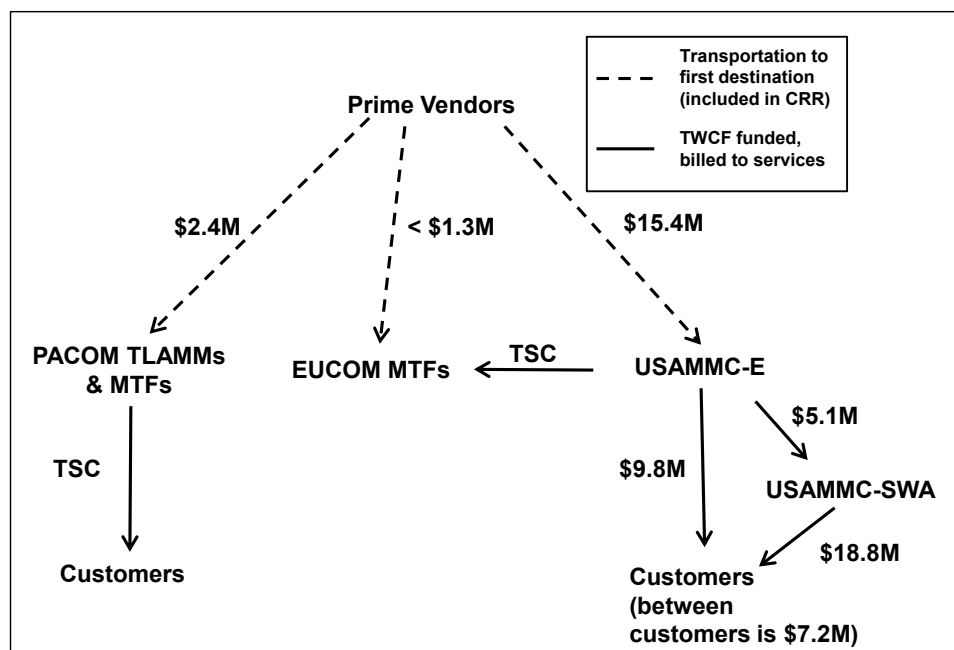
USAMMC-SWA as a distribution point. The cost of decreasing USAMMC-SWA operations alone may save DoD \$6 million to \$11 million annually, in addition to the savings in transportation costs that we will address in next, in the discussion of transportation from intermediate warehouses to end users.

Transportation to Final End User

Most CONUS consumers of medical materiel are ROFs in the PV contracts, who receive their materiel directly from the PV. Some operational units—such as infantry or combat units at Army installations—place orders with installation MTFs, which then place the orders on behalf of the operational units along with the rest of their medical materiel orders. Operational units who place orders with local MTFs can use unit or installation vehicles to pick up the materiel when it arrives at the MTF.

In USEUCOM, end users receive medical materiel through a number of means, including from PVs directly and through USAMMCE. Figure S.3 shows an overview of transportation costs.

Figure S.3
Medical Materiel Transportation Networks with Semiannual Costs



NOTE: Costs are semiannual, reflecting the data we received.

CRR = Cost Recovery Rate

TWCF = Transportation Working Capital Fund

USCENTCOM is far and away the most complicated theater for final delivery of medical materiel. All medical materiel that originates at a PV and is consumed in USCENTCOM passes through USAMMCE. After USAMMCE, this materiel may spend time in inventory at USAMMC-SWA, and then may be stored at a forward-positioned medical logistics company before it is delivered to the final end user. Medical materiel that is transported into or between USCENTCOM locations moves by military lift or commercial lift. Commercial lift operates at a level of service and price negotiated through the USTRANSCOM Class VIII tender. Once far forward, medical logistics teams may rely either on local logistics providers to move materiel to end-user locations; or end users may use unit vehicles to pick up medical materiel.

To reinforce how medical materiel is delivered to USCENTCOM units, Figure S.4 shows the weight of materiel that was distributed to USCENTCOM units using the Class VIII tender for commercial freight over the course of our research study. During this time, Class VIII tender for commercial freight constituted well over 90 percent of medical materiel shipments into USCENTCOM.

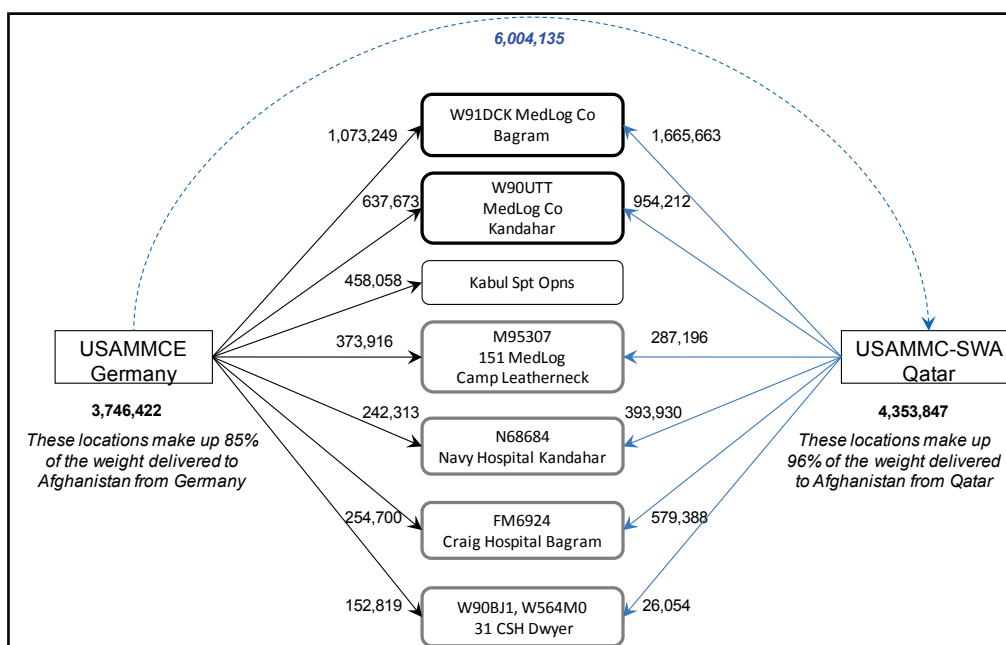
Figure S.4
Class VIII Commercial Tender Shipment Volume (in lbs.) from USAMMCE to USAMMC-SWA to Afghanistan and USAMMCE to Afghanistan (July 2010–December 2011)



SOURCE: Map provided by Google, with author overlay.

With the exception of one in Kabul, the shipments from USAMMCE and USAMMC-SWA went to the same set of receiving locations. As shown in Figure S.5, there is a strong overlap in USCENTCOM receiving locations. The locations to which USAMMC-SWA shipped materiel over this time were well served by USAMMCE—sometimes in even greater volume than from USAMMC-SWA.

Figure S.5
Consignees Receiving Class VIII Materiel from Both USAMMCE and USAMMC-SWA Using the Commercial Tender



NOTE: Weight amounts are in pounds
MedLog Co = Medical Logistics Company
Spt Opns = Support Operations
CSH = Combat Support Hospital

We view the activity to receive, inventory, and issue materiel from USAMMC-SWA plus the additional shipping costs associated with the extra leg of commercial air freight as the largest single opportunity for efficiency in the medical logistics enterprise. Ceasing to use USAMMC-SWA to distribute medical materiel to USCENTCOM would save DoD approximately \$12 million annually by shipping materiel directly to these locations from USAMMCE, using extant Class VIII tender prices. We estimate that by renegotiating the Class VIII tender to approach the price of Air Mobility Command (AMC) tenders for commercial air freight from Europe to USCENTCOM, DoD could save on the order of \$10 million to \$20 million annually.

The mission in USCENTCOM is changing. Even over the course of our study, medical materiel shipments to USCENTCOM in 2011 were significantly different than in 2010. The projected savings to DoD reflect this change. It follows then, that when the mission changes further, opportunities for efficiencies will as well.

Conclusions

This report investigates opportunities for efficiencies in the medical materiel distribution structure. We specifically addressed opportunities in purchasing power, information technology (IT), warehousing, and transportation.

The purchase price of medical materiel represents more than 85 percent of the cost associated with medical materiel distribution. In total, DoD purchases \$4.7 billion of medical materiel annually, \$750 million of which is distributed OCONUS. DLA has incorporated 80 percent of medical materiel procurement into the PV contracts and the ECAT system of procurement, leveraging bulk purchasing power across the federal government. We did not see any obvious opportunity for efficiency in this process, which has already been centralized and standardized.

The main IT systems used by the military services to manage medical materiel procurement (Defense Medical Logistics Standard Support [DMLSS] and Theater Enterprise Wide Logistics System [TEWLS]) perform many of the same functions as each other, and simultaneously overlap and rely upon the enterprise business system (EBS) to pay PVs through the PV contract. DMLSS and TEWLS are also used to manage medical materiel warehouses, performing many of the same functions as Distribution Standard System (DSS). While DMLSS and TEWLS both can track items by commercial stock numbers, DSS can only download item information based on national stock numbers (NSNs). We were unable to do an exhaustive study of IT system costs due to a lack of detailed cost data on IT systems such as DSS and EBS. Where possible, we recommend DoD could find efficiencies by using a single IT system, as each of these systems bears enormous costs to develop and maintain, on the order of hundreds of millions of dollars.

The total annual cost of warehousing and distributing medical materiel to OCONUS locations is \$140 million. Providing materiel to USCENTCOM makes up 77 percent of the total OCONUS costs, and a correspondingly large portion of the identified efficiencies. Providing medical materiel to the balance of OCONUS locations incurs \$33 million in annual warehousing and distribution costs.

Over the past decade, DoD has made great leaps forward in finding efficiencies in medical logistics. The DLA-managed PV contracts have eliminated the need for large stores of medical materiel, especially in CONUS. By negotiating the Cat A contract for medical materiel, DoD has put the same materiel in the hands of providers overseas as it supplies to units in the United States.

The greatest opportunity for efficiency is in USCENTCOM. Utilizing the Class VIII tender for commercial airlift in second-leg transportation is very costly. By seeking lower costs for commercial air freight and supporting units in USCENTCOM directly from USAMMCE, DoD has the opportunity to achieve savings on the order of \$30 million to \$40 million annually.

We observe opportunities for continuing improvement through taking full advantage of the capabilities that the DLA- and USTRANSCOM-negotiated PV and Cat A contracts can deliver. We propose three approaches through which the medical logistics community can achieve further efficiencies:

- maximizing direct delivery to end users
- exercising control over the catalog and deliberately managing the quantity of materiel held overseas to support surges and supply chain interruptions
- managing usage items and the PV statement of work to maximize supplier responsiveness to end-user demand.

We did not observe any DLA warehouses that have the specialized holding areas required for appropriate storage of all classes of medical items. Additionally, the DLA warehouses we visited did not employ staff with professional knowledge of medical items, which may help ensure items are handled correctly and may allow orders to be filled with substituted items.

With no DLA facilities suited to incorporate medical materiel warehousing and distribution into their existing infrastructure, we conclude there would be no efficiency in immediately altering the current management roles of the Class VIII supply chain. If new locations for warehousing and distributing medical materiel are sought, collocating medical materiel management with an MTF, DLA facility, or military service logistics facility should be considered if it presents efficiencies in transportation or infrastructure.

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Abbreviations

Symbol	Definition
AFMOA	Air Force Medical Operations Agency
AMC	Air Mobility Command
APS	Army prepositioned stock
Cat A	Category A
CJCS	chairman of the Joint Chiefs of Staff
COCOMS	combatant commands
CONUS	continental United States
CRF	cost recovery fee
CRR	cost recovery rate
DAAS	Defense Automated Addressing System
DCAM	DMLSS Customer Assistance Module
DLA	Defense Logistics Agency
DLATS	Defense Logistics Agency Transaction Server
DMLSS	Defense Medical Logistics Standard Support
DoD	Department of Defense
DoS	Department of State
DSS	distribution standard system
EBS	enterprise business system
ECAT	electronic catalog
EMA	European Medicines Agency
FDA	Food and Drug Administration
FISC	Fleet and Industrial Supply Center
HAZMAT	hazardous materials
III MEF	III Marine Expeditionary Force
IT	information technology
JLB	Joint Logistics Board
MEDCOM	Medical Command
medlog	medical logistics
MTF	medical treatment facility
NSN	national stock number
OCONUS	outside the continental United States
OSD	Office of the Secretary of Defense
PV	prime vendor

ROF	routine ordering facilities
Spt Opns	support operations
TEWLS	theater enterprise-wide logistics system
TLAMM	theater lead agent for medical materiel
TLAMM-P	theater lead agent for medical materiel–Pacific
TSC	theater support company
TWCF	Transportation Working Capital Fund
USAFRICOM	U.S. Africa Command
USAMMCE	U.S. Army Medical Materiel Center–Europe
USAMMC-K	U.S. Army Medical Materiel Center–Korea
USAMMC-SWA	U.S. Army Medical Materiel Center–Southwest Asia
USAMRMC	U.S. Army Medical Research and Materiel Command
USCENTCOM	U.S. Central Command
USEUCOM	U.S. Europe Command
USNORTHCOM	U.S. Northern Command
USPACOM	U.S. Pacific Command
USSOUTHCOM	U.S. Southern Command
USD AT&L	Undersecretary of Defense for Federal Drug Administration Acquisition, Technology and Logistics
USTRANSCOM	U.S. Transportation Command
WWX	Worldwide Express

1. Introduction

The Department of Defense (DoD) provides medical care to its service members whether they are at their home station or deployed, at locations all over the world. In order to provide this patient care, DoD must ensure that its health care providers have the proper quantity and quality of the required medical materiel resources. In the United States, manufacturers of drugs and medical devices must register with the Secretary of Health and Human Services and receive approval for the items they sell.⁵ Hence, the vast majority of medical materiel used in patient care in the United States is regulated by the Food and Drug Administration (FDA). By Executive Order 13139, and U.S. Code Title 10, the President of the United States and the U.S. Congress stated their expectation that, as part of the federal government, the military will administer only products approved by the FDA.⁶ Outside the United States, other organizations oversee medical item inspection, such as the European Medicines Agency (EMA). There are currently no equivalence arrangements that confer FDA approval upon EMA items, or vice versa. Therefore, in order to provide medical care to service members outside of the continental United States (OCONUS), DoD must procure significant quantities of medical materiel in the United States and ship it to overseas treatment facilities and operational units.

Procuring and distributing medical materiel carries a large annual cost for DoD, which spends approximately \$4 billion for these activities to support care facilities within the United States, and an additional \$750 million to procure and distribute OCONUS medical materiel.⁷ When the Office of the Secretary of Defense (OSD) directed all military organizations to find

⁵ U.S. Code, Title 21—Food and Drugs, Chapter 9—Federal Food, Drug, and Cosmetic Act. Subchapter II, Section 321, Definitions.

⁶ Clinton, William J., U.S. President, “Executive Order 1319—Improving Health Protection of Military Personnel Participating in Particular Military Operations,” *Federal Register*, Vol. 64, No. 192, October 5, 1999. “Sec. 2. Administration of Investigational New Drugs to Members of the Armed Forces . . . (b) It is the expectation that the United States Government will administer products approved for their intended use by the Food and Drug Administration (FDA).” U.S. Code, Title 10—Armed Forces, Subtitle A, Part II, Chapter 55—Medical and Dental Care. Subtitle A - General Military Law:

“PART II - PERSONNEL

CHAPTER 55 - MEDICAL AND DENTAL CARE

§ 1107. Notice of use of an investigational new drug or a drug unapproved for its applied use

(a) Notice Required:

(1) Whenever the Secretary of Defense requests or requires a member of the armed forces to receive an investigational new drug or a drug unapproved for its applied use, the Secretary shall provide the member with notice containing the information specified in subsection (d).”

Note that the requirement to use approved drugs and products in medical care of U.S. service members appears designed to prevent use of investigational drugs.

⁷ Defense Logistics Agency (DLA) Troop Support interview, 2011.

efficiencies,⁸ the Undersecretary of Defense for Acquisition, Technology and Logistics (USD AT&L) directed all military organizations in its reporting structure to initiate studies and analyses to identify potential efficiency opportunities. In response to that directive, the logistics-focused offices and commands within OSD and each military service formed the Joint Logistics Board (JLB) with the express purpose of identifying and acting on these efficiency opportunities. The JLB met throughout 2010–2012 and cast a wide net when considering what communities of practice to evaluate. In an attempt to focus the most recent round of efforts, the USD AT&L specifically directed the JLB to find opportunities for efficiencies in purchasing power and information technology (IT).⁹ The military medical logistics community was one that the JLB tasked to find opportunities for efficiencies in these two areas.

Findings Regarding IT

In studying possible efficiencies in IT, and procuring and delivering medical materiel, we began with IT and created the summary of systems shown in Figure 1.1. In the bounds of this study we were unable to make any detailed estimates about the cost of consolidating IT systems. However, we notice that multiple IT systems perform the same function for medical materiel. While both Defense Medical Logistics Standard Support (DMLSS) and Theater Enterprise Wide Logistics System (TEWLS) contain features to procure materiel, all functions related to purchasing items from prime vendors (PVs) must be duplicated in the DLA financial IT enterprise business system (EBS) because it is the only system that can directly pay PVs through the PV contract. DMLSS, TEWLS, and the DLA warehouse IT system (called Distribution Standard System [DSS]) all contain capability to manage warehouses, although DSS does not have the capability to download item data for items identified by commercial stock numbers—which is the vast majority of medical materiel. In addition, significant effort has been expended to make local medical materiel data visible globally, through the Joint Medical Asset Repository, and through the single-server framework underlying TEWLS. However, we still found that medical treatment facilities (MTFs) and managers of intermediate warehouses holding medical materiel around the world manage their inventory locally, without deliberate consideration of theater-wide inventory. We studied and present the opportunities for efficiencies in purchasing power in more detail in Chapter Three.

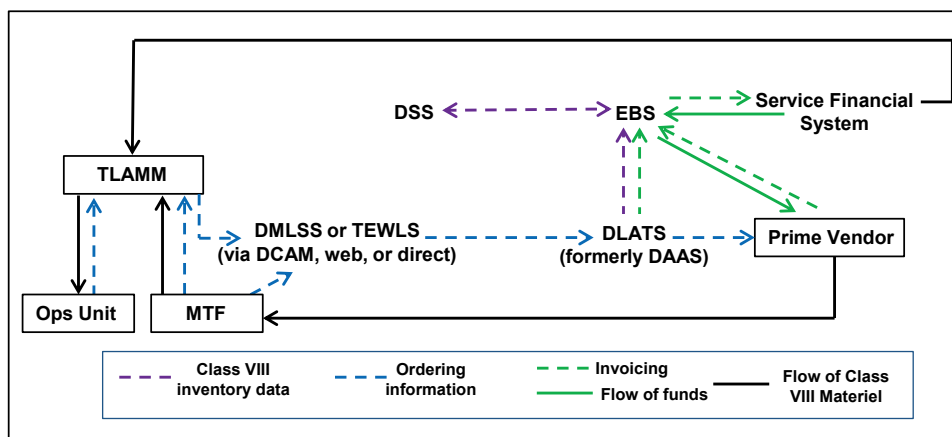
Description of Military Medical Logistics System

Many military commodities other than medical ones are managed by a DLA global enterprise. DLA manages a global supply chain for the following commodities: Class I,

⁸ DoD, *Defense Efficiencies Initiative* web page, undated.

⁹ Carter, Ashton B., USD AT&L, “Better Buying Power: Mandate for Restoring Affordability and Productivity in Defense Spending,” memorandum to acquisition professionals and briefing slides, June 28, 2010.

Figure 1.1
IT Systems for Military Medical Materiel Procurement and Distribution



NOTE: DAAS = Defense Automated Addressing System
 DCAM = DMLSS Customer Assistance Module
 DLATS = Defense Logistics Agency Transaction Server
 TLAMM = Theater lead agent for medical materiel

subsistence; Class II, clothing and textile; Class III, energy; Class IV/VII, construction and equipment; Class VIIIA, medical; Class IX, repair parts for aviation, maritime, and land systems.¹⁰ DLA procures these commodities and “sells” them to military service end users in an effort to gain efficiencies of scale and to leverage logistics expertise resident at DLA. The medical materiel commodity has remained a shared logistics enterprise between DLA and the services. Table 1.1 offers a summary of the reasons stated by senior leaders in DLA and the service medical logistics commands we interviewed for why medical logistics continues to be service-led.

