

Logistics Modernization in the Twenty-First Century

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Table of Contents

Table of Contents.....	iii
Table of Figures.....	iv
Executive Summary.....	v
DoD Logistics Today.....	v
Changes Driving Logistics Transformation.....	vi
To Achieve These Goals DoD Logistics Will Require:.....	vii
Barriers to Logistics Transformation.....	x
Conclusion.....	xi
I. DoD Logistics Today.....	1
DoD’s Vision.....	2
DoD’s Logistics Performance Still Far from World-Class.....	4
Roadmap.....	6
II. Changes Driving Logistics Transformation.....	7
Weapon System Support Challenges.....	7
Current Environmental Conditions.....	10
National Security Influences.....	13
Domestic Influences.....	14
III. Goals for Logistics Transformation.....	15
Be Responsive to Warfighter Requirements.....	15
Enable Timely Deployment of Expeditionary Forces.....	15
Reduce the Requirement for People, Equipment, and Supplies in Theater.....	15
Develop State-of-the-Art IT Systems to Re-engineer and Integrate Business Processes.....	15
Provide Total Asset Visibility at All Times.....	16
Better Integrate the Public and Private Sectors to Leverage the Strengths of Each.....	16
Improve Weapon Systems Availability.....	16
Cost Significantly Less.....	16
IV. DoD Logistics Transformation Will Require:.....	18
A Development of Key Technologies.....	18
A Modernized Logistics Infrastructure.....	21
Changes to Business/Finance Rules.....	25
Changes to the Personnel Policy.....	32
Reorganization of Joint Logistics to Create Unity of Command and Unity of Effort..	35
V. Barriers to Logistics Transformation.....	38
Cultural Barriers to Transformation.....	38
Technical Barriers to Transformation.....	39
Funding/Contractual Barriers to Transformation.....	39
Political Barriers to Changes with DoD Depots.....	40
Organizational Barriers to Transformation.....	41
VI. Summary and Conclusion.....	42
Reference List.....	44
Acknowledgment.....	48
About the Authors.....	49

Table of Figures

Figure 1. Logistics Results: “Successful,” but not World-Class (Bell 2007).	4
Figure 2: Operational and environmental challenges	8
Figure 3. Sustainment Availability and Response Time Pre-PBL and Post-PBL (Klevan 2005; Kratz 2008).	10
Figure 4. Procurement Budget Compared as with Acquisition Workforce Size.	12
Figure 5. Distribution of DoD Workforce.	13
Figure 6. Sense and Respond Network.	19
Figure 7. Savings from Implementing PBL. (Fowler 2009).	26
Figure 8. F/A 18 PBL Results.	27
Figure 9. F/A 18 Estimated Cost Savings from PBL.	28
Figure 10. F/A 18 Readiness Improvements During Implementation of PBL.	28
Figure 11. Changes in Tire Inventory due to PBL.	29
Figure 12. F404 Engine Cycle Repair Time in Days via Lean (Pauling 2006).	30
Figure 13. Results of A-76 Competitions in the Military Services.	33
Figure 14. DoD “Competitive Sourcing” Demonstrated Results 1994 – 2003.	34
Figure 15. Savings Rate for 16 Completed Activities via A-76 Competitions (Clark 2001).	35
Figure 16. Present DoD Supply Chain Responsibility.	36

Executive Summary

DoD Logistics Today

The Department of Defense (DoD) is one of the largest and most complex organizations in the world. DoD's budget dwarfs that of the world's largest corporation and it employs millions of people that operate worldwide. More importantly, the DoD supply chain accounted for \$162 billion in spending in Fiscal Year 2006, and managed a supply chain inventory of \$85.6 billion (over 5 million different secondary items) (Bell 2007)—orders of a magnitude of more inventory items than the largest retail corporations (Government Accountability Office 2003). The current “system” is largely an ad-hoc mix of government and industry, with little cost visibility or performance accountability, and does not perform to world-class standards for responsiveness, reliability, costs, personnel and visibility (Bell 2007).