To capture all aspects involved with this service-led mission, we laid out a representative value chain for military medical logistics to use as a guide for our research study (Figure 1.2), noting the organizations responsible for each of the activities. The same framework will be used for this report. The broad areas of the structure include:

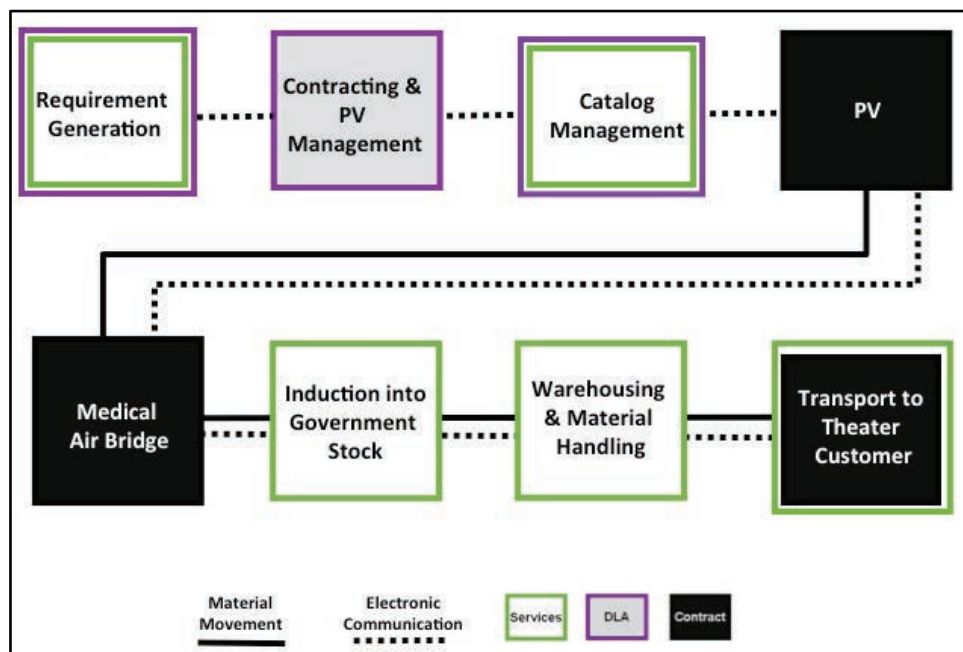
- contracting/catalog management
- transportation to first delivery location
- intermediate warehousing
- transportation to final end user

¹⁰ DLA, “DLA Distribution Command Brief,” briefing slides, February 2011.

Table 1.1
Characteristics of Medical Logistics Enterprise

Characteristics	Requirements/Effects
Mission objective is medical care, tolerance for adverse outcomes due to supply is very low	Stockouts at end user are not tolerated for usage items, non-usage items should be expedited
Items are generally commercial	Military may be able to procure quickly, not need to maintain significant inventory
Reparables are updated every one to three years, consumables are updated even more quickly	It is burdensome but feasible to develop materiel for reparables and sets (NSNs); it is infeasible with current manpower to develop materiel for consumables.
Pace of turnover in consumables catalog	
Require specialty facilities: environmentally controlled, controlled access, etc.	Diverse materiel handling needs: narcotics, vault, perishable, HazMat, pilferable, reparables
Seasonality, mass casualty events, troop surges	variability in demand with high levels of uncertainty
Guidelines placed upon the commodity by federal agencies	Agencies include Food and Drug Administration, OSHA Expertise required to be responsive to recalls, shelf life extension, local procurement

Figure 1.2
Military Medical Logistics Value Stream



Starting with the upper left corner of Figure 1.2, we show requirement generation as the first step in acquiring medical materiel. This is the process by which military organizations develop sets and kits that are procured as required for the military to meet its stated missions. We will not specifically address this activity in this project for two main reasons:

- a. While defining the nation's military goals will certainly affect the quantity of medical materiel it procures, we will take these definitions as a given and focus on finding efficient ways to support them with medical materiel.
- b. Much of the medical materiel DoD procures for its treatment facilities are commercial products used in continual patient care, and are not developed through DoD process.

The next activity, contracting and PV management, establishes a dominant portion of the costs that are born by DoD to supply units with medical materiel. As the owner and manager of the PV contracts, DLA is primarily responsible for setting the price at which DoD organizations procure medical materiel from any of the following: PV contracts, Electronic Catalog (ECAT), and other smaller repeat-use contracts. Combined, the PV and ECAT sources account for approximately 80 percent of all medical materiel purchased by DoD.¹¹

In order to provide all the information necessary for end users to purchase medical materiel through the PV and managed catalogs such as ECAT, administrative personnel must populate the logistics IT systems with item data that could include: purchase price, item description, packaging standards, materiel substitutes, unit of issue, weight and volume, and special handling characteristics such as cold chain or chain of custody.

Not only does DLA work with the manufacturers and ECAT suppliers to determine pricing, it also establishes the cost and method to ship items from CONUS consolidation points at the PV locations to the first delivery location OCONUS. DLA selects from among carriers who have submitted their OCONUS shipping rates to the U.S. Transportation Command (USTRANSCOM) to use in the Category A (Cat A) transportation contract. The Cat A contract specifies the price per pound at which shippers will deliver materiel to the first receipt location, and a single price is stated for each country listed.

DLA incorporates the transportation costs from the Cat A contracts into its operating budget, along with all its other activities, and sets its cost recovery rates (CRRs) for the following year accordingly. The CRR exists to allow DLA to recoup its expected costs for the following year.¹²

¹¹ DLA Troop Support interview, 2011; U.S. Army Medical Materiel Center—Korea (USAMMC-K) production report, 2011. The production report lists 75 percent PV and ECAT, with 10 percent credit card purchases and balances from other contracts.

¹² DLA charges customers a cost recovery fee (CRF), generated using the CRR, to recoup DLA's cost of operations. CRR represents an aggregate of costs for a specific class of supply cut by projected sales for that class.

- CONUS rates are separate from OCONUS rates.
- Rates differ for DVD, PV, and across supply classes.
- *Customer cost = CRF + distribution fee + item cost*

CRF covers the manpower to administer contract; IT supporting DLA; DLA overhead; cost of overhead and ops for the distribution network; and the cost to transport to the first location.

Distribution fees cover vendor distribution costs; special handling; low-volume items; and onsite representatives.

By this method, the purchasers of medical materiel do not directly bear their sites' share of the cost of delivering materiel from PV and ECAT suppliers to the first location of receipt. The cost is absorbed by DLA, aggregated along with all its other costs, and then assessed via a standard fee to DLA customers.¹³

The next activity in the value map is intermediate warehousing at the first location of delivery. In the United States, all MTFs and some operational units order and receive materiel directly from PVs and ECAT suppliers—bypassing any intermediate warehouse. Most operational units in the United States order materiel through the MTF at their installation. Therefore, excluding set building operations,¹⁴ there are no dedicated warehouses for medical materiel distribution in the United States. Each MTF is responsible for setting its inventory levels. OCONUS MTFs and operational units generally order materiel in two ways:

1. delivered directly from CONUS-based PVs and ECAT suppliers
2. delivered through OCONUS DoD-run intermediate warehouses.

In cases where materiel is delivered to an end user beyond the first receipt location, the final step in the value stream map is delivery from first location of receipt to the location of the end user. In this report, we will describe the cost and performance of the main methods of delivering materiel in the second transportation stage: The Class VIII tender servicing U.S. Central Command (USCENTCOM), and military air. We did not study in detail other modes such as local ground transportation via military truck, local package delivery, and military unit pick-up, as these are lower-cost activities and it would require significant effort to gather accurate data on their cost and performance.

Data Sources

We gathered background information on the global military medical logistics enterprise from three kinds of sources:

1. Interviews: DLA Troop Support, DLA Distribution, Army Medical Command, Air Force Surgeon General, Headquarters Marine Corps, Navy Medical Logistics Command, Navy Fleet Inventory Supply Center, III Marine Expeditionary Force, U.S. Army Medical Materiel Center-Europe (USAMMCE), USAMMC-K, Theater Lead Agent for Medical Materiel-Pacific (TLAMM-P), Navy Hospitals, Army Hospitals, British Medical Service, USTRANSCOM Surgeon, USCENTCOM Surgeon, U.S. Northern Command (USNORTHCOM) Surgeon, U.S. Southern Command (USSOUTHCOM) Surgeon, U.S. Africa Command (USAFRICOM) Surgeon, U.S. Pacific Command (USPACOM)

¹³ DLA, February 2011.

¹⁴ The military services and DLA collaborate to build sets for deployable units that consume medical materiel, such as Air Force expeditionary medical system units and army brigade combat teams. These kits are constructed of only developed materiel items that have national stock numbers (NSNs) attached. Unit sets consist largely of infrastructure, such as tenting and operating room equipment, and contain a small portion of materiel that would be consumed by MTFs to provide patient care.

Surgeon, U.S. Europe Command (USEUCOM) Surgeon, and Office of the Assistant Secretary of Defense for Health Affairs

2. Briefings: USAMMCE, USAMMC-K, DLA Distribution, TLAMM-P, and USNORTHCOM
3. Guidance: U.S. Code, Federal Register, Office of the Secretary of Defense Memoranda, Chairman of the Joint Chiefs of Staff Memoranda
4. Contracts: Medical Surgical PV GEN IV Solicitation, GEN IV Medical Surgical PV contract.

We gathered quantitative data from the following sources that allowed us to perform calculations regarding opportunities for efficiency in medical logistics:

1. USAMMCE receipts, inventory, issues
2. TRANSCOM Class VIII tender use
3. USAMMCE requirements
4. U.S. Army Medical Materiel Center–Southwest Asia (USAMMC-SWA) production report
5. JLB briefing regarding warehouse consolidation
6. Air Mobility Command (AMC) costs.

We proceed in this report with an introduction to medical logistics practice in the geographic Contracting Commands (COCOMS) in Chapter Two, and structure the balance of the report as follows: Chapter Three pertains to contracting/catalog management; Chapter Four describes transportation to first delivery location; Chapter Five explains warehousing; Chapter Six details transportation to final end user; and Chapter Seven offers conclusions and recommendations.

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2. Medical Logistics in COCOMs

The Chairman of the Joint Chiefs of Staff designated that a TLAMM be responsible for providing medical logistics support to joint task force commanders in deployed military operations.¹⁵ Through memoranda approved by the Chairman of the Joint Chiefs of Staff, military units assume these roles in each of the geographic areas. (This role was recently codified in USPACOM when the 18th Medical Group assumed the role as the TLAMM-P.¹⁶) These agents are tasked with ensuring that medical materiel is available to all operational military units in the region. By describing the lead agent characteristics in each of the geographic COCOMs, we develop a picture of the differing military missions and environments in each of the theaters, and the way DoD has designed its medical logistics enterprise to support them. We exclude USAFRICOM at this time because it represents a theater where medical logistics support is immature due to the limited presence of U.S. forces on the continent. Figure 2.1 shows the geographic COCOMs with their respective boundaries. Red dots in this figure represent OCONUS MTFs; yellow stars indicate locations of the TLAMMs.

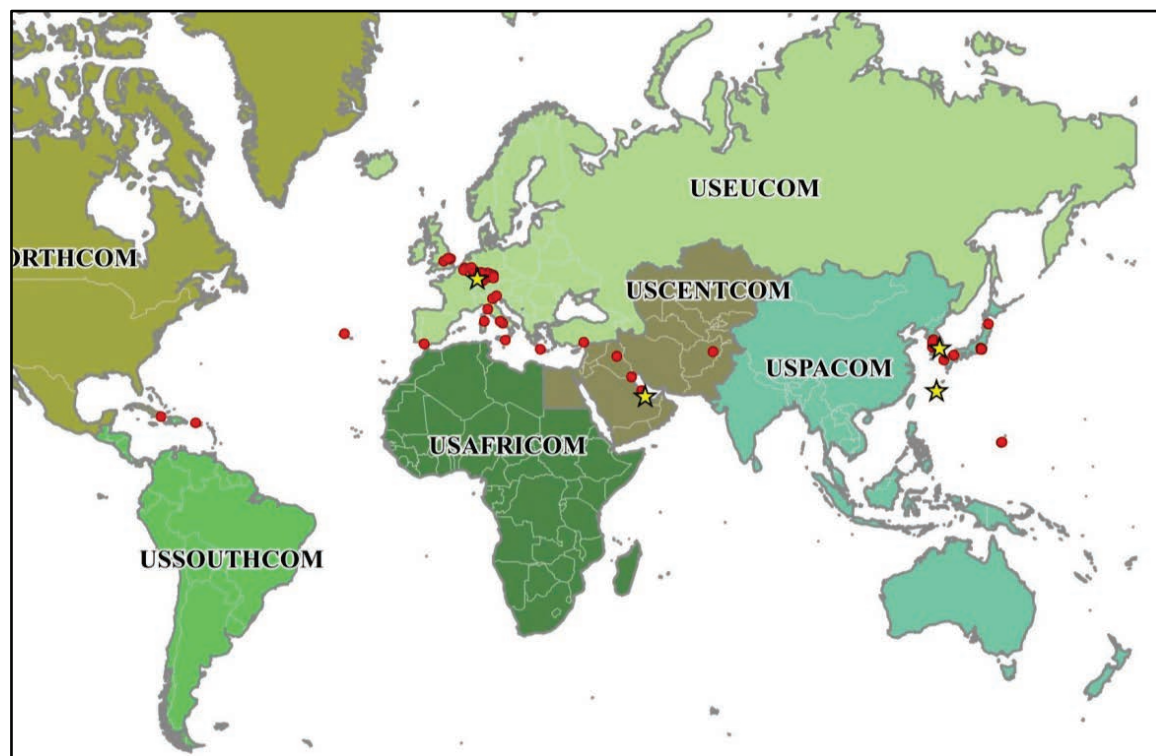
Table 2.1 shows the lead agents for medical materiel in each of the geographic COCOMs. Within each of the sections describing medical logistics practice in the geographic COCOMs, we will introduce a decision framework that helps distinguish the characteristics that define how the medical logistics mission varies by theater. The decision framework will organize our description of the current practice to supply medical materiel in each of the geographic COCOMs, and will include the following sections:

- quantity and distribution of units
- distance from PV and hubs
- transportation modality and infrastructure
- response for contingency operations.

¹⁵ Joint Chiefs of Staff, “Health Service Support,” Joint Publication 4–02, October 31, 2006.

¹⁶ Mullen, M.G., Chairman of the Joint Chiefs of Staff, Department of Defense, “Recommended Designation of Theater Lead Agent for Medical Materiel (TLAMM),” memorandum for DLA director, CM-0922-09, November 13, 2009.

Figure 2.1
Map of geographic COCOMs, OCONUS MTFs, and TLAMMs



NOTE: USAFRICOM = U.S. Africa Command
USCENTCOM = U.S. Central Command
USEUCOM = U.S. Europe Command
USNORTHCOM = U.S. Northern Command
USPACOM = U.S. Pacific Command
USSOUTHCOM = U.S. Southern Command

Table 2.1
Comparison of Theater Medical Logistics Agents, Fall 2011

	COCOM	Service	Lines of Stock Held	Inventory Value	U.S. Military Manpower^a	Other Manpower^b
USAMMCE (Germany)	USEUCOM USCENTCOM USAFRICOM	USA	11,000+	\$33.5M	80	319
USAMMC-SWA (Qatar)	USCENTCOM	USA	2,600+	\$13.2M	73	39
USAMMC-K (S. Korea)	USPACOM (USFK)	USA	2,200+	\$2.5M	15	54
TLAMM-P (Japan)	USPACOM	USAF	---	---	4	---

^a U.S. military manpower is active duty and civilian

^b Other manpower is contract and other nation

NOTE: USFK= United States Forces Korea

SOURCES: USAMMCE, USAMMC-SWA, USAMMC-K, and TLAMM-P command briefings.

USNORTHCOM:

Quantity and Distribution of Units

There are 172 locations dedicated as PV ROFs in the United States; most are MTFs, with some operational units.¹⁷ These ROFs span the MTFs in USNORTHCOM, so MTFs can receive materiel directly from PVs. Some operational units, such as selected aviation and medical logistics units that consume medical materiel, are listed as ROFs and can order materiel directly from PVs. The balance of operational units that consume medical materiel, such as infantry units running battalion aid stations, order medical materiel to be delivered through the MTF at their location.

Distance from PV and Hubs

In USNORTHCOM, MTFs and many operational units receive medical materiel direct from the PV. First destination transportation from the PV to the CONUS ordering facility is required by the PV contract and covered by the distribution fee component of the CRR. The PV is required to deliver usage items within 24 hours of an order, unless a lower standard is chosen in the site's service level election.¹⁸ Because the lead time is short, USNORTHCOM customers can manage their own inventory in such a way that they have sufficient materiel to meet surges in demand over the delivery lead time. While USNORTHCOM military units also must manage their inventory to buffer against interruptions in the supply chain where delivery times may be longer than expected, we infer that these units regard the supply chain as fairly robust due to the strong infrastructure for shipping in North America.

Transportation Modality and Infrastructure

As stated, the North American network of highways is reliable, redundant, and capable of allowing quick delivery of large quantities of medical materiel to destinations in all populated areas of the continent. Commercial air freight is also widely available to many areas, and DoD has a large fleet of military aircraft stationed in the United States that can be called upon to delivery supplies in an emergency where the prior two modes of transportation are limited.

Response for Contingency Operations

Responsible for North America, USNORTHCOM is supported by Army Medical Command (MEDCOM) for the mission of providing medical materiel to operational units in times of contingency operations. For this purpose, MEDCOM has designated four master ordering facilities: Madigan Army Medical Center, Brooke Army Medical Center, Martin Army

¹⁷ DLA Troop Supply, Gen IV Medical Surgical PV, Contract No. SPM2DV-11-D-0001, April 4, 2011.

¹⁸ DLA Troop Supply, 2011.

Community Hospital, and Womack Army Medical Center.¹⁹ These are large Army hospitals that have been selected because their geographic locations are well suited to respond to contingency operations—such as humanitarian relief operations or homeland defense—that may arise in North America, and because the infrastructure they possess would allow a surge in medical logistics activity to provide materiel in support of contingency operations. While these facilities already have the IT, infrastructure, and facilities necessary to support a surge in medical materiel procurement, the medical activities operating them may require supplemental manpower to perform the mission.

There are no DoD warehouses in USNORTHCOM dedicated to holding inventory to make sure that USNORTHCOM military units have the medical materiel they require should they experience a surge in demand or longer-than-expected delivery times from suppliers. Table 2.2 summarizes the USNORTHCOM medical logistics scenario.

Table 2.2
NORTHCOM Summary

Decision Framework	State of World	Effect
Units (ordering procedures)	Many MTFs and operational units	Proximity to PV and U.S. infrastructure allow ordering direct to units.
Distance from PV and hubs (buffer)	PV delivers in 1-2 days	Store little inventory at units.
Transportation (steady state practice)	Robust ground, commercial air, and military air	Rely on commercial ground transportation.
Contingency response	Operational units have materiel at home station, considerable central military stores in theater.	MTFs can order materiel from PV, receive materiel for operational units at master ordering facilities, use commercial ground.

¹⁹ MAJ Tim Sharpe, ARNORTH SG, USNORTHCOM Class VIII Working Group briefing, January 24, 2011.

USSOUTHCOM

Quantity and Distribution of Units

The designated agent for medical materiel to support USSOUTHCOM is the Air Force Medical Operations Agency (AFMOA) location in San Antonio, Texas.

There are few military units in South America that require routine medical materiel support. Notably there are two MTFs, one at Guantanamo Bay and the other in Honduras. The Guantanamo Bay MTF is a Navy unit that receives its supplies from the Navy (and is a ROF on the PV contracts). The Honduras MTF is operated by the joint task force, and receives medical materiel support from AFMOA.

Distance from PV and Hubs

In USSOUTHCOM, only the MTF at Guantanamo Bay is established as a ROF in the PV contracts; the other USSOUTHCOM MTF relies upon the TLAMM, which is outside the region but somewhat nearby in the United States. On this basis, the USSOUTHCOM units need to maintain a larger inventory of materiel than those in USNORTHCOM to buffer against surges in demand and interruptions in the supply chain. But the distances between the USSOUTHCOM units and PVs in the United States are not nearly as large as the distances between PVs and the USEUCOM and USPACOM units. Therefore, USSOUTHCOM units can act with slightly greater confidence in support from their suppliers.

Transportation Modality and Infrastructure

Commercial air and ground freight transportation is reliable to the populated areas of USSOUTHCOM in which many of the military units operate. Transportation infrastructure to more distant areas of the region is more limited. For steady-state operations, the USSOUTHCOM units can rely on commercial freight to deliver materiel, and it is possible they could continue to do so in contingencies. However, based on the type of mission and locations, it is also likely that commercial freight access may collapse or be limited and the military should be prepared to use military airlift in these cases.

Response for Contingency Operations

As with USNORTHCOM, there is no warehouse that holds materiel inventory designated to support USSOUTHCOM military units should they experience a surge in demand or an interruption of the supply chain that would cause them to exhaust their inventory before receiving new supplies. USSOUTHCOM units have accepted the risk associated with relying on AFMOA for expedited resupply. Like all DoD ROFs in USNORTHCOM, AFMOA can use the DLA contracts to order medical materiel from PVs with expected two-day delivery, and AFMOA can arrange military or commercial air delivery of the materiel quickly to USSOUTHCOM units. In the event of a contingency—such as the January 2010 earthquake in

Haiti²⁰—AFMOA personnel in San Antonio would begin fielding orders for material from deployed and disadvantaged users. AFMOA would handle the procurement and transportation planning, but the process is designed so that the material would be transported from the supplier direct to the ordering unit. In other words, the material would not be physically received in San Antonio by AFMOA prior to being sent to the ordering unit.

During interviews with USSOUTHCOM representatives, they expressed concern that current procedures in place at AFMOA to procure medical materiel for USSOUTHCOM end users on a continual basis are not well designed to surge in case of contingency operations. Currently, AFMOA requires payment from end users when it procures items. When items are urgently needed, waiting for payment from end users may cause a delay. Options to alleviate this delay include allowing AFMOA access to funds, such as Defense Working Capital Funds, that can be used to procure items in advance of reimbursement for end users outside the Air Force. Table 2.3 summarizes the USSOUTHCOM medical logistics scenario.

Table 2.3
USSOUTHCOM Summary

Decision Framework	State of World	Effect
Units (ordering procedures)	Only two MTFs, operational units proximate to MTFs.	Operational units can order with MTFs.
Distance from PV and hubs (buffer)	PV delivers to TLAMM (AFMOA) within two days. Only one military routine ordering facility in USSOUTHCOM.	Store sufficient materiel at units to offset delivery time.
Transportation (steady state practice)	Commercial transportation to limited locations.	Use commercial to unit locations.
Contingency response	Few units in theater, little supplies in theater.	Deploying units will bring materiel with them, transition to TLAMM and military air support.

²⁰ Operation Unified Response (Haiti), Class VIII Medical Logistics Support After Action Report, November 2010.

USEUCOM

Quantity and Distribution of Units

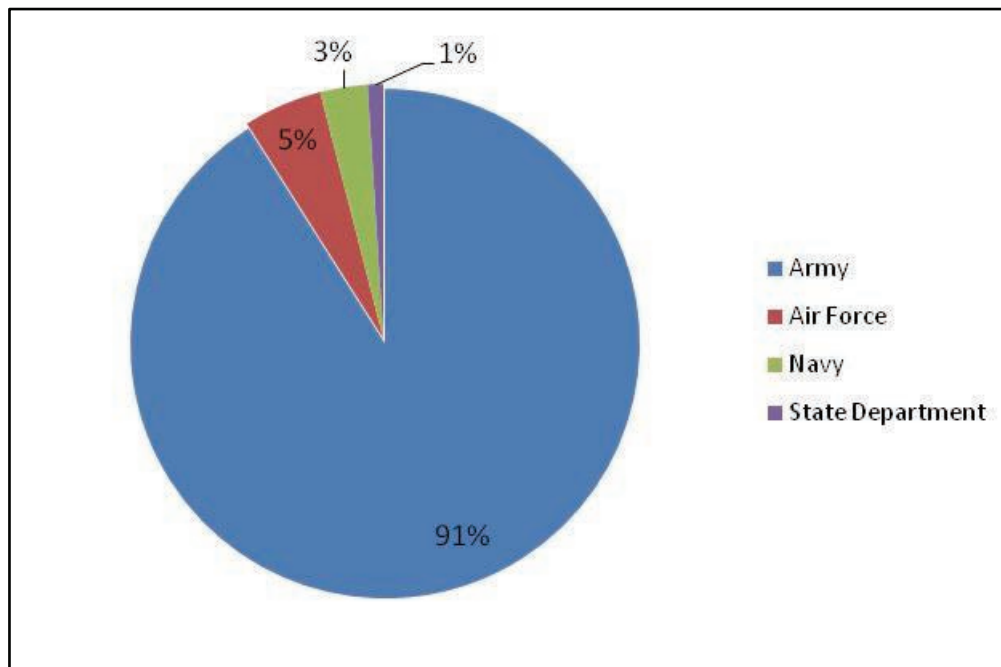
There are many more U.S. military units in Europe than in South America, so USEUCOM maintains a more elaborate medical logistics enterprise than USSOUTHCOM. There are tens of MTFs and hundreds of operational units in USEUCOM that consume medical materiel, and they vary in size and capability. Many of the MTFs, particularly those that are inpatient facilities, are listed as ROFs for PV items. The operational units in USEUCOM are generally not ROFs, and order medical materiel through other units.

The Cat A contract provides a seamless way for medical materiel to be delivered from PVs and ECAT suppliers, via commercial air, to OCONUS locations at established rates. Through the PV contract, medical PVs are required to deliver *usage items* (regularly ordered items) to the ordering units within seven days when certain ordering criteria are met. This arrangement applies to all installations that are designated as ROFs in the PV contract. As such, many MTFs in Europe are contractually able to order medical materiel directly from PVs and receive usage items via commercial shipping in seven days. However, the MTFs practice this contractual right in differing variations and quantities.

Some of the variation in ROF–PV ordering practices is due to the Army having directed its MTFs in Europe to order medical materiel exclusively to be delivered through USAMMCE, which operates a large medical materiel warehouse in Pirmasens, Germany. The Navy and Air Force MTFs in Europe are not directed by their service chain of command to exclusively use USAMMCE, so these MTFs locally manage the method by which they procure medical materiel. Navy and Air Force MTFs in USEUCOM order medical materiel to be delivered both directly from PV and ECAT suppliers, and through USAMMCE. They use USAMMCE in particular for items such as cold-chain items, and chain-of-custody items.

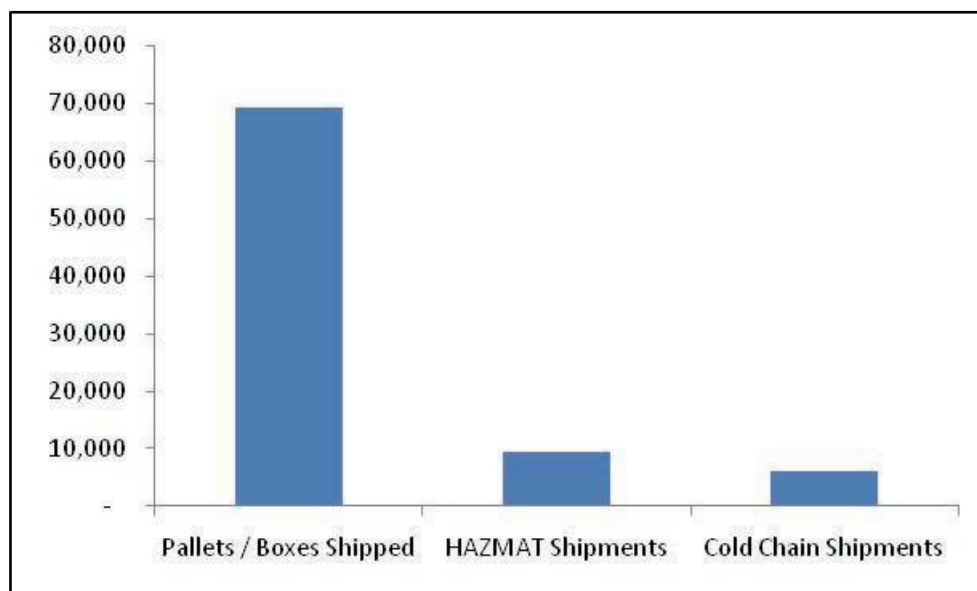
In fiscal 2010, Navy and Air Force units made up 8 percent of USAMMCE shipments (Figure 2.2). During this time, USAMMCE filled 440,000 customer orders that made up 69,000 boxes and pallets shipped (Figure 2.3). Of these shipments, approximately 22 percent were hazardous materials (HAZMAT) and cold-chain items (which must be packaged specifically to keep the contents at a low temperature).

Figure 2.2
USAMMCE Shipments by Organization, Fiscal 2010



SOURCE: USAMMCE Command Brief, 2011.

Figure 2.3
USAMMCE Shipments, Fiscal 2010



SOURCE: USAMMCE Command Brief, 2011.

USAMMCE maintains an inventory of medical materiel to support the orders it receives from its hundreds of customers. During the period surrounding the writing of this report (May 2011–December 2011), USAMMCE delivered materiel to 38 countries across USEUCOM, USAFRICOM, and USCENTCOM, with the majority of items going to USEUCOM MTFs and USCENTCOM.

Distance from PV and Hubs

The PV statement of work mandates that PVs must supply usage items to end users in USEUCOM within seven days of ordering so long as certain ordering requirements are met.²¹ Given the robust channel of air freight between the U.S. East Coast and Europe, when units in USEUCOM order medical materiel within the guidelines established to define common “usage” items in the PV statement of work, the units can generally expect to receive the materiel in about a week.

When items are ordered for the first time, the PV statement of work allows PV suppliers 90 days to acquire a sufficient supply of items to meet end-user orders. After that, if end users continue to order that particular item on a monthly basis, it is then defined as a usage item, and PVs are responsible for delivering it to end users within seven days—so long as end users order the item in a predictable way.

For end users to continue to receive seven-day delivery performance on items they order through the PV, they need to give the PV an estimate of the quantity one month in advance. Per the PV contract, the PV may compel an end user to pay for the full estimated quantity, even if the end user orders a smaller quantity. An end user may order up to 110 percent of the estimated quantity and still be guaranteed the seven-day performance from the PV. The PV is not required to deliver the excess quantity in a defined time period for orders that exceed 110 percent of the estimate. We interpret this statement of work to be equivalent to a 37-day lead time on recurring orders, with a 97-day lead time for new item orders.

Units in USEUCOM that are not ROFs in the PV contract must order materiel to be delivered through units that are ROFs, either MTFs or the TLAMM, USAMMCE. If units order materiel through MTFs, they are likely collocated with the MTF, and can receive materiel with the same delivery times as the MTFs. When Army units order materiel to be delivered through USAMMCE, and the warehouse at USAMMCE has the materiel on hand, robust ground transportation in Europe can generally deliver the items in one or two days. If USAMMCE does not have the materiel on-hand, end users would receive materiel within one or two days of its arrival at USAMMCE.

²¹ Defense Supply Center Philadelphia, Medical Surgical Prime Vendor GEN IV SOLICITATION, SPM2DS-09-R-001, August 3, 2009.

Units in USEUCOM that order materiel from PVs directly must maintain inventory sufficient to buffer against the potentially lengthy delivery lead times. Units that order materiel from USAMMCE must maintain sufficient inventory to buffer against the very responsive lead times when USAMMCE has the item in stock. However, as USAMMCE fills 65 percent of orders, end users must maintain a buffer against a lead time that is similar or slightly longer than required when ordering materiel directly from the PVs (for materiel that is delivered to USAMMCE and then passed to end users).

USAMMCE uses a blended set of policies to determine the quantity of inventory it holds. Its policies are based on the lead time to receive materiel from the suppliers and on historic ordering rates from customers. In 2010, USAMMCE began using an enterprise management system, called TEWLS, that assists in setting inventory. The Army developed TEWLS to be used in its set-building organizations and TLAMMs in Europe, Korea, and Qatar.

Transportation Modality and Infrastructure

Commercial air freight between the United States and Europe is typically robust. It can be relied upon to delivery medical materiel to end users in USEUCOM under the vast majority of circumstances. Only occasionally is this air freight interrupted, such as it was when the volcano interrupted in Iceland in 2010.

Response for Contingency Operations

USAMMCE holds inventory equivalent to approximately one month of demand from the units that order through it. This materiel is intended to buffer against both interruptions in delivery from the United States to Europe, and in the event of surges in demand in USEUCOM, USCENTCOM, or USAFRICOM. In addition to holding inventory to distribute to end users during continuing operations, USAMMCE (like USAMMC-K and the DLA Distribution Centers we visited) holds inventory of particular pharmaceuticals procured by the federal government to be used in major disasters or newly developing large-scale contingency operations. USAMMCE holds approximately \$57 million of inventory for this purpose. Table 2.4 summarizes the USEUCOM medical logistics scenario.

Table 2.4
USEUCOM Summary

Decision Framework	State of World	Effect
Units (ordering procedures)	Many capable MTFs, voluminous operational units.	MTFs order from PVs, TLAMM supports many MTFs and operational units in steady state.
Distance from PV and hubs (buffer)	PV delivers to Europe in seven–37 days. TLAMM can deliver items from inventory to USEUCOM units in one or two days.	MTFs store substantial inventory, and so does TLAMM.
Transportation (steady state practice)	Robust commercial air freight between PV and end users, robust local ground for second-leg distribution.	Use commercial to unit locations.
Contingency response	Many units in theater, all hold inventory; USAMMCE holds inventory, also central military stores in theater.	Theater is rich in prepositioned inventory.

USPACOM

Two organizations have been designated as lead agents for medical materiel for distinct portions of the theater: USAMMC-K and TLAMM-P. USAMMC-K is collocated with the Army prepositioned stock (APS) at Camp Carroll, South Korea, and TLAMM-P is the 18th Medical Group at Kadena Air Force Base in Okinawa, Japan. The 18th Medical Group assumed the role of TLAMM-P as a small supplement to its mission delivering health care to Kadena Air Force base beneficiaries. DoD divided responsibility for medical materiel in the Pacific region into these two areas in accordance with operational plans for the region.

USPACOM-Korea:

Quantity and Distribution of Units

In Korea, the two main end users of medical materiel are the hospitals at Osan Air Base operated by the 51st Medical Group, and the Brian Allgood Hospital at Yongsan Army Garrison. While there are smaller military health clinics and additional operational units in Korea that require medical materiel, these two facilities consume the majority of such items shipped to Korea. Much like in Europe, both of these facilities can—and do—receive medical materiel direct from the PV and ECAT suppliers. The amount received varies according to the commanding military services' respective preferences as described earlier.

For example, the Army directed the Brian Allgood Hospital to order its materiel to be delivered through USAMMC-K. This decision was made for reasons other than supply chain efficiency: It was made to support continued operations at USAMMC-K, anticipating USAMMC-K having value in future contingency operations. If USAMMC-K did not supply the Brian Allgood Hospital, it would have a fraction of its current workload. Only in cases where materiel needs to be expedited is it shipped directly from the CONUS-based suppliers to the Brian Allgood Hospital, bypassing USAMMC-K.

By contrast, the Air Force hospital at Osan Air Base receives the majority of its materiel directly from PV and ECAT suppliers, and orders from USAMMC-K in limited volume.

Distance from PV and Hubs

The Korea MTFs and USAMMC-K are ROFs, and receive medical materiel from PVs with approximately the same level of responsiveness as their counterparts in Europe, with perhaps one extra day of delivery time due to the longer distance in commercial air freight from the U.S. West Coast to the Pacific region. The Air Force MTFs in Korea must maintain sufficient materiel inventories to buffer against the delivery lead time from the United States. The Army operational units, health clinics, and the Brian Allgood hospital at Yongsan Army Garrison in Seoul all order materiel through USAMMC-K. These units can hold smaller inventories locally, relying on the USAMMC-K inventory to buffer against lead time demand variance.

Transportation Modality and Infrastructure

Commercial air freight is robust between the United States and air hubs in the Pacific. The distance is somewhat longer than the distance between the United States and Europe, so transportation times are slightly longer. Within Korea, ground transportation is widely available and reliable.

Response for Contingency Operations

The military has staged significant central stores of materiel in Korea for use in contingency operations. In addition to this materiel, Air Force MTFs and USAMMC-K each hold inventory to

support steady-state operations and buffer against local demand surges or interruptions in the supply chain. USAMMC-K manages its inventory to hold 30 days' worth of supply for the end users it supports. Table 2.5 summarizes the USPACOM-Korea medical logistics scenario.

Table 2.5
USPACOM - Korea Summary

Decision Framework	State of World	Effect
Units (ordering procedures)	Several MTFs, assorted operational units.	Air Force MTFs order from PVs, TLAMM supports Army MTF and Army units.
Distance from PV and hubs (buffer)	PV delivers to Korea in seven to 37 days. TLAMM can delivery items from inventory to Korea units in one or two days.	Air Force MTFs store substantial inventory, as does TLAMM.
Transportation (steady state practice)	Robust commercial air freight between PV and Pacific air hubs, robust ground infrastructure to reach end users, and for second-leg transportation	Use commercial freight to unit locations, local ground for second-leg distribution
Contingency response	In addition to unit inventory at inventory at the TLAMM, the military has staged significant central inventory stores in the theater.	Theater is rich in prepositioned inventory.

USPACOM – All but Korea:

Quantity and Distribution of Units

The military units in the TLAMM-P portion of USPACOM that consume the most medical materiel are U.S. Naval Hospital Okinawa, and naval installations on the main island of Japan. In USPACOM, Navy hospitals order and warehouse medical materiel independently of other DoD organizations and theater medical materiel agents.

While Navy ships consume a smaller quantity and variety of medical materiel than Navy shore hospitals, the methods to supply them are more complicated. Navy ships order medical materiel by multiple methods: the Fleet PV program (which is different from the DLA PV program), through TLAMMs and MTFs, and through Navy Fleet and Industrial Supply Centers (FISCs). FISCs order medical materiel and other classes of materiel from CONUS-based suppliers intended for Navy ships in the region and support a broad spectrum of materiel requirements; medical is only a small portion of their mission.

On April 6, 2010, the Navy and DLA signed a memorandum of agreement to transfer supply storage and distribution functions to DLA.²² As such, DLA Distribution has assumed responsibility for the warehousing mission at Navy FISCs, and FISC Yokosuka is an example of such a relationship. DLA Distribution Depot Yokosuka orders medical materiel for FISC Yokosuka, and holds medical materiel in inventory from the time it arrives from the supplier until the time it is put aboard the Navy ships. It is worth noting that the inventory of medical materiel held at the FISCs represents a small subset of that which is held in stock at warehouses managed by materiel agents like USAMMCE in USEUCOM. Additionally, DSS, which DLA uses as its warehouse management IT system, is only capable of receiving, tracking, and issuing materiel with an associated NSN. The significance of this is described in Chapter Three.

DLA Distribution Depot Yokosuka also performs a medical materiel mission for DoD, holding inventory of specific pharmaceuticals for use in major disasters.

The medical logistics element of the 18th Medical Group primarily supports the clinic at Kadena Air Force Base. This medical logistics element also forms the basis of TLAMM-P, designed to support to the rest of the Pacific region outside of Korea. TLAMM-P hosts two staff from the nearby (Okinawa, Japan) III Marine Expeditionary Force (III MEF). Through the shared facilities at TLAMM-P, these staff members order medical materiel for the III MEF. Besides the III MEF, the 18th Medical Group, and forces collocated with these units, TLAMM-P does not perform routine ordering materiel for other units in USPACOM.

²² “NAVSUP, DLA Complete Transfer of FISC Norfolk Warehouses,” *Navy Supply Systems Command News*, Story Number NNS110421-24, April 21, 2010.

Distance from PV and Hubs

Naval MTFs in USPACOM order medical materiel direct from CONUS-based suppliers, and they should receive items with approximately the same delivery performance as other ROFs. The naval MTFs hold inventory locally to buffer against supplier lead times. Due to the dispersed-over-water nature of the Pacific region, it is difficult to gain any advantage by pooling inventory.

When Navy ships are at sea, they may be a large distance from the FISC and DLA Distribution locations where PV materiel is delivered. The FISC manages delivery of all materiel to ships when they are not in port, and medical materiel is among those supplies.

Even though III MEF is a short drive away, TLAMM-P holds inventory primarily for the outpatient medical facility at the installation. TLAMM-P does not hold inventory for III MEF.

Transportation Modality and Infrastructure

Commercial air transportation is robust to the hubs in the Pacific, and is available to most locations in the region. However, as water separates most military locations in the region (with the exception of small Navy treatment facilities spread out around the main island of Japan that enjoy distribution of materiel by ground), there is poor availability of ground transportation to deliver materiel between locations in many cases.

Response for Contingency Operations

TLAMM-P is designed to function as an operational capability, ordering medical materiel to be shipped to those locations at which operational units will be performing exercises or contingency operations. TLAMM-P would order the materiel and expedite delivery direct from the supplier to the location of the exercise or contingency operation. With its current staffing and infrastructure, TLAMM-P is not well designed to perform this mission on a large scale. To date, TLAMM-P has performed this mission in support of the Joint Special Operations Task Force-Philippines, instructing commercial carriers to route materiel from the United States, through Narita International Airport (in the Tokyo metropolitan area), and direct to the location of the operational units. Table 2.6 summarizes the medical logistics scenario for USPACOM outside Korea.

Table 2.6
USPACOM – All but Korea Summary

Decision Framework	State of World	Effect
Units (ordering procedures)	Several MTFs, assorted operational units.	All units order materiel direct from PVs except III MEF, which partners with TLAMM-P.
Distance from PV and hubs (buffer)	PV delivers to Pacific in seven to 37 days. Units are generally geographically dispersed across water.	MTFs and III MEF store substantial inventory, DLA Distribution holds materiel for fleet.
Transportation (steady state practice)	Robust commercial air freight between PV and Pacific air hubs, little ground transportation.	Commercial freight to unit locations; military freight for second-leg when necessary.
Contingency response	Since locations in the Pacific are not connected by land, it is nearly as easy to push materiel to deployed locations from the United States as from Pacific locations.	Route materiel to deployed locations with commercial air, direct from PV. Or use military airlift from Kadena.

USCENTCOM:

Quantity and Distribution of Units

The final and most complicated theater of operations is USCENTCOM, which is the most active theater for hostilities, and the most difficult region for delivering medical materiel from CONUS-based suppliers. During the 2010–2011 time period of our study, DoD maintained three MTFs in USCENTCOM, as well as operational units consisting of more than 100,000 active-duty troops—all of which required significant medical materiel support. While the Cat A medical materiel transportation contract lists ROFs in USEUCOM and USPACOM that may receive materiel direct from the PV and ECAT suppliers, locations in USCENTCOM are not explicitly included on that contract. USCENTCOM locations are listed on the PV contract, although it is logistics locations and not the MTFs. This exclusion means that DoD has two options when determining how to provide medical materiel to USCENTCOM: Modify the PV contract to include USCENTCOM MTFs on the list of ROFs and include USCENTCOM countries on the Cat A contract, or use other methods to support these locations with medical materiel.