An integrated (end-to-end) system within DoD—a critical component of “world-class” commercial logistics systems—does not exist. This is due, in large part, to DoD's traditional approach to logistics. This approach has proven to be highly inefficient, with segmented accountability and control by various stakeholders (Combatant Commands, Services, Depots, Defense Logistics Agency, Defense Contractors etc.), each with individual requirements, restrictions, and priorities. With most military disciplines there are few sound commercial models. However, with respect to logistics transformation, many of the necessary tools and concepts have already been well proven in the commercial sector.

DoD's Vision

Witnessing the capabilities of advanced state-of-the-art supply-chain implementation by commercial firms, coupled with the stresses of supporting two major conflicts, has crystallized the belief within the Department's logistics' community of the need for logistical transformation. The following planning documents demonstrate this recognition, and offer strategies to pursue it.

- *Quadrennial Defense Review, September 2001*
- *Focused Logistics Joint Functional Concept, Dec. 2003*
- *DoD Management Initiative Decision (MID) #917 October 2004*
- *DoD Logistics Transformation Strategy, December 2004*
- *DoD Directive Required Incorporation of RFID Throughout (beginning January 2005)*

Despite these policy initiatives, logistics transformation within DoD to date has been fragmented, and unfortunately the results have been limited. As a result, we believe there is a clear requirement to move away from the traditional DoD models of support, and transform DoD's logistics, fully leveraging the tools and capabilities used by “world class” logistics providers.

Changes Driving Logistics Transformation

Weapon System Support Challenges

Operational and structural challenges directly contribute to the overall weapon system support challenges the DoD faces today. The operational environment is defined by a high operations tempo, high maintenance levels, large maintenance/supply footprint and turnover of maintenance personnel. The structural environment has high equipment design complexity, disconnect between the performance of a system and its required maintenance, lack of communication between acquisition and logistics, long waits for priority parts, legacy organic depots and numerous standalone legacy logistics business systems. These challenges strain DoD's ability to effectively support weapons systems. While the current system generally meets requirements, the lower reliability, availability, and inefficient processes result in higher costs. More specifically, weapon system support challenges include

- *The current logistics structure does not support rapid force projection or the warfighter efficiently.*
- *Weapon systems require a large in-theater presence for support.*
- *The support comes through a complex, inefficient supply chain, with limited in-transit and in-theater asset visibility.*
- *Turnover of maintenance personnel is problematic.*
- *Original equipment and support contractors are not incentivized to improve system availability.*

Three sets of external factors also influence the need for, and pace of, logistics transformation: current environmental conditions, national security influences and domestic influences. Current environmental conditions include globalization, isolationist trends, changes in the defense industrial base and the government workforce. National security influences include threat changes, new military missions and technology changes. Domestic influences include the U.S. economy, defense budget shifts and technological advances.

Goals for Logistics Transformation

Based on the current state of DoD logistics, and the anticipated future environment, we believe the following are the goals for the required for DoD logistics transformation.

DoD Logistics Must:

- ***Be Responsive to Warfighter Requirements***
- ***Enable Timely Deployment of Expeditionary Forces***
- ***Reduce the Requirement for People, Equipment, and Supplies in Theater***
- ***Develop State-of-the-Art IT Systems to Re-engineer and Integrate Business Processes***
- ***Provide Total Asset Visibility at All Times***
- ***Better Integrate the Public and Private Sectors to Leverage the Strengths of Each***
- ***Improve Weapon Systems Availability***
- ***Cost Significantly Less***

To Achieve These Goals DoD Logistics Will Require:

A. Development of Key Technologies to support Sense and Respond Logistics Networks

DoD needs to move away from its traditional hierarchical command and control structure towards a more adaptive system, that will provide the precise, agile support required for the distributed, network-centric operations that DoD envisions—an adaptive “Sense and Respond Logistics Network” (SRL).

As envisioned, SRL is focused on achieving a network-centric, knowledge driven environment where information technology provides superior and relatively seamless connectivity of data, information, and awareness. SRL should provide a competitive advantage across the strategic, operational, and tactical levels of war through predictive, anticipatory and interpretative measures (Office of Force Transformation 2004). In order to implement SRL, several key technologies need to be further developed, most importantly (1) improved sensing and (2) improved modeling and algorithms.