Some operational units in USCENTCOM have so little capability to handle medical materiel that they are supported by forward-deployed medical logistics (medlog) companies. These companies hold a small cache of inventory that can be used to rapidly resupply units that are mobile or otherwise unable to maintain an independent inventory.

Distance From PV and Hubs

Units in USCENTCOM are not generally included as ROFs in the PV statement of work. An exception is USAMMC-SWA, which is on the PV contract for distribution, but is not well supported by the Cat A contract for materiel transportation. As a result, units in USCENTCOM order medical materiel to be distributed through an intermediate warehouse. Two intermediate distribution warehouses can be used in the process of delivering medical materiel into USCENTCOM locations: USAMMCE and USAMMC-SWA. As these units are both Army TLAMMs, they operate on the same IT enterprise system, TEWLS. This system contains logic to route orders from customers to distribution centers or suppliers. At the time of this study, orders were first routed to USAMMC-SWA; if USAMMC-SWA could not fill orders, they were sent to USAMMCE.

USAMMC-SWA experimented with receiving materiel directly from the PVs, but had a bad experience and returned to serving strictly as a subordinate warehouse to USAMMCE. All the medical materiel received at USAMMC-SWA originates at USAMMCE, and all the lines of stock held at USAMMC-SWA are also held at USAMMCE. USAMMC-SWA has a mission to provide faster resupply to units in USCENTCOM than is possible from USAMMCE, and to hold materiel in inventory that would buffer against a surge in demand from USCENTCOM units or

an interruption in the supply chain delivering medical materiel from USEUCOM to USCENTCOM. USAMMC-SWA maintains a modest complement of manpower to perform warehouse operations, and holds a restricted set of items, approximately one-fourth the variety of items held at USAMMCE.

USAMMCE supports units in USCENTCOM in the same manner that it supports units in USEUCOM. That is, by holding materiel in inventory sufficient to meet end user demands and buffering against the lead time to receive materiel direct from suppliers.

USAMMCE can deliver items to USCENTCOM via commercial freight in approximately four to five days. USAMMC-SWA can deliver items to USCENTCOM locations via commercial freight in approximately three to four days. Both locations have access to military airlift. USAMMCE does not routinely use military airlift to deliver items to USCENTCOM, but USAMMC-SWA does, and experiences delivery times similar to when it uses commercial airlift. USAMMC-SWA can deliver items to some locations in USCENTCOM faster by using commercial air freight, and some locations are reached faster using military airlift.²³ At the time of this 2008 study, locations that were hubs on main military airlift routes were generally reached faster by military airlift, and other smaller volume locations were reached faster by commercial airlift.

Transportation Modality and Infrastructure

Commercial air freight can reach most locations in USCENTCOM, but there are a few locations only reachable by military airlift. Ground transportation is not typically used for medical materiel due to its unreliability.

Response for Contingency Operations

USAMMCE and USAMMC-SWA both deliver items to locations in USCENTCOM, and both organizations hold materiel to be used if demand surges beyond typical levels or if the supply chain is interrupted between the United States and USCENTCOM. Table 2.7 summarizes the USCENTCOM military logistics scenario.

²³ Welser, Yoho, Robbins, Peltz, Van Roo, Resnick, and Harper, 2010.

Table 2.7
USCENTCOM Summary

Decision Framework	State of World	Effect
Units (ordering procedures)	Several MTFs, many operational units.	All units order materiel through the TLAMM, which sources the items from USAMMCE and USAMMC-SWA.
Distance from PV and hubs (buffer)	Commercial air freight delivers materiel from USAMMCE in four to five days, from USAMMC-SWA in three to four days.	USCENTCOM units hold materiel to buffer against delayed delivery from warehouses and medlog companies.
Transportation (steady state practice)	Reliable commercial air freight from intermediate warehouses to units, but it is expensive.	Use commercial freight, but try to avoid the expense.
Contingency response	Current operations can be considered contingency operations.	Ensure robust capability to deliver materiel to end users via military airlift if necessary.

Section Summary

In this introduction section we surveyed the geographic regions where DoD supports its overseas units with medical materiel. We introduced a decision framework that helps account for key differences in the mission to provide medical materiel in each theater, and how DoD has responded to these conditions in establishing its current medical logistics enterprise. While we state the current practice in this introduction, we will describe policy options in the next chapter that present opportunities for efficiency without sacrificing capability.

Having described an overview of the medical logistics enterprise in each COCOM, the following chapters will discuss value-chain activities, giving insight into factors that have led DoD to supply medical materiel as it currently does, and any opportunities we observe to gain efficiency without sacrificing capability or, ultimately, patient care.

3. Contracting / Catalog Management

DoD spent approximately \$4.7 billion in fiscal 2010 to procure medical materiel, and nearly 80 percent was procured through acquisition programs (PV and ECAT) managed by DLA and using federal pricing agreements. These items are purchased at prices determined to be advantageous to the federal government, through methods such as the Federal Supply Schedule, Distribution and Pricing Agreements, or other contracts established by DLA or the Department of Veterans Affairs.

When considering opportunities to gain efficiency, organizations frequently look for ways in which operations that are currently fractioned can be consolidated to gain efficiencies and implement best practices. We can consider the medical materiel that is procured through federal government best-price contracts to be procured in exactly such a way. Observing the well-functioning system of pooled purchase contracts that DoD and federal government currently implement, we did not perform additional research to investigate opportunities to centrally procure materiel at a lower purchase price.

When DoD health care beneficiaries purchase prescription medication through non-DoD pharmacies, their purchases are processed through a pharmacy benefit manager that works with TRICARE. It would be interesting to compare the effective price DoD pays for prescription medication purchased by its beneficiaries at commercial retail outlets with the price that military units pay through DoD.

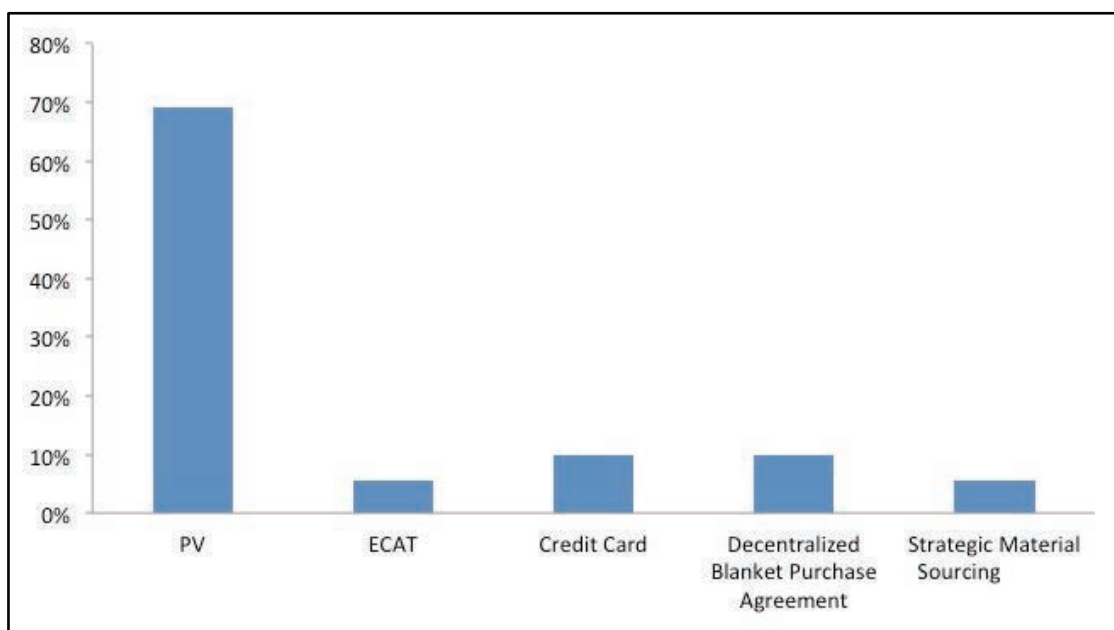
While visiting MTFs and warehouses outside the United States, we learned that each organization maintains a procurement division to ensure that proper and sufficient materiel is available to meet its needs. Local contracting staff were responsible for managing PV and ECAT orders and deliveries and for managing local procurement through credit card purchases, an activity designed as a last recourse to procure materiel when it is not available in a satisfactory time line from globally managed suppliers. Local contracting staff were also responsible for taking new item requests from local users, comparing them to existing products to ensure comparable items are not already available (substitutions), and then working with DLA to add items with an appropriate pricing contract to the central medical materiel computer catalog, along with other characteristic information such as item description, product identification number, and price.

Besides procuring materiel from PVs, medical materiel agents can also contract individually to procure medical materiel, and they too can use credit cards for small purchases. These service methods of procuring materiel are designed for use in instances where the DLA contracts cannot deliver the desired materiel in the time required, or the manufacturers and suppliers of the materiel choose not to participate in the ECAT or do business with the PVs. As an illustrative example, we can show the case of USAMMC-K. In briefings they shared with us, we observed

that in the 12 months leading up to February 2011, USAMMC-K procured 75 percent of its materiel from PV and ECAT. We would estimate that installations located closer to PV distribution centers in CONUS would purchase slightly more items from PV and ECAT and fewer items with credit cards because of greater availability of ECAT items for CONUS distribution than OCONUS distribution and because shorter PV delivery times alleviate demand for rush orders procured by local purchase (Figure 3.1).

As PV items make up approximately 80 percent of medical materiel purchased by DoD, the focus of this study is the procurement and transportation of them. The DLA PV and ECAT programs, supported by TRANSCOM Cat A contracts for OCONUS customers, enable the delivery of these items to their first destination. For expediency, we will refer to the PV and ECAT suppliers as *PV suppliers*. Materiel procured through other methods can be managed locally, and practices vary by installation.²⁴ When we study sourcing and distribution from warehouses to end-user locations, we will consider medical materiel purchased through all procurement methods, as they are treated similarly.

Figure 3.1
Purchases at USAMMC-K, Feb. 2010 – Feb. 2011



SOURCE: USAMMC-K production briefing.

²⁴ It is worth noting that observations taken during our site visits indicate that credit card purchases at some locations are excessive (far beyond what we see at USAMMC-K) and that some location-specific efficiencies might be identified by performing site-by-site audits.

During this activity, the medical logistics enterprise has the opportunity to manage which items are readily available for end users to procure. By only populating item data for standardized items, the medical logistics enterprise can restrict the diversity of items used in the field, which may have many benefits. Standardizing medical equipment (as opposed to consumables) that is in use in deployed environments can both mitigate interoperability challenges and lessen the burden on the maintenance community, allowing maintainers to support a smaller variety of items. Standardizing consumable items downrange can also lend great efficiency in the supply chain, allowing smaller quantities of stock to buffer against supply-chain interruptions or surges in demand, and can normalize DoD-wide orders to suppliers, which can present an opportunity to work with suppliers to better meet orders.

Restricting availability of PV items during catalog management may not be a simple solution; items must be assessed for clinical equivalency. Nor will restricting availability of PV items alone be sufficient to achieve greater uniformity of fielded medical materiel. As long as end users have the ability to circumvent PV programs through local purchase, promoting clinician use of common materiel through training and other opportunities will be necessary to achieve the desired effects of supply-chain efficiency and greater interoperability.

The cost to the enterprise of performing catalog management may not be great compared with the significant costs of transportation and warehousing. However, we suggest that catalog management as an activity could involve efficiencies if the performance of activities were to be consolidated at a centralized location that supports global locations remotely, rather than being performed individually at each warehouse and installation globally, as is currently done.

Opportunities for Efficiencies

DLA has incorporated 80 percent of medical materiel procurement into the PV contracts and the ECAT system of procurement. Each of these methods is managed centrally across DoD, by DLA, and leverage the available bulk purchasing power of the entire federal government through federally negotiated purchase prices. We do not see any salient opportunity for efficiency in this process, which is already highly centralized and focused on efficiency.

MTFs maintain staff at each installation to do local procurement. We understand this can require local staff to meet with local suppliers. When we visited OCONUS MTFs, we observed that some MTFs had more robust capability to do local procurement than others. Further, some organizations appeared to have a more mature and managed approach to such procurement. We recommend that it may be possible to consolidate local procurement capabilities among MTFs that are geographically close, thus making it possible to maintain a sufficient local presence to meet with local suppliers while gaining efficiency through economies of scale in collocating procurement staff. Efficiencies can also be gained through procurement best practices if it is possible to retain the best experts at local procurement and place more procurement staff with them to adopt their best practices.

Since local procurement is a method designed to supply materiel to end users when it cannot be made available in a reasonable amount of time from central sources, it is important that local procurement staff have access and familiarity with local suppliers. This would imply that decentralized local procurement should work well. However, when we visited OCONUS warehouses and MTFs, we found that each individual organization maintained staff to perform this activity, even when the organizations were fairly close geographically. Some organizations had a large staff performing local procurement, others had a small one. In order to gain efficiencies of scale, we recommend that DoD organizations pool resources when possible to do local item procurement and ensure that best practices are employed. Considering the different methods of payment when organizations from different services or agencies are involved, there may be a challenge to implement a shared local procurement activity, but based on the potential rewards in efficiency, we recommend considering options to work around this hurdle.

We estimate the order of magnitude of effort required to locally procure medical materiel for OCONUS MTFs with this single data point: While visiting the naval hospital in Okinawa, we learned they have 12 staff dedicated solely to local purchases.²⁵ According to data from the TRICARE Management Activity MTF finder,²⁶ there are 17 OCONUS hospitals and medical centers, seven of which are in the Pacific. Some local procurement is centralized already at USAMMCE for USEUCOM MTFs, so we will turn to the opportunity to consolidate staffing in the Pacific for an example. If each hospital in the Pacific maintains a similar staff to locally procure medical materiel (as the Navy hospital in Okinawa does), we estimate there are on the order of 125 staff at hospitals in the Pacific dedicated to purchasing medical materiel locally.²⁷ The opportunity to gain economies of scale by consolidating procurement operations would be a portion of the total current staffing.

Catalog management: Catalog management can be performed at a variety of locations: locally at MTFs; centrally at medical materiel agents; or at a single, consolidated location, akin to the Defense Medical Logistics Center at Ft. Detrick. Aside from credit card purchases, all purchases of medical materiel must be executed through a valid government contract. Materiel that is procured at a federally negotiated price through a PV or ECAT contract must be processed through DLA, the manager of these contracts. There are opportunities at each stage for DoD to enforce control over the quantity and variety of medical materiel procured, thereby representing opportunities for efficiencies.

We suggest that centralizing the activity of entering new item data into the catalog to allow additional items to be procured through the DLA-managed contracts could have several benefits. First, there may be efficiencies to performing this activity by centralizing all the necessary manpower and infrastructure at a gathered location; this task can certainly be performed

²⁵ Interview with Naval Hospital Okinawa staff, 2011.

²⁶ TRICARE, *MTF Locator*, web page, undated.

²⁷ This estimate may be high, as the Naval Hospital Okinawa is the largest OCONUS Navy hospital.

remotely via IT telecommunications. When we asked local MTFs and warehouses why they thought it was important to keep this activity distributed at a local level, the common response was that customer support could be met more easily when the staff doing catalog management are separated from the materiel consumers by only a local phone call. Second, whether the problem of providing support remotely is due to a lack of communications capability at forward locations or a need for contracting staff who can work hours outside of a 9 a.m.–5 p.m. EST workday in order to be available to overseas organizations, either of these problems can be mitigated easily. Last, based on both theory and experience in comparable communities, we suggest that centralizing catalog management could be an opportunity to implement rigor in standardizing the set of fielded medical materiel. But even after addressing catalog issues, the question remains of how to manage local procurement efficiently.

DoD has decided to permit military units to purchase all commercially available medical materiel as a way for providers to work as they choose in providing the highest quality medical care possible. We can use data from USAMMCE as an example of the number of items that are requested in a year by end users in USEUCOM and USCENTCOM. Over the course of a 12-month period in 2010–2011, USAMMCE received approximately 6,800 new item requests from external end users. During this same time period, due to the rate of turnover in commercially available items, USAMMCE incurred a burden to find approximately 10,000 substitute or equivalent items for those it had previously held in inventory. In total, USAMMCE faced a demand for 17,000 new items, in comparison to the 33,000 items it held in inventory at the time.²⁸ USAMMCE was faced with either inducting these items into the catalog of commercially available medical materiel with federally approved purchase prices and handling characteristics, or denying the items entry into the catalog by citing clinical redundancy.

When DoD implemented PV sourcing of medical materiel, it was relatively easy to ignore standardization and expand the line of medical materiel available to providers because DoD did not need to maintain inventories of this medical materiel to support end users in CONUS. MTFs could maintain small caches of inventory in MTF supply rooms, and rely on PVs to replenish supplies in one to two days.

When the military designs assemblages of materiel to store in inventory in case of deployments, it restricts these assemblages to materiel that is fully developed with NSN data and restricts the variety of materiel that makes up these assemblages.²⁹ Then, if military units do deploy, they can rely on resupply of NSN-based medical materiel through the same logistics channels as the balance of military materiel.

Since the recent cohort of military providers have gained clinical experience working in MTFs that are supplied by PVs with the full breadth of commercially available medical

²⁸ USAMMCE production report, March 2011.

²⁹ In anticipation of a deployment, units may tailor assemblages to the specific mission.

materiel,³⁰ these providers have sought upon deployment to use the materiel with which they are accustomed. DoD has sought to support this desire to promote optimal conditions for patient care.

There are exceptions to this policy. But for the recent addition of a fleet PV program, the Navy only allows materiel in its authorized medical allowance list and authorized dental allowance list to be supplied to ships. To gain perspective on this issue, we met with the chief of the British medical service, who told us that the United Kingdom (UK) restricts materiel used by its deployed medical units to materiel that is developed for its sets.³¹ To help its providers become comfortable working in the environment with military developed materiel, the UK rotates its providers through an MTF in Great Britain that uses only military developed medical materiel for an orientation of several months before its service members deploy.

Aside from OCONUS fixed-facility MTFs, if DoD were to focus on restricting materiel used by deployed units—units that may be reliant upon intermediate warehousing support—it could achieve efficiencies in its medical materiel supply chain. The efficiencies would be achieved mostly in intermediate warehousing, and somewhat in shipping materiel in the second leg and receiving materiel at the location of the end user. As there are no economies of scale for purchasing individual items in the PV structure, there would be no efficiency in reducing variety of items purchased or first-leg delivery, which is covered in the PV service.

Achieving efficiency in inventory storage and management by standardizing items is a well-understood method of gaining efficiency in supply-chain management.³² If the breadth of materiel ordered by deployed OCONUS end users were restricted, warehouses responsible for distributing such medical materiel could hold a smaller variety and quantity of it, thus reducing the workload for placing it in inventory, Care of Supplies in Storage (which involves inspecting and preventing deterioration), picking, and packing. Shipping materiel across the second leg could gain slight efficiencies, if the reduced variety of materiel allowed for reduced shipments. We do not expect weight shipped would change significantly. If receiving a smaller variety of materiel reduced workload, slight efficiencies may be gained in receiving at warehouses and end users—but, again, we expect volume of materiel received to be consistent.

Lastly, these effects can be achieved even if only deployed end users restrict the variety of items ordered. If intermediate warehouses are only used to support deployed units that have little organic materiel handling and storage capability, and PVs deliver a broader range of items direct to OCONUS fixed-facility MTFs, significant supply-chain efficiencies could be gained.

³⁰ We refer here to providers who have entered the military since the adoption of the medical PV system.

³¹ Interview with British Medical Service, 2011.

³² Kenneth R. Baker, Michael J. Magazine, and Henry L. W. Nuttle, “The Effect of Commonality on Safety Stock in a Simple Inventory Model” *Management Science*, Vol. 32, No. 8, August 1986, pp. 982–988.

Section Summary

The purchase price paid for medical materiel is the dominating cost in the mission to provide medical materiel to military units. DLA has enacted PV and other contracts to support all military units that make it possible for units around the world to purchase items at federally negotiated prices. As DoD only accounts for approximately 1 percent of the total U.S. market, well-negotiated prices for commercial items is an efficient solution to purchasing low-cost materiel. We believe the contracts negotiated by DLA represent the predominance of efficiencies available in procuring materiel. However, there remain opportunities—not only for efficiency in contracting to procure items not included in the DLA contracts, but also for managing the materiel catalog.

We recommend that, when possible, military units that are located nearby consolidate local contracting for economies of scale and to share best practices. We also recommend that DoD deliberately consider the variety of items available for end users to purchase in cases where they rely upon intermediate distribution support. The mission to provide intermediate warehousing could be made significantly more efficient if the variety of items provided to end users through the supply chain were decreased.

4. Transportation to First Delivery Location

For PV-supplied materiel ordered by end users in the United States, transportation from the supplier to the first delivery location is provided through the PV program at a distribution fee established in the PV contract. Further, all MTFs and some operational units are designated as ROFs and can place orders to the PV and ECAT suppliers that, depending on customer location, will be delivered within negotiated delivery times, generally one to two days. Operational units that are not ROFs typically set up accounts with MTFs at their installations, and order materiel to the MTF and pick it up locally.

Outside the United States, most MTFs and the theater medical logistics agents are designated as ROFs. But most land-based operational units are not ROFs, and must set up accounts with them through which to order PV materiel. The medical materiel PV contracts mandate that materiel must be delivered in seven days from the time of order. However, there are extensive clauses in place that restrict the circumstances under which PVs are held to the seven-day delivery standard. Ordering facilities must provide PVs with predicted item orders one month in advance, and even if they order fewer items, they may be compelled by PVs to pay for the entire predicted amount. Further, PVs are not required to meet delivery performance standards for quantities of items ordered in excess of 110 percent of the predicted amount. In addition, when an ordering facility requests an item that it has not previously ordered, the PV has 90 days to begin filling item orders. Table 4.1 describes the effective standards.

Through the Cat A contract, commercial air carriers deliver materiel from PV locations to OCONUS ROFs. USTRANSCOM negotiates rates for each commercial carrier to transport materiel to each country in which there is a ROF. DLA selects the carriers to be used and incurs the cost for this first-leg transportation. DLA then includes the Cat A shipping costs with all DLA operating expenses when setting its cost recovery rates.

Table 4.1
Exceptions to the Seven Day Delivery Standard

Circumstance	PV Delivery Schedule
Customer orders items in larger than normal quantities	37 days
Customer orders items infrequently (no order for a part or item in 90 days)	90 days ^a

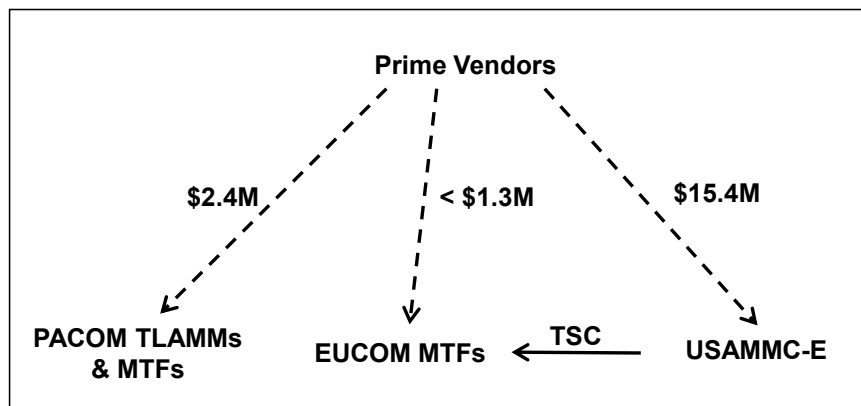
^a PVs are allowed 90 days to re-establish support for the items, after which are held to the seven- or 37-day delivery standard.

SOURCE: Defense Supply Center Philadelphia, 2009.

Because the Cat A contract supports commercial carriers delivering materiel directly from PVs to end users that are ROFs, we recommend that DoD can gain efficiency by maximizing use of this capability. When PV and ECAT suppliers ship materiel to intermediate warehouses that hold medical materiel, and the services or agencies managing the warehouses then ship the materiel to end users, the services or agencies bear the additional costs of receiving, storing, and issuing the materiel, as well as the cost of the second transportation leg.

We calculated the cost incurred by DLA to reimburse shippers to deliver materiel to its first destination through the overseas Cat A shipping contract to be \$19.1 million over the span of our study, which includes the latter half of 2010. Extrapolated to a year, DLA would incur approximately \$38 million annually to pay for shipping medical materiel overseas. As illustrated in Figure 4.1, 81 percent of these costs (\$15.4 million) were borne to ship materiel to USAMMCE. DLA paid less than \$1.3 million to ship medical materiel directly to other USEUCOM locations, and \$2.4 million to ship medical materiel to USPACOM locations. Included in the materiel shipped to USAMMCE is all the PV materiel eventually shipped to USCENCOM.

Figure 4.1
Transportation From PV to First Location



NOTE: TSC = theater support company

Opportunities for Efficiencies

Figure 4.2 shows the modality frequency for transportation of medical materiel within COCOMs. Shipping from PVs to a first destination OCONUS is done via a Cat A contract negotiated by USTRANSCOM and paid for directly by DLA. Materiel is moved by ground in CONUS, then shipped to locations in USPACOM and USEUCOM by air. Commercial carriers deliver materiel to ROFs at a fixed rate per pound, for each country. The shipping rate in the Cat A contracts is comparable to or lower than other DoD rates for commercial shipping, so we conclude there is no efficiency to be gained by shipping items via air to locations in USPACOM and USEUCOM.

Figure 4.2
Modality Frequency for Transportation of Medical Materiel Within COCOMs

	<i>Military Transportation</i>		<i>Commercial Transportation</i>		
					
NORTHCOM	Infrequent	Infrequent	Frequent	Frequent	Never
SOUTHCOM	Frequent	Frequent	Occasional	Occasional	Never
EUCOM	Infrequent	Frequent	Occasional	Frequent	Infrequent
AFRICOM	Frequent	Frequent	Occasional	Occasional	Never
CENTCOM	Occasional	Occasional	Frequent	Frequent	Never
PACOM	Occasional	Occasional	Frequent	Frequent	Infrequent

Distribution Costs

We posed the suggestion to staff working in the military medical logistics enterprise that certain medical materiel items that are ordered consistently over time, consumed in large quantities, and not perishable may be shipped via surface from PVs to locations in USEUCOM and USPACOM. This would be a paradigm shift for the medical materiel enterprise, which at the time of this study predominantly uses air freight for overseas shipping. We have not determined whether this is a viable option, or whether there is a sufficient opportunity for efficiency to warrant further study.

Additionally, it may be possible to reduce transportation costs from supplier to first delivery location at overseas sites by procuring materiel from local suppliers. Increasing supply to overseas locations from local suppliers, rather than from CONUS PVs, may only be possible if more non-FDA items are used. The FDA and EMA are working toward collaboration on product inspections,³³ but do not currently have any agreement on equivalent product approvals. Using non-FDA items in care provided to U.S. service members would require a policy change and further study for medical best practices.

To estimate the opportunity for cost savings, we observe that transportation costs ran approximately \$4.8 million annually to distribute medical materiel to USPACOM, and approximately \$33.4 million to USEUCOM (Figure 4.1). Together, these shipping costs to first-destination recipients are equivalent to 5 percent of the \$750 million procurement cost of materiel shipped OCONUS. If medical materiel can be procured locally for the same cost as

³³ EMA-FDA Good Clinical Practice Initiative, *Report on the Pilot European Medicines Agency-Q&A*, July 2011.

from CONUS PVs, a 5 percent savings would be achieved. If locally procured materiel were procured for less cost than PV-supplied materiel, savings could be greater.

In cases where DoD deploys medical capability in response to major disasters, units may provide medical care to large numbers of non-U.S. patients. Thus, although policy issues bar DoD from using non-FDA items in treating U.S. service members, DoD medical units may be able to use locally supplied medical materiel to provide care to non-U.S. patients. In interviews with staff members from Surgeon General offices of OCONUS theaters, we learned that they are working on methods to procure materiel from World Health Organization suppliers who can provide materiel more cheaply and quickly for use in such scenarios.

Implication for Inventory Management

Inconsistency in delivery time from the PV to the first delivery location makes it difficult for end users and managers of intermediate warehouses to order materiel as needed. Conversely, they must hold greater amounts of materiel in inventory to buffer against delivery time variance. Organizations like USAMMC-K and USAMMCE choose to both maintain an inventory equivalent to one month of demand by the units they support and serve as an intermediate distribution warehouse for all orders. Efficiency could be gained while continuing to maintain an inventory buffer (and turning it periodically to avoid obsolescence), with PVs sending routine usage item orders directly to end users.

By contracting for more consistent or flexible delivery of medical materiel, the medical logistics enterprise could gain efficiencies by reducing inventories while maintaining materiel availability.

In addition to the inherent inefficiency incurred by organizations that order medical materiel from PVs under uncertain delivery times, the lack of delivery guarantees may create a mission risk for medical providers. End users who are unable to order quantities of materiel far in excess of their customary amounts may face materiel shortages if they encounter mass casualty events that exhaust inventories.

Section Summary

In this chapter, we described the method by which materiel is delivered from PVs to the initial recipient. This process is very quick in the United States, with nearly next-day delivery. Outside the United States, Cat A commercial carriers can deliver materiel in approximately one week. The contract for overseas air freight provides a high level of service at a reasonable price. So for *usage items*, end users in Pacific and European regions can order materiel as they consume it and have it delivered in seven days, direct to their location from the PVs.

Other aspects of the shipping performance are less advantageous. The rigid structure defining which items qualify as usage items allows many end-user orders to be fulfilled in 37 or 97 days rather than the seven-day performance the PV contract is designed to deliver. If DoD could pool

usage projections across all its end users, this may allow for monthly variation in orders from individual units while maintaining a fairly smooth aggregate rate of demand, which would compel the PV to deliver materiel with the quicker performance standard.

5. Warehousing

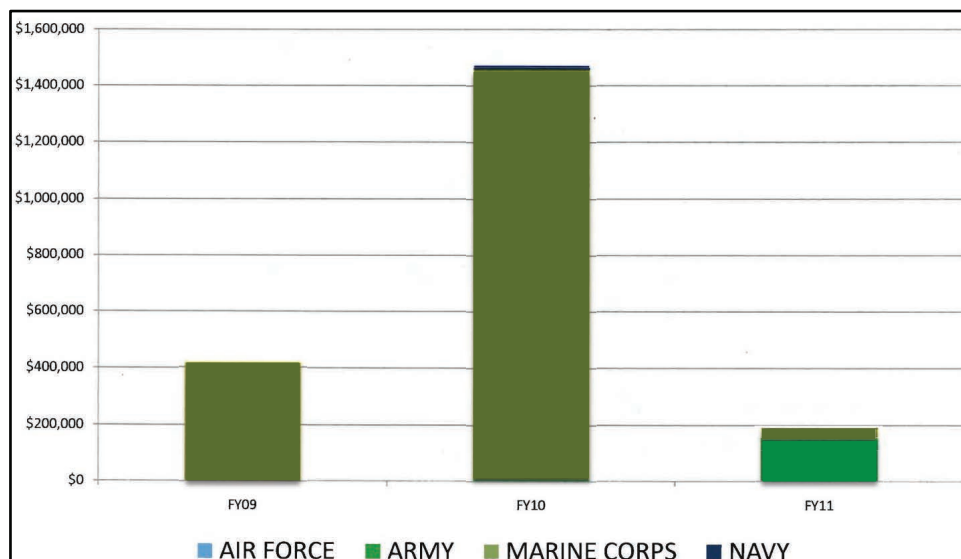
DoD stores medical materiel locally at unit locations and centrally at DoD warehouses. Each unit that consumes medical materiel must maintain a supply of materiel to meet demand that arises between supply shipments. In the United States, supply from PVs can reach purchasers in one to two days, so units who order directly from these suppliers do not need to maintain very large inventories. Outside the United States, where supply lead times are longer, units must maintain larger inventories to meet demands over these time periods. In addition to storing materiel at the end-user locations, DoD maintains inventories of medical materiel at warehouses in order to provide more responsive supply to the end users than can be had from the original suppliers directly.

In USPACOM, all MTFs order their medical materiel directly from PV suppliers. Outside of Korea, no DoD warehouses hold inventory intended for MTFs in the Pacific region. There is slight exception: On Okinawa, the 18th Medical Group that performs patient care for beneficiaries in the area of Kadena Air Force Base holds a very small amount of inventory for collocated operational units and has been designated as the TLAMM-P. In this role, it procures and ensures delivery of medical materiel to operational units in the region in the event of contingency operations. The III Marine Expeditionary Force (III MEF) lent two staff to work at the 18th Medical Group as liaison officers, and they essentially make up the standing manpower of TLAMM-P. The vast majority of issues from TLAMM-P go to the Marines at III MEF (Figure 5.1).

TLAMM-P has partnered with III MEF on an ongoing basis to order medical materiel for III MEF, and uses Marine Corps funds to that end. TLAMM-P procurement activity is separate from that of the 18th Medical Group, which uses Air Force Working Capital Funds to procure medical materiel for itself. The separate sets of funds inhibit pooling inventory, although we do not know if these end users consume similar items that would present an opportunity to do so. As a result, inventory for III MEF is not held by TLAMM-P at the 18th Medical Group, it is held in a III MEF warehouse at Camp Kinser. In exceptional cases, a small remainder of materiel purchased with Marine Corps funds may remain in the 18th Medical Group warehouse—for example, if TLAMM-P orders materiel for III MEF, in excess of the unit's immediate needs.

The Navy fleet has partnered with DLA Distribution to perform the intermediate warehousing mission for multiple classes of supplies. The Navy operates FISCs at all its main ports, to procure materiel for the fleet and manage delivering the materiel to ships' locations if they are not in port. FISCs maintain the procurement and distribution responsibilities to supply ships with materiel, but have turned over management of receiving, storing, and issuing materiel to DLA Distribution. When we visited Yokosuka, we saw the DLA Distribution Yokosuka warehouse, and met with its staff. The DLA Distribution Yokosuka warehouse holds materiel

Figure 5.1
Issues From TLAMM-P



SOURCE: TLAMM-P Workload Data, March 2011.

from many classes—including medical. The DLA warehouse at Yokosuka holds medical cold chain items, chain of custody items, and HAZMAT items. DLA Distribution Yokosuka procures and warehouses this medical materiel upon request by the FISC and Navy ship end users, but it does not manage as wide a breadth of materiel as is consumed by MTFs in USPACOM. Through the FISCs, Navy ships can only order medical materiel that has been developed and has an associated NSN. DLA warehouse management software cannot induct item information for materiel that is not associated with an NSN.³⁴

DLA Distribution Yokosuka stocks approximately 1,200–1,500 lines of medical materiel.³⁵ While this is a sizable variety of items, it is only a fraction of the variety of items at larger, dedicated Army medical intermediate warehouses. Medical items stored at DLA Distribution Yokosuka were procured with Navy funds and are considered Navy-owned. This is a contrast from the balance of materiel stored in DLA Distribution warehouses, which is generally procured with Defense Working Capital funds.

In USPACOM–Korea, the main intermediate distribution warehouse for medical materiel is USAMMC-K, at Camp Carroll. Also at Camp Carroll, DLA Distribution Korea may handle trans-shipment of a few class VIII items, but the DLA warehouse there generally stores class IX

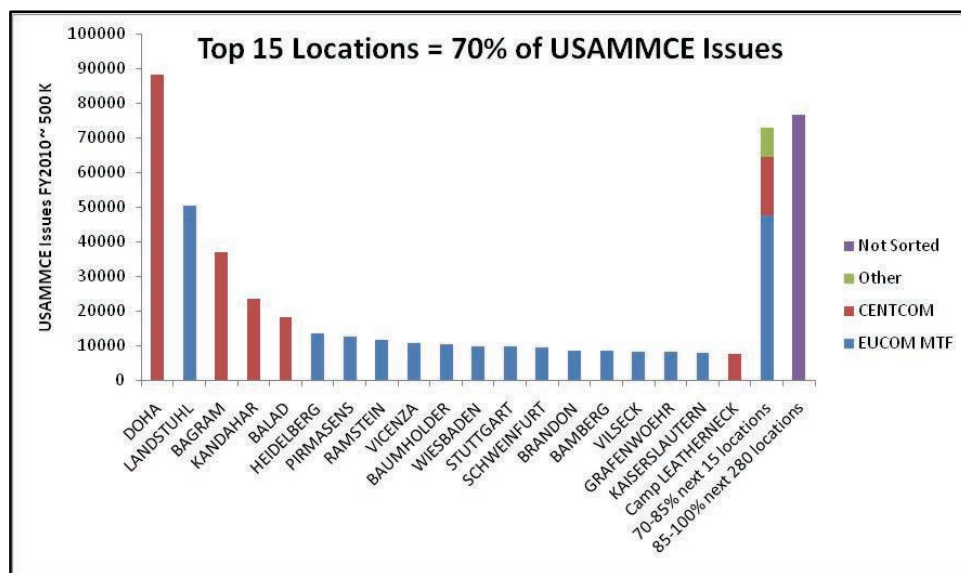
³⁴ When Navy ships are in port, they can order materiel from PVs that may not be associated with an NSN.

³⁵ DLA Distribution Yokosuka interview, 2011.

materiel. USAMMC-K holds about \$3 million of medical materiel,³⁶ the majority of which goes to the Brian Allgood Hospital at U.S. Army Garrison, Yongsan, Korea.

In Europe, the main DoD warehouse that stores medical materiel is USAMMCE, which holds \$33.5 million of medical materiel to support end users in USEUCOM, USCENTCOM, and USAFRICOM.³⁷ At the time of the study, USAMMCE supported both military users and Department of State (DoS) users in these regions. Over the latter half of 2010, USAMMCE supported approximately 300 locations. However, the top 15 locations made up 70 percent of USAMMCE issues in this time period (Figure 5.2). Far and away the biggest ordering facility from USAMMCE was USAMMC-SWA, which orders all its materiel from USAMMCE. Represented as Doha in Figure 5.2, USAMMC-SWA makes up 17 percent of issues from USAMMCE.

Figure 5.2
USAMMCE Issues



SOURCE: USAMMCE data from TEWLS, 2011.

USAMMCE also supports the MTFs in USCENTCOM directly. Including USAMMC-SWA, USCENTCOM units accounted for approximately 30 percent of the issues from USAMMCE. MTFs in USEUCOM accounted for approximately 40 percent of the issues from USAMMCE, with the largest single purchaser being Landstuhl Regional Medical Center, which procured approximately five times the amount of materiel as any other MTF from USAMMCE, and makes up 10 percent of USAMMCE issues.

³⁶ USAMMC-K, "R&A Briefing," 2011.

³⁷ USAMMCE Command Brief, 2011.

Approximately 55 percent of the manpower assigned to USAMMCE works in the inventory and distribution activities.³⁸ On this basis, we estimate that 55 percent of USAMMCE’s operating costs are associated with warehousing and distribution activities. According to a report sponsored by the JLB, it costs \$9.8 million per year to operate USAMMCE.³⁹ However, this amount excluded the cost of military personnel. If we estimate an additional annual cost of \$9.6 million to support active-duty manpower and Army civilians working at USAMMCE that brings total operating costs to \$19.4 million annually (Table 5.3) Using a similar calculation, we can estimate the cost to operate the other intermediate warehouses dedicated to holding medical materiel.

Table 5.3
Cost to Operate Military Medical Materiel Warehouses

	COCOM	Service	Lines of Stock Held	Inventory value	Organic Manpwr	Contract Manpwr	Cost (w/o organic)	Cost (with organic)
USAMMCE (Germany)	EUCOM CENTCOM AFRICOM	USA	11,000+	\$33.5M	80	319	\$9.8 M	\$19.4 M
USAMMC-SWA (Qatar)	CENTCOM	USA	2,600+	\$13.2M	73	39	\$6.5 M	\$11.8 M
USAMMC-K (South Korea)	PACOM (USFK)	USA	2,200+	\$2.5M	15	54	\$1.9 M	\$4.1 M
TLAMM-P (Japan)	PACOM	USAF	---	---	4	No	---	\$0.4 M

SOURCES: Wieczorek, 2010; USAMMCE briefing, USAMMC-K briefing, TLAMM-P briefing, USAMMC-SWA briefing, USAMMCE personnel strength

Opportunities for Efficiencies

Medical materiel is stored locally at all locations that consume it. Each location determines its inventory policies independently, presumably based on the nature of demand and resupply performance. In only a few instances, medical materiel intended for use by military units and MTFs is stored at consolidated TLAMMs and DLA-operated warehouses—particularly those DLA locations collocated with FISCs.⁴⁰

³⁸ USAMMCE Requirements, 2010.

³⁹ Wieczorek, Thomas, “Backup Data for Warehouse Consolidation” briefing, October 25, 2010.

⁴⁰ DLA Distribution warehouses and other DoD warehouses not associated with TLAMMs or FISCs may hold medical materiel in inventory for centralized programs intended for use in major disasters or large-scale contingency operations. Each service maintains stocks of prepositioned materiel that contain medical materiel, but these inventories are not intended for consumption by military units or MTFs outside of large-scale contingency operations. We explored opportunities to distribute prepositioned stocks to operational units or MTFs in advance of the items’ expiration dates to avoid the loss when the items are destroyed. The vast majority of items in

We address the costs that warehousing medical materiel incurs in two stages: first, the costs of holding the inventory; second, the effort required to process the inventory from receipt, to storage, and issuing for distribution.

Cost of Holding Inventory

Holding materiel in inventory incurs an opportunity cost based on the value of the materiel, consumes resources to physically house the inventory, requires effort to ensure that the materiel remains in serviceable condition, and some materiel is attrited due to obsolescence.