Much of the improved sensing capability for SRL is being developed under the rubric of some Automated Identification Technologies (AITs). AITs are comprised of a suite of tools and devices that collect, aggregate, compute, and communicate data to enable accurate, timely visibility of assets. Use of AITs integrated with a supply chain database system will significantly improve asset visibility. To fully implement SRL, however, current technical issues including security, electromagnetic compatibility, range, readability, durability and costs must be addressed.

The use of SRL would be enhanced by the development of improved modeling and algorithms that improve current data interpretation by creating programs that learn. Current programs make accurate demand predictions at the tactical, operational, and strategic levels based on analysis of historical “sensed data.” While valuable, these projects could be improved through the use of innovative intelligent agents that work autonomously in conjunction with other programs and systems, respond to changes, and have the ability to infer and learn. The improved context-related knowledge would enhance decision-making. Research on this topic must continue.

B. A Modernized Logistics Infrastructure

Until DoD can successfully transform its business operations, it will continue to confront the pervasive, decades-old management inefficiencies. Consequently, transformation of business systems is integral to transforming overall DoD logistics management. To accomplish this, we believe DoD must:

- **Continue to evolve to Service Oriented Architecture (SOA).** SOA, by providing an integrated and flexible software framework, will help create a unified logistics community that collects information DoD-wide without infringing upon autonomy.
- **Accelerate implementation of logistics’ Enterprise Resource Planning Systems (ERPs).** ERPs maintain the referential integrity of transactions within a single system, allowing users to standardize and streamline business activities, reduce the costs of the system, improve performance and ensure security. For

successful logistics transformation, DoD requires ERPs to fully integrate its entire logistics enterprise.

- **Provide the necessary communications bandwidth.** The existing communications network was not built to handle the immense information flow of the digital age. Transformed DoD logistics will be data intensive, requiring high bandwidth to support the high-volume data exchange required for real-time updates.
- **Assure security (physical and cyber).** A global supply chain offers greater access but also greater vulnerability. As DoD transforms its supply chain, security must be a key consideration, particularly given the greater dependence on information systems.
- **Distance support and training.** Expansion of distance support and training for logistics personnel is vital to successful infrastructure improvement. DoD must examine and improve methods by which it delivers training to personnel. Use of virtual support and training technology must be maximized.

C. Changes to Business/Finance Rules

Along with infrastructure, the DoD needs to address many business and financial issues that hinder logistics transformation. Required changes include:

- **Streamline Contracting and Finance Mechanisms.** The current defense acquisition process is overly complex, burdensome and slow, creating exceedingly high barriers to entry for new firms. Further, financial regulations severely restrict the necessary flexibility that program offices need to properly manage their programs.
- **Optimize Use of Performance Based Logistics (PBL).** DoD must shift from purchasing parts to purchasing outcomes. DoD can achieve this end by optimizing use of PBL, which has the goals of attaining the highest levels of efficiency, effectiveness, accountability and reliability. PBL differs from more traditional support arrangements by (1) clearly delineating outcome driven performance goals; (2) ensuring responsibilities are assigned; (3) reducing cost of ownership; and (4) provides incentives for attaining performance goals. PBL is the standard for world-class commercial firms and has been successfully implemented in DoD projects, such as the F/A 18 Super Hornet.
- **Encourage Continuous Process Improvement.** DoD has not implemented a department-wide policy to ensure its employees continuously improve DoD processes to increase efficiency. Individual programs that have implemented these policies, such as the F/A-18 F404 engine, have seen dramatic improvement.
- **Correct “Color of Money” and Working Capital Fund (WCF) Issues.** “Color of money” restrictions and working capital fund issues must be corrected to permit flexibility and adaptability of funding after the budget process is completed. Current policies create budget instability and provide the incorrect incentives for performance.