In some industries, the opportunity cost of inventory could be assessed as the cost of capital. In the case of DoD, dollars that are tied up in inventory cannot be used by the federal government for another purpose. Were the inventory liquidated, the federal government could reduce the borrowing it performs every year to manage the federal budget deficit. However, as the current federal rate of borrowing is close to 1 percent, we ignore the cost of capital for DoD materiel. This assumption is consistent with other assessments of the component of DoD inventory holding costs represented by the opportunity cost of capital.⁴¹

It is difficult to assess how much it costs to house materiel at DoD warehouses because

- many of the capital costs of infrastructure are not borne by the organizations performing warehouse operations
- those costs are assessed as an aggregate to the military agency running the installation.⁴²

However, we can partially account for the cost of facilities with the upkeep costs reported in the JLB report.⁴³

We estimated the cost of obsolescence using reports from the Army medical materiel agents that list the items destroyed and the inventory of items nearing their expiration. A report from USAMMC-K shows that 2 percent of the inventory (by cost) intended for end users was nearing

prepositioned inventories (approximately 80 percent from Army) are not the items consumed by operational units and MTFs, so the opportunity to gain efficiency by distributing this materiel is on the order of several million dollars annually, rather than tens of millions of dollars. To gain even the efficiencies available by distributing prepositioned items near their expiration to operational units and MTFs, DoD would need to perform financial machinations, as the funds used to purchase prepositioned materiel may preclude their use in operations outside their intended contingency use.

⁴¹ James W. Anderson, *Defense National Stockpile Holding Costs*, Defense Logistics Agency, Alexandria, Va.: Defense Logistics Agency, AD-A233 757 DLA-90-P00165, May 1990. "Each dollar invested in [Defense National Stockpile] DNS commodities is viewed as replacing a dollar of investment in the private sector. That is, a dollar returned to the Treasury from a public investment represents a dollar that is not removed from the population through borrowing or taxation. If the Stockpile is sold and the proceeds are returned to the Treasury, they can be used for other Government purposes. Conceptually, this reduces the amount of money required to be removed from the public through taxation or borrowing." See also, Robert Bickel, *Improving Air Force, Purchasing and Supply Management of Spare Parts*, Santa Monica, Calif.: RAND Corporation, RGSD-173, 2003.

⁴² Methodology to consider very low marginal direct operating costs of holding inventory is consistent with Anderson, 1990.

⁴³ Wieczorek, 2010.

expiration within 90 days,⁴⁴ as was a sizable quantity of pharmaceuticals intended solely for major disasters. Using the very basic approximation that slightly less than 2 percent of items expire every quarter, we estimate that approximately 5 percent of items intended for distribution to end users may expire annually and be considered an obsolescence cost. Using this estimate and the inventory data provided to us, we project that each of the dedicated medical materiel intermediate warehouses may incur a cost of obsolescence of 5 percent of their inventory, which we show in Table 5.2.

Table 5.2
Projected Annual Costs of Obsolescence at Medical Materiel Warehouses

Organization	Inventory Value	Project Cost of Obsolescence
USAMMCE	\$33.5M	\$1.7M
USAMMC-SWA	\$13.2M	\$0.7M
USAMMC-K	\$2.5M	\$0.13M
TLAMM-P	<\$1M	

It is possible that the quantity of inventory held at DoD locations may be decreased through optimizing inventory levels. Currently, MTFs and distribution centers generally order materiel on the basis of stock level policies, where stock levels are set proportionate to historic monthly demand for items, or lead-time demand for items. We described the cost of holding inventory at MTFs and distribution centers as driven by obsolescence, rather than opportunity cost of capital or marginal direct operating costs. We know medical logistics staff members are taking steps to manage these costs: We observed processes in place at distribution centers to preferentially ship items with approaching expiration dates. The challenge of minimizing costs due to obsolescence can only be lessened by carefully managing inventory levels, keeping materiel on hand at the minimum quantity necessary to ensure orders are filled to desired performance levels.

Cost of Processing Inventory

We propose that the medical logistics enterprise can gain efficiency by reducing the intermediate handling that occurs after materiel has been issued from the supplier and before it is received by the end user. Under the current PV and Cat A contract for Class VIII materiel, the cost to issue materiel from suppliers and ship it to locations in USPACOM and USEUCOM includes few economies of scale associated with ordering larger batch sizes.

⁴⁴ USAMMC-K production report, 2011.

There are no discounts for purchasing large quantities of individual items rather than purchasing several smaller orders. Shipping rates are largely determined by weight, so shipping one large package costs approximately the same as shipping several smaller ones.

Further, shipping costs in the Cat A contract are the same for all destinations in a country. All the packages that go through USAMMC-K can be shipped directly to end user locations in Korea for the same cost. Approximately 80 percent of the packages distributed to Europe MTFs through USAMMCE go to MTFs that are also in Germany.

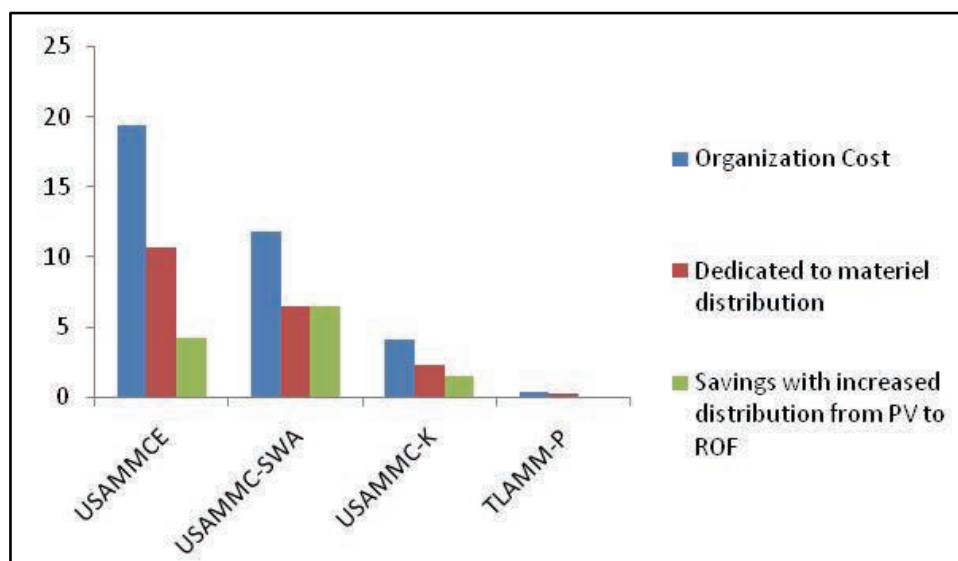
Thus, DoD can purchase and ship materiel directly from PVs to the end users in Korea and Europe who are served by USAMMC-K and USAMMCE for essentially the same cost it currently incurs shipping that materiel to these materiel agents. DoD should maximize the service it receives from PVs and commercial shippers under the Cat A contract by ordering materiel direct to ROFs as much as possible. We will discuss potential efficiencies and risks of this policy.

The first notable opportunity for efficiency by ordering materiel directly to ROFS rather than intermediate warehouses is the elimination of double-touching. When materiel flows to end users through DoD warehouses, DoD personnel and other-nation staff who work at these organizations must receive the materiel, store it in inventory, pick the materiel, and issue it to the end user. By eliminating these steps, DoD would save the costs associated with these activities.

We estimated that 55 percent of the costs associated with operating USAMMCE result from the mission to receive, warehouse, and issue materiel, with the balance of USAMMCE costs associated with its other missions, such as optical fabrication and equipment maintenance. For simplicity, we will use this factor to estimate the portion of the other TLAMMs' costs that are associated with materiel distribution.

We showed that 40 percent of USAMMCE issues are to MTFs in Europe, and estimate the savings if USAMMCE decreased its distribution mission by this amount. We estimate that 65 percent of USAMMC-K issues are to the Brian Allgood MTF and could be accomplished with direct PV delivery. In a later section devoted specifically to USCENCOM, we will propose that USAMMC-SWA could cease operations as a distribution center, decreasing its cost to distribute materiel by 100 percent. These savings are displayed in Figure 5.3.

Figure 5.3
Costs to Distribute Medical Materiel and Proposed Savings



The primary risk associated with this policy is that end users who were accustomed to receiving materiel from warehouses may experience longer lead times for orders when they receive materiel from PVs directly. Looking at end users who routinely received materiel from USAMMCE in 2010, we observed that these end users received materiel from USAMMCE approximately one to two days after ordering. If these end users were to place orders directly with PVs, they could expect to receive materiel in approximately the seven-day delivery performance that PVs are contracted to provide. However, we note that USAMMCE fills only approximately 65 percent of orders placed to it, so MTFs in Europe that routinely order materiel to be delivered through USAMMCE are accustomed to receiving materiel in seven or more days for the 35 percent of materiel orders not filled from USAMMCE inventory.

With longer delivery times, end users may choose to stock more inventory locally. Although this would increase inventory costs at MTFs, the increase in delivery lead time is only from one to two days to approximately seven (for 65 percent of item requests that are filled at USAMMC), so we do not anticipate that the MTFs will respond by increasing local inventory dramatically. In cases where locations are proximate, MTFs may continue to find opportunities to pool inventory for infrequently used items, either at MTFs or intermediate warehouses. Clearly, when MTFs move to order more materiel directly from PVs, the coordination of inventory at the MTFs and at USAMMCE will be important to address when acting to gain this efficiency.⁴⁵

⁴⁵ We propose, but do not prove, an optimal inventory policy for OCONUS MTFs and distribution centers. Considering that PVs must fill demands for usage items, so long as demand is projected one month in advance, we recommend that:

- MTFs and distribution centers in an OCONUS theater should collectively hold sufficient inventory to meet one month's demands, plus a buffer to ensure service levels.

Our points of contact in the U.S. Army Medical Command have described the importance of the buffer capability that USAMMCE provides, holding materiel in inventory that can be used to meet end-user demands if the supply chain from the United States is interrupted. USAMMCE can still meet this mission, hold whatever inventory it determines is appropriate, and still achieve the efficiencies from ceasing to receive, store, and issue materiel to resupply end users in USEUCOM for steady-state operations.

The same paradigm applies to USPACOM–Korea. We recommend that ROFs in Korea order as much materiel as possible directly from PVs in order to gain the greatest value from the PV and Cat A contracts. We make the same recommendation for USAMMC-K as for USAMMCE, as it can hold inventory to support units in Korea should the supply chain from CONUS be interrupted, and provide this capability while reducing the cost of receiving, storing, and issuing materiel to Korean end users who are also ROFs.

We point out that these estimates of cost savings from shipping materiel direct to end users—bypassing intermediate warehouses—may be an upper bound on the associated savings to DoD. If MTFs in Europe are responsible for ordering materiel directly from PV suppliers, they will generally face longer procurement lead times. When USAMMCE fills orders, it delivers materiel to USEUCOM installations in one to two days. If USEUCOM MTFs order materiel directly from PV suppliers, they will only receive the contracted performance from these suppliers, which is described in detail in the contracting section. There may be costs associated with increased inventory at end-user locations.

The opportunities for efficiency we recommend for USAMMCE and USEUCOM, USAMMC-SWA and USCENCOM, and USAMMC-K and USPACOM-Korea, do not apply to most USPACOM units outside of Korea. In most cases, ROFs in this theater currently order materiel directly from PVs.

Section Summary

We recommend that DoD reduce the extent to which intermediate distribution warehouses are used to supply materiel to end users that are themselves PV ROFs. When possible, we recommend shipping materiel directly from PVs to end users as the shipping costs are the same to all locations in a country, and there are few efficiencies for bulk orders.⁴⁶ Applying this policy to USAMMCE and USAMMC-K, we estimate DoD could save approximately \$6 million dollars

-
- PVs should ship materiel directly to users, as shipping costs are the same to all ROFs in a theater.
 - Buffer stock should be allocated efficiently among MTFs and distribution centers, given the fixed facility costs, holding costs, and transportation times between distribution centers and MTFs.

⁴⁶ The appendix describes actions taken in response to this recommendation, subsequent to the project sponsor briefing in August 2011.

annually.⁴⁷ We also recommend that DoD cease using USAMMC-SWA as a distribution point for current operations, as USAMMCE can ship materiel to the same set of delivery locations at a lower shipping cost. Closing USAMMC-SWA as a distribution point could save DoD on the order of an additional \$6 million annually.⁴⁸

To enact these policy changes, DoD should also decrease the inventory at the intermediate distribution warehouses used as a buffer against surges in demand or supply-chain interruptions. As a complementary policy, DoD should consider the aggregate amount and type of materiel that it forward positions across its warehouses, treatment facilities, operational units, and central stores, to ensure it is efficiently providing the buffer against supply chain risk and demand surges it seeks to support its missions

⁴⁷ Savings in distribution center costs by shipping direct from PV to MTFs amount to \$4 million by reducing shipments from USAMMCE to MTFs, and \$2 million by reducing shipments from USAMMC-K to MTFs (Figure 5.3).

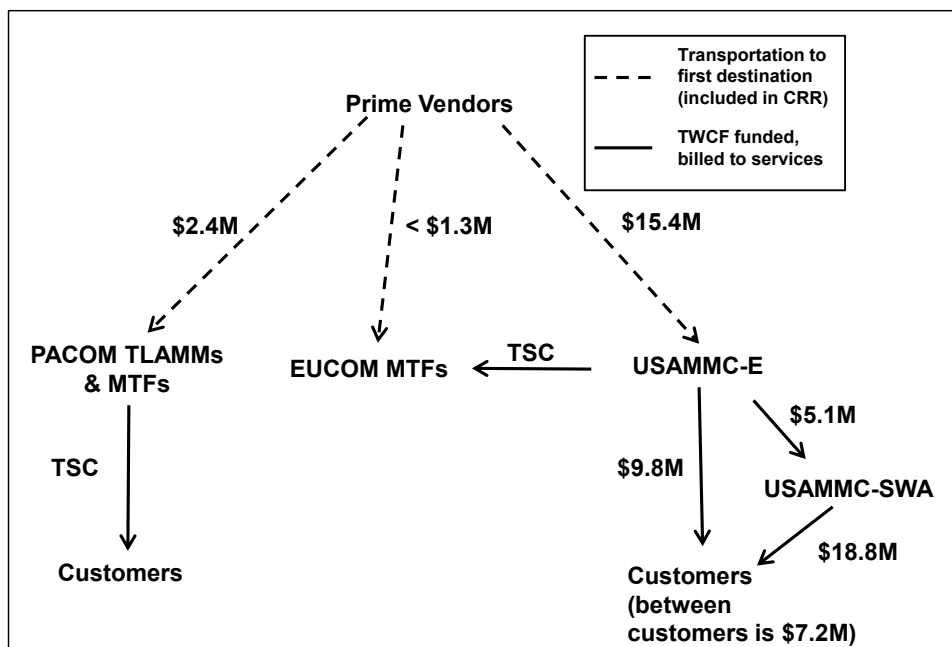
⁴⁸ This reflects the cost of operating USAMMC-SWA associated with distribution mission (Figure 5.3). The appendix describes actions taken in response to this recommendation, subsequent to the project sponsor briefing in August 2011.

6. Transportation to End-User

In the United States, most consumers of medical materiel are ROFs in the PV contracts that receive materiel direct from PVs. Most operational units, such as infantry or combat units at Army installations, place orders with the MTF at their installation, which places the orders for the operational units along with the rest of its medical materiel orders. Operational units that place orders with local MTFs can use unit or installation vehicles to pick up the materiel when it arrives at the MTF.

In USSOUTHCOM, units either receive medical materiel from military service suppliers (in the instance where the MTF at Guantanamo Bay receives materiel with direct support from the Navy), or during contingencies from AFMOA, the TLAMM for USSOUTHCOM. Depending on whether the end user's location is reachable by commercial transportation, AFMOA will contract for delivery of materiel using the Worldwide Express (WWX) USTRANSCOM contracts. If the end-user location is not reachable by commercial transportation, AFMOA will arrange for military transport by coordinating with the Tanker Airlift Control Center at Scott Air Force Base in Illinois to obtain sufficient airlift. For users outside USNORTHCOM and USSOUTHCOM, we display the general picture of medical materiel distribution in Figure 6.1.

Figure 6.1
Medical Materiel Transportation Networks with Semiannual Costs



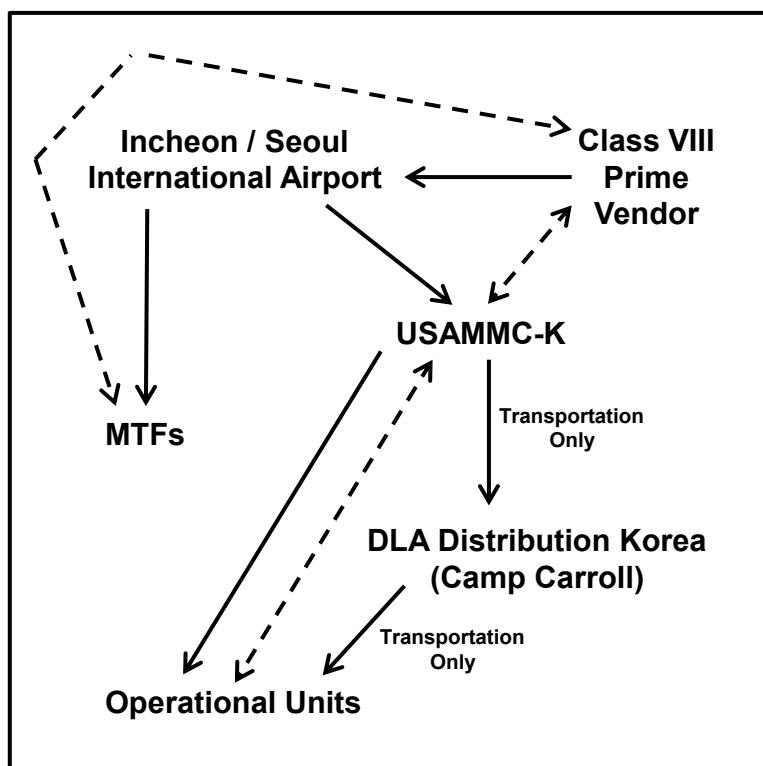
NOTE: TWCF = Transportation Working Capital Fund

SOURCE: Cat A contract and USTRANSCOM, Class VIII tender actuals data.

In USEUCOM, end users receive their medical materiel through a number of means. Many MTFs order materiel directly from the PVs, and do not require a second transportation leg. In general, the only intermediate warehouse for USEUCOM is at USAMMCE, which delivers medical materiel to the MTFs and operational units that it supports by ground transportation such as the TSC, which are trucks operated by U.S. military organizations; German organizations partnered with the U.S. military; or, less frequently, commercial ground freight. As the distances are not vast, all locations that receive medical materiel from USAMMCE are reachable by ground transportation within 24 hours. However, some locations only receive trucks on certain days of the week, so the second leg of medical materiel distribution in Europe requires one to two days.

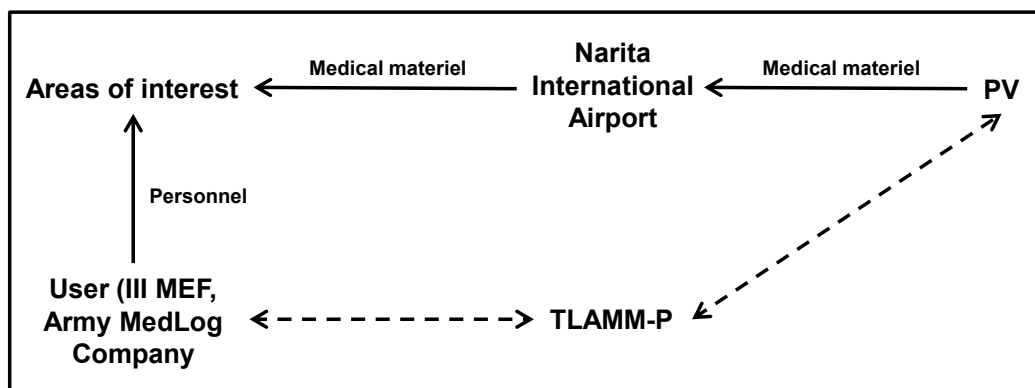
In USPACOM, MTFs generally receive their medical materiel directly from the PVs, requiring no second leg of distribution. When TLAMM-P has placed orders for units who are in deployed locations, they received their medical materiel directly from the PV when their location was reachable by commercial transportation. The general concept for medical materiel distribution in both USPACOM-Korea and the balance of USPACOM are shown in Figures 6.2 and 6.3.

Figure 6.2
USPACOM–Korea Medical Materiel Transportation Network



NOTE: Route information from interviews with USAMMC-K staff.

Figure 6.3
USPACOM (All but Korea) Medical Materiel Transportation Network



NOTE: Route information from interviews with TLAMM-P staff.

In Korea, Army units are an exception to the general practice where MTFs in USPACOM receive most of their medical materiel directly from PVs. All Army units, including the Brian Allgood hospital at Yongsan Army Garrison in Seoul, receive their medical materiel primarily via USAMMC-K. In the case of Brian Allgood Hospital, medical materiel is flown via the Cat A contract for medical materiel distribution from PV locations on the U.S. West Coast to Seoul Incheon International Airport. The materiel is trucked past the Seoul metropolitan area, within 15 miles of Yongsan Army Garrison, and carried roughly 200 miles south to Camp Carroll, where USAMMC-K is located. The Brian Allgood hospital makes up approximately 67 percent of the issues from USAMMC-K. When it receives materiel from USAMMC-K, the same method is used in reverse, with trucks transporting the materiel 200 miles north again to the MTF.

In USPACOM outside of Korea, MTFs receive materiel directly from PVs. Navy ships can order medical materiel through several means, such as the Fleet PV (which is managed differently from other medical PVs), or via a TLAMM or MTF. If ships are in port, they may receive such materiel at the port through installation delivery services.

Navy ships can also order medical materiel through the FISC, utilizing an intermediate warehouse to distribute medical materiel, which makes them an exception in USPACOM. Orders for medical materiel placed through the FISC are delivered to DLA Distribution warehouses (similar to other classes of supplies that Navy ships order through the FISC.) DLA receives the materiel and inducts it into DLA data systems. If the ships are in port and collocated with DLA Distribution (at Yokosuka) installation delivery services can deliver the materiel to the ships. If the ships are not on the same installation, DLA Distribution uses ground transportation trucks to deliver materiel to the end users. As in USEUCOM, it is possible for trucks to deliver materiel from DLA Distribution to end users within 24 hours. Trucks may not operate all routes on all days, however, so if ships are in port, they can receive their materiel within one to three days from when it is issued from DLA Distribution.

When ships are at sea, it is the FISC's responsibility to deliver medical materiel to the ships in a process that may take seven to 21 days from the time materiel arrives in USPACOM.

USCENTCOM is far and away the most complicated theater for final delivery of medical materiel. There are many locations where operational units consume medical materiel, that are distant from an MTF; only a few locations in USCENTCOM are included on the PV contract, and they are logistics hubs; and the active conflict in this theater creates an uncertain planning environment with dynamically changing demands, and potentially high demand for medical materiel.

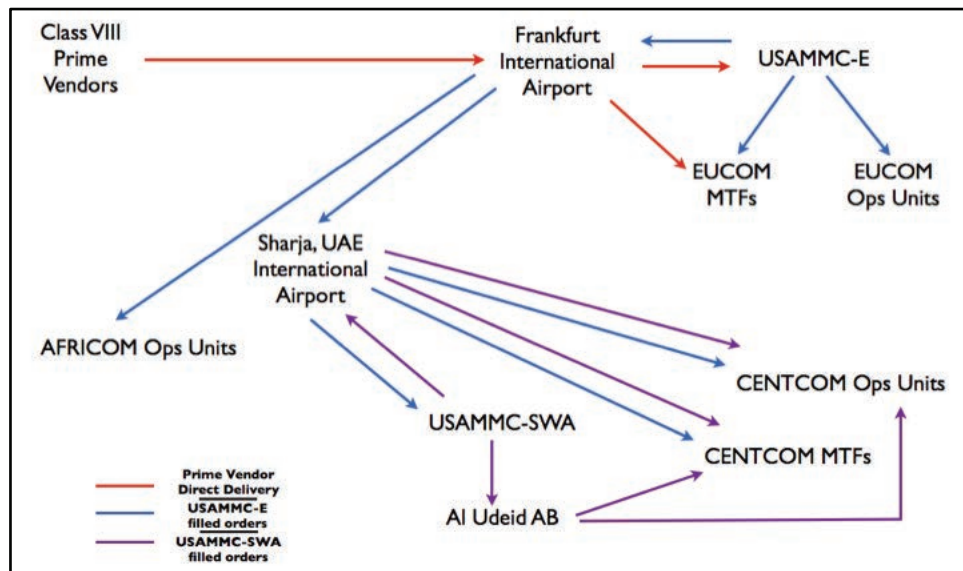
All medical materiel that originates at a PV and is consumed in USCENTCOM passes through USAMMCE. After USAMMCE, this materiel may spend time in inventory at USAMMC-SWA, then be stored at a forward-positioned medical logistics company before being delivered to the end user.

Materiel staged at intermediate warehouses provides a buffer against supply-chain interruptions and surges in demand. It also speeds replenishment time for end users with little inventory capability, and allows a transition between modes of transportation. Inventory staged at USAMMCE provides a buffer against supply-chain interruptions between the United States and Europe, inventory staged at USAMMC-SWA similarly buffers against supply-chain interruptions between Europe and Southwest Asia. However, staging inventories at these locations incurs the costs of additional material handling and further legs of transportation.

Medical materiel that is transported either into USCENTCOM or between USCENTCOM locations generally moves by military or commercial lift—at a level of service and price negotiated through the Class VIII tender. Once far forward, medical logistics teams either rely on local logistics providers to move materiel to end-user locations, or use unit vehicles to pick up medical materiel. Figure 6.4 depicts a simplified explanation of medical materiel flow into USCENTCOM.

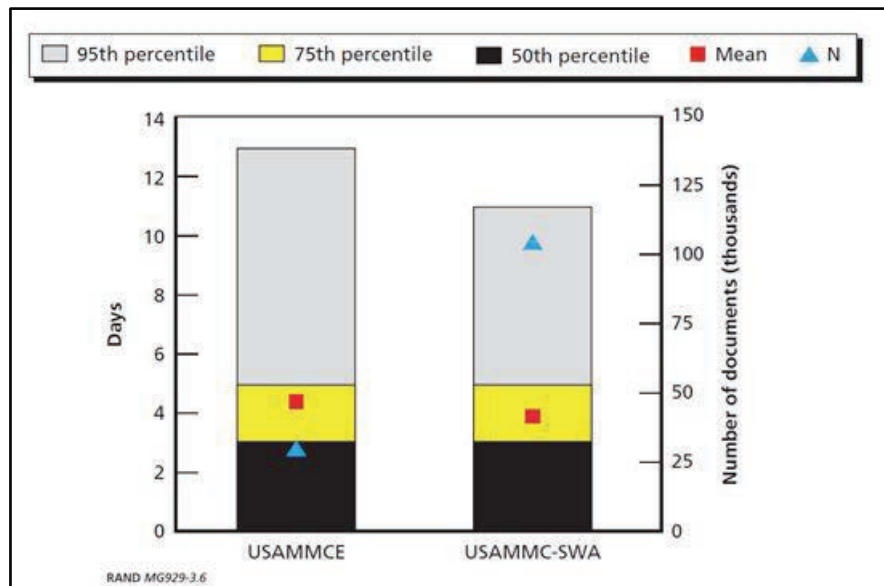
USAMMCE and USAMMC-SWA both generally use commercial lift to ship materiel to USCENTCOM end users, USAMMC-SWA also uses military lift. Figure 6.4 shows that commercial air carriers transport materiel from USAMMCE to USCENTCOM locations, departing from Frankfurt and laying over in Sharja. Commercial carriers that transport materiel from USAMMC-SWA to other USCENTCOM locations also lay over in Sharja. From both USAMMCE and USAMMC-SWA, materiel is delivered through Sharja to end-user locations with the same aircraft. The only difference in speed to deliver materiel to USCENTCOM locations from USAMMCE and USAMMC-SWA is the difference in time required to fly materiel from Frankfurt to Sharja, and from Qatar to Sharja. As shown in Figure 6.5, the mean time to deliver materiel via commercial airlift from USAMMCE to USCENTCOM is approximately 4.5 days, and the mean time to deliver materiel from USAMMC-SWA to USCENTCOM is approximately 3.5 days.

Figure 6.4
USCENTCOM Medical Materiel Transportation Network



NOTE: Route information from interviews with USAMMC-E, USAMMC-SWA staff.

Figure 6.5
Transit Times to USCENTCOM



SOURCE: Welser, Yoho, Robbins, Peltz, Van Roo, Resnick, and Harper, 2010.

In the next section, we describe military and commercial lift via the Class VIII tender and quantify the portion of medical materiel that moves by these two methods.

Opportunities for Efficiencies

In cases where DoD uses distribution warehouses as an intermediate waypoint between the supplier and end user, DoD must pay to ship the materiel to the end user, and bears the cost in several different ways. We will explain opportunities for efficiency on a theater basis.

In USNORTHCOM, there are no distribution centers for medical materiel, and no cost associated with distributing materiel to the end user.

For USSOUTHCOM, materiel is generally shipped directly to the end user by commercial air, managed by AFMOA under the WWX contracts.

In USPACOM—outside Korea, the intermediate warehouses are DLA Distribution collocated with FISCs, and TLAMM-P. DLA Distribution holds materiel for Navy ships from the time it arrives in inventory until the time the ships require it. DLA Distribution uses a combination of local ground resources to distribute materiel to end users and also receives medical materiel for Navy ships. When ships are at sea, the FISC is responsible for delivering the materiel from DLA Distribution to the ships. Using a combination of Navy-supported resupply methods, FISCs perform this mission for all classes of materiel that are supplied to ships. We did not identify any opportunities for efficiencies to propose for this theater.

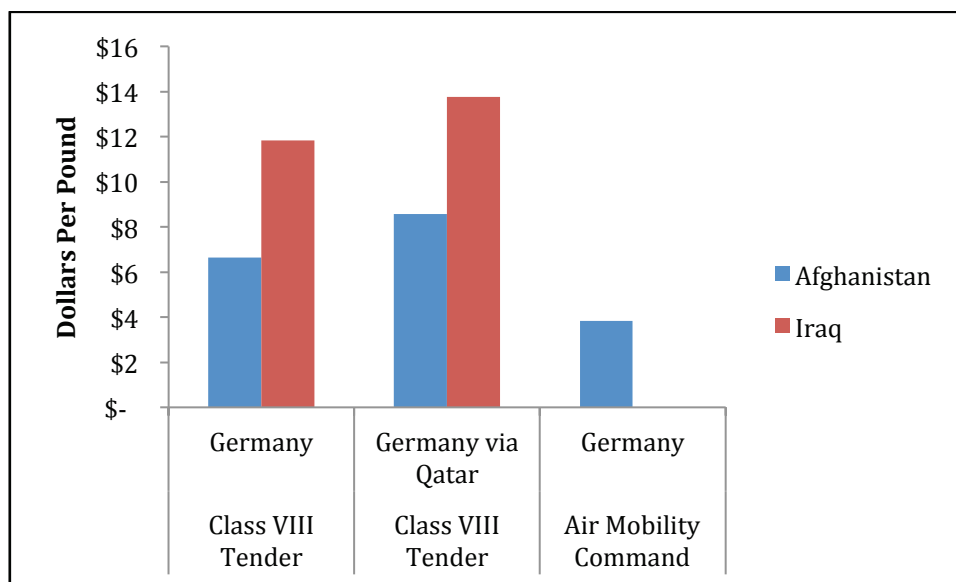
In USPACOM—Korea, USAMMC-K distributes materiel to end users via truck and has several methods in place to gain access to ground transportation—the TSC provides support, as do arrangements with Korean labor forces. When beneficial, USAMMC-K takes advantage of its proximity to DLA Distribution Korea to put materiel on DLA Distribution truck routes that go to the same end users. To the extent that sharing truck routes is efficient, we recommend that these organizations continue this practice.

In USEUCOM, the intermediate medical materiel warehouse is USAMMCE, which delivers materiel to end users in Europe via ground transportation. USAMMCE is located approximately one hour's drive away from DLA Distribution Europe in Germersheim, Germany. We recommend that USAMMCE and DLA Distribution Europe (which are located 45 miles apart) share ground transportation routes, if the opportunity exists, as USAMMC-K and DLA Distribution Korea have done.

USAMMCE also supplies a vast amount of materiel to USCENTCOM units. USAMMCE utilizes air freight to deliver materiel to these locations, and has the ability to use both commercial and military air freight. Over the course of the current conflict, as commercial air access to USCENTCOM has become robust, USAMMCE has come to use commercial air almost exclusively to ship materiel to USCENTCOM. USAMMCE uses the Class VIII tender to procure airlift from commercial shippers to deliver medical materiel to USCENTCOM locations. The Class VIII tender guarantees delivery of materiel within specific time frames based on the

priority of the shipment, with options for delivery in 48, 72, or 96 hours. Of course, shipping materiel with higher priority carries a higher price. The Class VIII tender also specifies procedures for commercial shippers to deliver materiel that has special handling requirements, such as hazardous materiel, cold-chain, and chain-of-custody items. All of these performance guidelines come with a cost, as the Class VIII tender reimburses commercial shippers at a significantly greater rate than other DoD shipping contracts such as the AMC rates to ship materiel from Europe to USCENTCOM (Figure 6.6). We have several recommendations as to how DoD can seek efficiencies through its use of tenders and contracts to pay for commercial air freight.

Figure 6.6
Shipping Rates for Air Freight, Germany to USCENTCOM

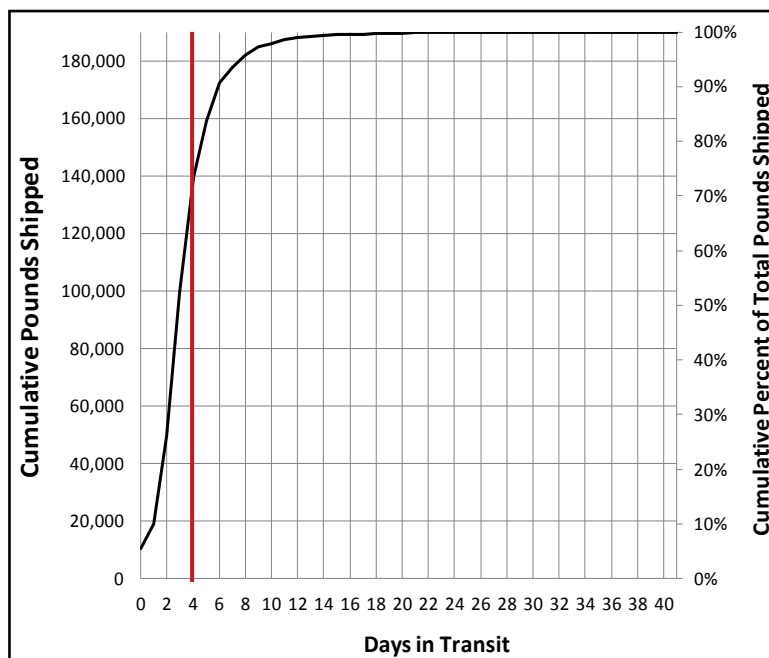


SOURCE: AMC; USTRANSCOM, Class VIII tender actuals data.

While the Class VIII tender requires commercial shippers to deliver materiel in specified time windows, we observe that shipments paid for under this tender are frequently late. The Class VIII commercial tender guarantees four-day delivery for all items. However, an examination of the delivery performance measured in terms of days in transit shows that 37 percent of all shipments were in transit more than four days (Figure 6.7).

We recommend that DoD seek a refund from the commercial shippers when materiel is delivered later than specified time lines. We also recommend that DoD closely consider the time line under which it truly requires materiel from different classes to be delivered, and write a contract to meet these guidelines, aware that they may be able to receive lower shipping rates for

Figure 6.7
Shipment Durations With Class VIII Tender



SOURCE: USTRANSCOM, Class VIII tender actuals data.

relaxed time constraints.⁴⁹ Beyond seeking lower rates for air freight to the end user, we recommend that DoD minimize the use of second and third intermediate locations and the repeated touching of medical materiel between the supplier and end user. After the PV ships medical materiel to USAMMCE that is intended for end users in USCENCOM, this same materiel may be shipped to USAMMC-SWA, where it sits in inventory before being delivered to end users. Materiel may also spend time at a forward medical logistics company before it is delivered to the end users. At each of these stages, DoD incurs a cost of materiel handling, as well as the cost of shipping the materiel an additional leg. We start with the case of USAMMC-SWA and then show the costs associated with shipping materiel from forward medical logistics companies to end users.

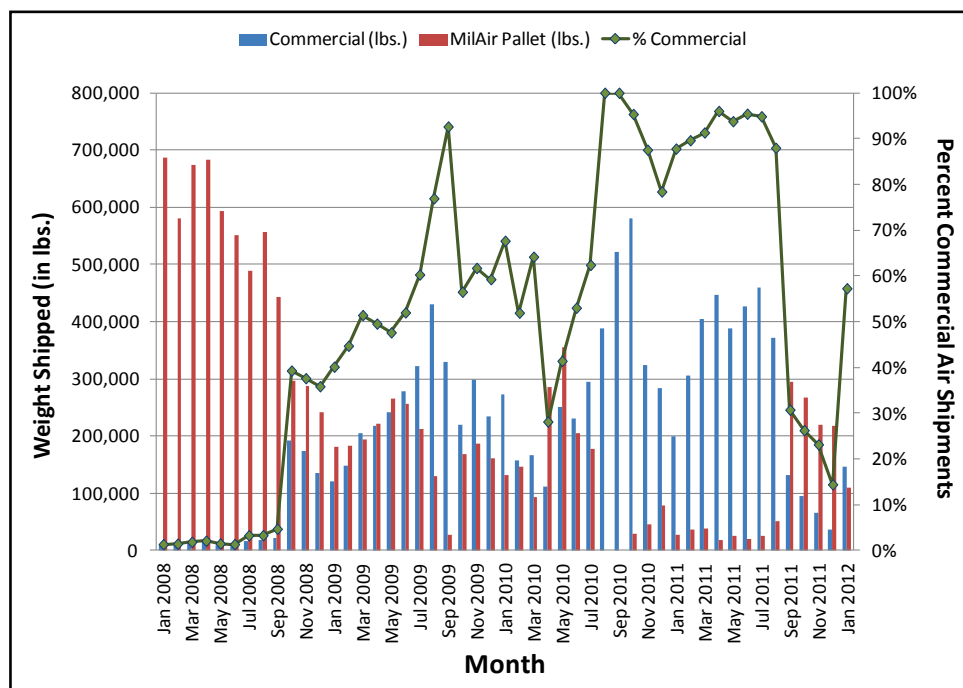
Fulfilling Class VIII Demand via USAMMC-SWA

An existing Class VIII tender commercial air contract for USAMMCE was amended in 2008 to allow USAMMC-SWA to use this mode of transport to serve customers in USCENCOM.⁵⁰ As operational intensity gradually shifted from Operation Iraqi Freedom to Operation Enduring Freedom between 2008 and 2011, the use of air transportation to deliver Class VIII materiel from USAMMC-SWA shifted from military airlift to commercial (Figure 6.8). Between August 2010

⁴⁹ The appendix describes actions taken in response to this recommendation, subsequent to the project sponsor briefing in August 2011.

⁵⁰ Welser, Yoho, Robbins, Peltz, Van Roo, Resnick, and Harper, 2010.

Figure 6.8
Total Weight of Class VIII Materiel Shipped by Commercial or Military Air from USAMMC-SWA
from January 2008 to January 2012



SOURCE: USAMMC-SWA, Production Reports, January 2008-January 2012.

and August 2011, the use of commercial air freight with the Class VIII tender dominated air freight from USAMMC-SWA to USCENTCOM locations. Commercial freight continually represented more than 75 percent of all airlift from USAMMC-SWA, and was typically more than 90 percent.

The Class VIII commercial tender delivery times tend to be less variable; unlike military air, the commercial tender runs regular routes regardless of how many packages are on the aircraft. The commercial tender also offers greater visibility for tracking cargo while in transit, which is an attractive and desired service. However, both the regularity of shipment lead times and the in-transit visibility come at a cost. As the numbers of troops in Iraq were drawn down during 2011 and the intensity of combat operations shifted to Afghanistan, there was a coincidental increased scrutiny on the costs of the wars. This scrutiny has caused managers at all levels to look for savings opportunities, and transportation costs are an obvious target for cuts. Opportunities to reduce transportation costs while maintaining performance necessary to safeguard and preserve life are going to become more and more attractive.

We gathered data on the costs incurred by shipments from USAMMC-SWA using the Class VIII tender for the time frame of August 2010–January 2011. Over this time, the cost of this airlift from USAMMC-SWA was \$40.9 million, or a rate of \$82 million per year.

In August 2011, RAND delivered its final briefing of this study to leadership within the U.S. Army Medical Research and Materiel Command and the DLA, highlighting the cost of using the Class VIII tender for commercial air freight. In an effort to avoid those costs, leadership at USAMMC-SWA made a conscious effort to utilize military airlift when possible in shipments from USAMMC-SWA, and subsequently achieved more than \$9 million in cost avoidance between September and December 2011 (Figure 6.8). It should be noted that using military airlift rather than the Class VIII tender may avoid the costs of commercial transportation. The medical logistics community (and other commodity managers) could gain efficiencies by working with USTRANSCOM to use unfilled military lift; however, it may be difficult to have perfect information about underutilized cargo aircraft and we cannot otherwise assume military airlift is a cost-free resource.

Analysis of Class VIII Materiel Commercial Tender Shipments

RAND analyzed the Class VIII commercial tender shipment data provided by USTRANSCOM covering July 28, 2010 through December 31, 2011 to identify how the commercial tender was being utilized and to determine if and how activity in the supply chain has shifted as military operations have changed over the same time period.

Quantity of Materiel Shipped to USCENTCOM via Class VIII Tender

The movement of Class VIII materiel to Afghanistan begins in CONUS with shipments originating with the PV. All shipments from the PV intended for USCENTCOM end users are first delivered to USAMMCE in Pirmasens, Germany. USAMMCE ships Class VIII materiel directly to locations in Afghanistan and also supplies the forward warehouse at USAMMC-SWA, in Qatar. Over the 18 months between July 2010 and December 2011, USAMMCE shipped 4.3 million pounds of materiel to Afghanistan via USAMMC-SWA (Figure 6.9). The balance of the 6 million pounds of materiel shipped to USAMMC-SWA eventually went to other USCENTCOM locations or USAMMC-SWA inventory.

In addition, USAMMCE shipped 3,751,601 pounds of Class VIII materiel directly from Germany to Afghanistan (see Figure 6.10).

However, when medical materiel arrived in Afghanistan, more than half of the shipments by weight had still not reached their end user. Of the 8,105,448 pounds of Class VIII materiel moved into Afghanistan, more than half of it—4,484,374 pounds—was consigned to the medlog companies in Bagram and Kandahar. The medlog companies in Afghanistan are used as consolidation points, which then moved materiel forward to outlying and remote areas within the country, 2.8 million pounds of which moved via the Class VIII tender (Figure 6.11).

Figure 6.9
Class VIII Commercial Tender Shipment Volume (in lbs.) from USAMMCE to USAMMC-SWA to Afghanistan (2010-2011)



SOURCE: USTRANSCOM, Class VIII tender actuals data; map provided by Google, with author overlay.

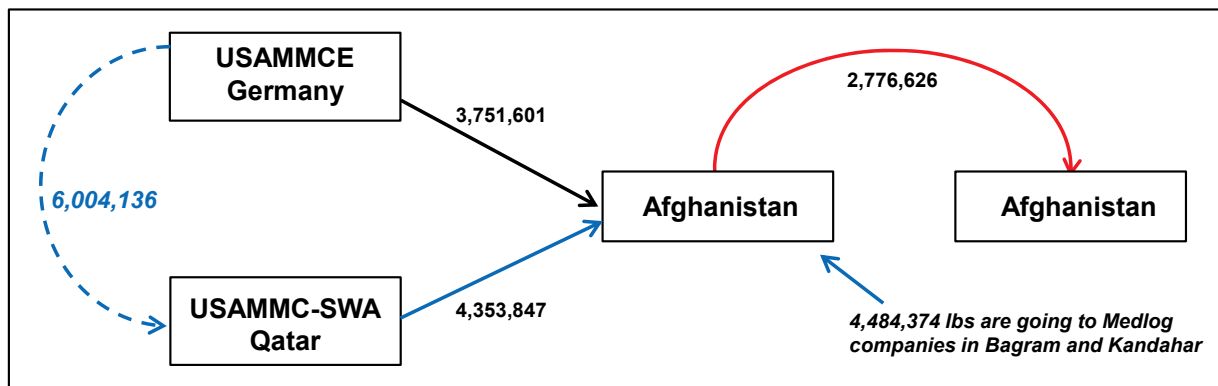
Figure 6.10
Class VIII Commercial Tender Shipment Volume (in lbs.) from USAMMCE to USAMMC-SWA to Afghanistan and USAMMCE to Afghanistan (July 2010–December 2011)



SOURCE: USTRANSCOM, Class VIII tender actuals data; map provided by Google, with author overlay.

Figure 6.11

Class VIII Tender Materiel Movements (in lbs.) to Afghanistan from USAMMCE and USMMC-SWA



SOURCE: USTRANSCOM, Class VIII tender actuals data.

As operational tempos have increased from 2010 to 2011, more Class VIII materiel has been sent directly from USAMMCE to Afghanistan (Table 6.1).

Table 6.1

Class VIII Materiel Shipped (in pounds) from Qatar to Specific Destination Countries by Commercial Tender

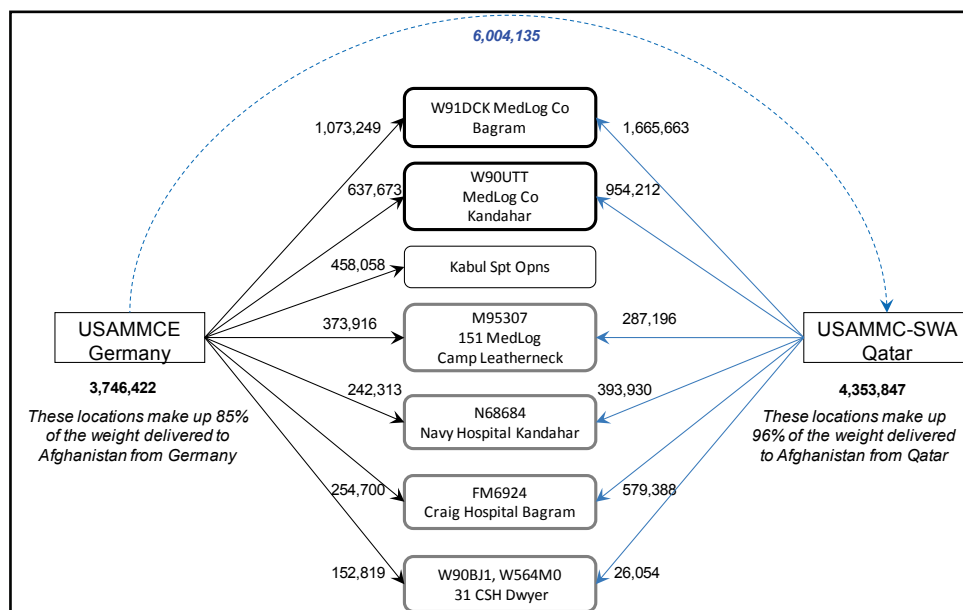
Destination	Country				Total Pounds
	GERMANY		QATAR		
	Year		Year		
	2010	2011	2010	2011	
Afghanistan	1,022,357	2,729,244	1,728,048	2,625,799	8,105,448
Qatar	2,322,834	3,681,302			6,004,136
Iraq	70,007	355,881	390,553	658,481	1,474,922
Kuwait	39,296	121,897	19,038	188	180,419
Djibouti	26,499	47,089	57		73,646

SOURCE: USTRANSCOM, Class VIII tender actuals data.

There were many instances where the same consignee received materiel from *both* USAMMCE and USAMMC-SWA (Figure 6.12). The medlog company identified as DoDAAC W91DCK in Bagram received the greatest volume followed by medlog company identified by the DoDAAC W90UTT, in Kandahar. Considerable time and money could be saved if consignees that can receive materiel directly from USAMMCE have that source of supply as a dedicated provider rather than receiving materiel from both USAMMCE and USAMMC-SWA.

Figure 6.12

Consignees Receiving Class VIII Materiel (in lbs.) from Both USAMMCE and USAMMC-SWA using the Commercial Tender



NOTE: Kabul Spt Opns = Kabul Support Operations

SOURCE: USTRANSCOM, Class VIII tender actuals data.

Shift in Medical Materiel Support to USCENTCOM Locations, 2010–2011

Shipments to Afghanistan from USAMMCE increased 167 percent—from 1 million pounds in 2010 to 2.7 million pounds in 2011—as shown in Table 6.1. Shipments to Iraq increased by more than 400 percent—from 70,007 pounds in 2010 to 355,881 in 2011. During the same time frame, USAMMC-SWA shipped 52 percent more Class VIII materiel to Afghanistan in 2011 than in 2010 and 69 percent more to Iraq. The increase in direct shipments from USAMMCE to Afghanistan has decreased material handling and transportation costs associated with inventory receiving, warehousing, and issuing at USAMMC-SWA, and an additional transportation leg to reach Afghanistan.

Section Summary

We described in great detail the system of delivering medical materiel from intermediate distribution warehouses to end users, and (in some cases in Afghanistan) to forward medical logistics companies. Performing this activity incurs a great cost. Looking at Class VIII tender data, we see that DoD has been spending approximately \$80 million annually to ship medical materiel from intermediate warehouses to end users.

Ceasing to use USAMMC-SWA to distribute medical materiel to USCENTCOM would save DoD approximately \$12 million annually, by shipping materiel directly to these locations from USAMMCE, using the same Class VIII tender prices.⁵¹ We estimate that by renegotiating the Class VIII tender to approach the price of AMC tenders for commercial air freight from Europe to USCENTCOM, DoD could save on the order of \$10 million to \$20 million annually.⁵²

The mission in USCENTCOM is changing. Even over the course of our study, we see that medical materiel shipments to USCENTCOM in 2011 were significantly different than in 2010. We have projected savings to DoD using materiel procurement and distribution activity during the period of the study. When the mission changes, assuredly the opportunities for efficiencies will as well.

⁵¹ Savings from closing USAMMC-SWA as a distribution center (Figure 5.3), along with the savings in shipping costs by shipping materiel direct from USAMMCE to USCENTCOM rather than via Qatar (Figure 6.6) is estimated at \$12 million.

⁵² We estimate that \$10 million to \$20 million could be saved by reducing the cost per pound to ship medical materiel to USCENTCOM. This quantity represents 12-25 percent of the annual Class VIII tender costs over the course of our study. Note that AMC-negotiated commercial airlift rates from Europe into USCENTCOM are more than 33 percent cheaper than Class VIII tender rates (Figure 6.6).

7. Conclusions

This project began with the sponsors asking whether efficiencies could be gained in the medical materiel distribution structure, through the existing framework, or through a new framework of military service, DLA, and commercial infrastructure. The sponsors specifically asked us to investigate opportunities for efficiency in purchasing power, IT, and warehousing. We proposed including transportation in the study.

The purchase price of medical materiel represents more than 85 percent of the cost associated with medical materiel distribution. In total, DoD purchases \$4.7 billion of medical materiel annually, \$750 million of which is distributed OCONUS. DLA has incorporated 80 percent of medical materiel procurement into the PV contracts and the ECAT system of procurement, leveraging bulk purchasing power across the federal government. We did not see any obvious opportunity for efficiency in this process, which has already been centralized and standardized.

We found that the two main IT systems used by the military services to manage medical materiel procurement (DMLSS and TEWLS) perform many of the same functions and simultaneously overlap and rely upon EBS to pay PVs through the PV contract.

DMLSS and TEWLS are also used to manage medical materiel warehouses, performing many of the same functions as DSS. While DMLSS and TEWLS both can track items by commercial stock numbers, DSS can only download item information based on NSNs. On an IT basis alone, medical materiel logistics cannot be simply consolidated at DLA because of the limitations of DSS. Thousands of new commercial items are used at MTFs each year, and assigning each of these items an NSN would overwhelm the capacity of existing organizations responsible for this activity. As DoD is not a true market-maker in the medical materiel marketplace, it appears commercial stock numbers will be used to identify medical materiel items for the foreseeable future; thus, an IT system capable of treating these numbers must be used to support this supply chain.

Due to a lack of detailed cost data on IT systems such as DSS and EBS, we were unable to do an exhaustive study of IT system costs. Where possible, we recommend DoD seek efficiencies by using a single IT system, as each of these systems bears enormous costs to develop and maintain—on the order of hundreds of millions of dollars. Because of the absence of detailed cost data and the fact that DSS cannot handle commercial stock numbers, our research team focused more effort on finding warehousing and distribution efficiencies, where we could learn enough over the course of the study to make comprehensive recommendations.

The total annual cost of warehousing and distributing medical materiel to OCONUS locations is \$140 million, for activities included in Table 7.1. In the USCENTCOM total, we included costs of first-leg shipping, along with warehousing at USAMMCE for materiel that eventually is delivered to USCENTCOM locations. Providing materiel to USCENTCOM makes

up 77 percent of the total OCONUS costs and a correspondingly large portion of the identified efficiencies. Providing medical materiel to the balance of OCONUS locations incurs \$33 million in annual warehousing and distribution costs, which we see as the combined USEUCOM and USPACOM total costs in Table 7.1.

Table 7.1 Costs and Efficiencies Identified in Warehousing and Distribution of Medical Materiel to OCONUS Locations

OCONUS Warehousing and Distribution Costs (\$M) *			
Activity	Theater - Materiel Final Destination	Cost	Efficiencies
First Leg Transportation	CENTCOM	15.0	
	EUCOM	20.6	
	PACOM	2.4	
	All	38.0	
Intermediate Warehousing	CENTCOM	10.9	6.6
	EUCOM	6.4	4
	PACOM	3.1	2
	All	20.4	12.6
Second Leg Transportation	CENTCOM	82.0	27
	EUCOM	n/a	
	PACOM	n/a	
	All	82.0	27
Total	CENTCOM	107.9	33.6
	EUCOM	27.0	4
	PACOM	5.5	2
	All	140.4	39.6
* Activities discussed in report, not included in this data: contracting staff support, warehousing at DLA, ground transportation.			

In Tables 2.2–2.7, the report shows the range of methods used for contingency response across the geographic theaters. In each theater, it is a compromise between peacetime efficiency and resources invested in scalability for contingency operations. The methods range from having few theater resources dedicated for contingency operations to supporting MTFs during peacetime in the same way as is expected during hostilities—although it may be inefficient.⁵³ In USPACOM-All but Korea, MTFs receive medical materiel directly from PVs in peacetime and

⁵³ This observation is highlighted in the appendix.

TLAMM-P is a warm-base capability with little personnel or inventory that can be scaled up to support deployed units in the theater during hostilities. In USPACOM-Korea, Army MTFs are supported wholly through USAMMC-K, which employs personnel and maintains inventory to supply these units during peacetime as it would during hostilities.

Over the past decade, DoD has made great leaps forward in finding efficiencies in medical logistics. The DLA-managed PV contracts have eliminated the need for large stores of medical materiel, especially in CONUS. By negotiating the Cat A contract for medical materiel, DoD has put the same materiel in the hands of providers overseas as it supplies to units in the United States.⁵⁴

The greatest opportunity for efficiency is in USCENTCOM. Utilizing the Class VIII tender for commercial airlift in second-leg transportation is very costly. By seeking lower costs for commercial air freight and supporting units in USCENTCOM directly from USAMMCE, DoD has the opportunity to achieve savings on the order of \$30million to \$40 million annually.⁵⁵ We note that these savings reflect the pace of military operations in USCENTCOM during the 2010–2011 time period of our study and the corresponding costs of commercial airlift during this same period. Even with a drawdown in forces in this area, we recommend continued attention to the way medical materiel is moved, as transportation costs associated with delivering medical materiel to USCENTCOM locations represent 58 percent of the total cost to distribute materiel OCONUS, and 80 percent of the identified opportunities for efficiency.

We observe opportunities for continuing improvement through taking full advantage of the capabilities that the DLA- and USTRANSCOM-negotiated PV and Cat A contracts can deliver. We propose three approaches through which the medical logistics community can achieve further efficiencies:

- maximizing direct delivery to end users
- exercising control over the catalog and deliberately managing the quantity of materiel held overseas to support surges and supply chain interruptions
- managing usage items and the PV statement of work to maximize supplier responsiveness to end-user demand.

Outside the mission of providing medical materiel to USCENTCOM locations, the opportunities for efficiencies we identified in USPACOM and USEUCOM were on the order of single-digit millions of dollars in savings per year. Implementing them requires renegotiating the PV contract and the associated Cat A transportation rates, and re-balancing OCONUS buffers of

⁵⁴ This observation is highlighted in the appendix.

⁵⁵ We estimate that seeking lower shipping rates alone could save \$10 million to \$20 million, and that shipping materiel direct from USAMMCE to USCENTCOM rather than through Qatar could save \$12 million. We also estimate that negotiating new shipping costs and shipping directly from USAMMCE could save \$30 million to \$40 million.

medical materiel inventory. Each of these activities may bear costs offsetting efficiencies identified in this study.

We did not observe any DLA warehouses that have the specialized holding areas required for appropriate storage of all classes of medical items: Staff at DLA Distribution Yokosuka were installing new temperature-controlled storage areas for sensitive medical materiel, but they did not have the deep cold storage area required for some medical items.

The DLA warehouses we visited also did not employ staff with professional knowledge of medical items, such as pharmacists. Staffing intermediate warehouses with medical item experts can ensure that items are handled, inspected, identified, and distributed correctly. Additionally, employing a pharmacist and/or other trained professionals may help fill orders, allowing medical items to be substituted in ways that are not codified.

With no DLA facilities suited to incorporate medical materiel warehousing and distribution into their existing infrastructure, we conclude there would be no efficiency in immediately altering the current management roles of the Class VIII supply chain. If new locations for warehousing and distributing medical materiel are sought, collocating medical materiel management with an MTF, DLA facility, or military service logistics facility should be considered if it presents efficiencies in transportation or infrastructure.⁵⁶

⁵⁶ The appendix describes actions taken in response to this recommendation, subsequent to the project sponsor briefing in August 2011.

Appendix. Actions Subsequent to the Project Final Briefing

1. Based on the August 2011 brief, the cosponsors concurred with several constructive long-term recommendations for improving the performance and efficiency of medical supply operations, particularly with respect to materiel standardization, pooling of demands, consolidation of local purchasing activities, and management of catalog data.
2. The RAND/Arroyo Center's presentation to the study cosponsors in August 2011 also included shorter-term recommendations that resulted in the following actions:
 - a. **Recommendation: Cease Class VIII distribution from USAMMC-SWA, shifting all support to USAMMCE.**⁵⁷ The cosponsors concurred with the recommendation, consistent with a time line established by USCENTCOM and resolution of issues related to the pending relocation of USAMMCE. USCENTCOM supports an orderly drawdown of USAMMC-SWA in conjunction with the withdrawal of U.S. forces from Afghanistan, while retaining a warm-based capability that will enable rapid resumption of operations if required. In the meantime, USAMMCE and USAMMC-SWA—in coordination with USCENTCOM and in addition to actions described below—have continued to rebalance line-item stock and distribution channels in order to reduce transportation costs.
 - b. **Recommendation: Hold commercial carriers accountable for performance, using less expensive rates when premium service is not required.**⁵⁸ The cosponsors concurred with the recommendation. Subsequent actions by USAMMC-SWA have significantly shifted Class VIII distribution volume from commercial air to military air, particularly WWX. USAMMCE-SWA currently ships nearly 90 percent of Class VIII cargo via MILAIR, and reports a reduction in annual transportation costs by more than \$6 million (February 2012–February 2013). In addition, the USCENTCOM J-4 coordinated closely with USTRANSCOM in development of a new Cat A contract for Class VIII distribution, which is now used by both USAMMCE and USAMMCE-SWA. They report that it provides greater flexibility for matching delivery requirements to mission, providing both access to a variety of carriers competing for the business and incentives for performance within the contract. Consequently, it has helped reduce shipping rates. The new Cat A contract provides more operational flexibility, as several carriers offer better niche services and routes that are all needed to support this very large and dynamic theater.
 - c. **Recommendation: Increase volume of direct support from CONUS PVs to MTFs in USEUCOM and USPACOM.**⁵⁹ The cosponsors directed the Europe Regional Medical Command in coordination with DLA Troop Support and the U.S. Army Medical Research and Materiel Command to consider the effects of increasing direct delivery of PV items to end users. The European command determined that potential efficiencies of direct PV delivery were not sufficient to implement a policy change,

⁵⁷ See p. 50 of this report.

⁵⁸ See p. 58 of this report.

⁵⁹ See p. 49 of this report.

given projected costs associated with increased inventory at end-user locations. It also concluded that it would degrade USAMMCE's capability to support contingency operations in its three supported COCOMS. In Korea, USAMRMC coordinated policy decisions with USAMMC-K and U.S. Forces Korea headquarters. It concluded that potential savings from a shift to direct delivery from CONUS would not offset the operational reasons to conduct Class VIII distribution from the theater's primary sustainment base at Camp Carroll. In both Europe and Korea, the cosponsors concluded that the capability of theater distribution centers to provide end users with one- or two-day delivery of usage items (the same standard as CONUS MTFs) and the advantage of centralized theater inventory to mitigate risks of both interruption in strategic transportation channels and short- or no-notice demands of contingency operations were salient advantages of a global military Class VIII distribution strategy.⁶⁰

d. **Recommendation: Do not consolidate Class VIII warehousing and distribution into DLA Distribution centers, but consider collocation of USAMMCE with the DLA Distribution Center at Germersheim Army Depot.**⁶¹

The cosponsors concurred with the recommendation. Subsequent analysis by the Installation Management Command-Europe and U.S. Army Europe headquarters considered Germersheim as a possible location for USAMMCE; however, they determined that sufficient space is not available in view of the consolidation of other theater support activities at that location. Instead, their recommended course of action is to consolidate USAMMCE operations at Kaiserslautern Army Depot. This location has significant merits, including proximity to the largest customer (Landstuhl Regional Medical Center) and military air terminal (Ramstein Air base), collocation with primary ground transportation support, availability of military housing and other personnel support services in the Kaiserslautern military community, and the ability to retain a trained (yet smaller) workforce.

5. At the August 2011 brief, the cosponsor agreed that the recommendations answer the primary question that led to the conduct of this study⁶²; that is, management and distribution of medical materiel should not be consolidated into DLA information systems that lack the capability to incorporate commercial stock number information, nor should it be consolidated into existing DLA infrastructure used for other common supply commodities that lacks the facilities to store items with medical-unique handling requirements.
6. The global distribution strategy for medical materiel requires an effective partnership between DLA and the Military Health System.⁶³ This report highlights the depth of that

⁶⁰ It is important that the military have the capability to surge delivery of medical materiel to regions where units deploy. Maintaining scalable medical materiel distribution centers overseas is a way to establish this capability. In this case, infrastructure is maintained with the objective of supporting future operations, rather than the objective of supply-chain efficiency. Both objectives should be considered explicitly when determining the optimal size and location of a warm base or functioning distribution center.

⁶¹ See p. 68 of this report. Collocating medical materiel management with MTFs and locations in close proximity to transportation support is commendable.

⁶² RAND briefing to project sponsors, USAMRMC and HQ DLA, August 2011. Recommendation also made on p. 68 of this report.

⁶³ See p. 67 of this report.

partnership and an example of how the partnership achieves continuous improvement resulting in an effective supply chain that is a compromise between peacetime efficiency and a need to surge in case of a contingency, and provides a sound foundation for further business process improvements.⁶⁴

⁶⁴ See p. 66 of this report.

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