- **Broaden Use of Prime Vendors.** DoD should expand the use of virtual prime vendors (VPV). In this model, one a vendor is contracted, under a performance based contract, to store and distribute products (both manufactured by the vendor and bought from other stores). Government customers can place orders with the vendor and receive items directly. VPV improves logistics support by taking advantage of the private sector information technology and distribution capabilities. As a result, logistics costs are shifted from the government to the VPV, who, in turn, has incentives to minimize those costs.
- **Encourage “Gainsharing”.** “Gainsharing” can be a highly effective technique for promoting continual performance improvements and cost reductions. Gainsharing allows a supplier (either private or public) to retain a defined portion of any cost reduction occurring through process improvement that positively impacts the customer. To achieve cost savings and additional service improvements, the supplier must be empowered to improve its processes. This strategy is necessary to incentivize firms and organizations to make the necessary investment in the short-term to achieve the desired long-term performance improvements and savings.

D. Changes to the Personnel Policy

To achieve greater logistics efficiency, government personnel must alter their focus from being a direct component of supply chain operations to a more supervisory role that requires overseeing logistics functions that are being carried out by the private sector. More specifically, DoD should implement two policies. First, DoD should reserve military personnel for military functions. At present, all too often, military personnel are used to perform functions that can be accomplished less expensively, at equal or higher quality, when performed by the private sector or by civilian personnel. Second, DoD should optimize the use of competitive sourcing. DoD civilian employees still perform functions that are not inherently governmental and readily available commercially. When these tasks are competitively sources, the DoD has achieved significant performance improvements and savings—regardless of whether the winner of the competition is the public or the private sector. DoD should continue to expand competitive sourcing to gain the benefits of introducing competitive pressure throughout the supply chain.

E. Reorganization of Joint Logistics to Create Unity of Command and Unity of Effort

Today, the DoD’s supply chain and logistics responsibilities span several organizations without unity of command or effort. Elements may be optimized, but often produce sub-optimized results at the system level. Although tentative steps to establish an end-to-end supply chain have been undertaken, the current challenges will require greater organizational changes. The DoD should:

- **Create a Joint Logistics Command.** This command must have the authority and accountability to provide essential support to global operations. This command could potentially subsume current transformation efforts and would be supported by the Service logistics commands as service components. The Service logistics

commands, however, would retain their service responsibilities and continue to perform these functions, as is the case with other service component commands.

- **Designate USD (AT&L) as Responsible for DoD CIO.** The conflict between two federal laws (the Goldwater-Nichols Department of Defense Reorganization Act of 1986 and the Information Technology Management Reform Act of 1996, also known as the Clinger-Cohen Act) continue to hamper DoD’s efforts at effective business transformation in the broader context—and as a result, logistics transformation. Goldwater-Nichols assigned full responsibility for all acquisition activities to the Under Secretary of Defense (for Acquisition, Technology, and Logistics). Later, the Clinger-Cohen Act changed the process for federal agencies to acquire and manage their information technology and systems, assigning those responsibilities to the Department CIO. These two laws overlap in the area of IT acquisition and introduce an unnecessary level of complication which should be resolved. The Secretary of Defense should place the Assistant Secretary of Defense for (Networks and Information Integration) in the USD (AT&L) organization, and then Congress should modify the Clinger-Cohen Act so he/she can then remain the CIO.

Barriers to Logistics Transformation

DoD faces numerous barriers to logistics transformation, categorized in five broad categories: cultural barriers, technical barriers, funding/contractual barriers, political barriers and organizational barriers.

Cultural barriers arise principally from the nature of organization culture to resist any significant change. Factors that contribute to this resistance include the push to protect jobs; distrust of contractors; distrust of other military services; belief that Commercial-Off-the-Shelf (COTS) is inadequate; the urge to physically “see” inventory; suspicions regarding IT security; and pervasive belief that “transition is too hard.”

Technical barriers to transformation include the breadth and scale of DoD operations and the failure of previous enterprise resource planning system implementations.

Funding/Contractual barriers to transformation include “color of money” issues; lack of proper incentives for continuous improvement in the current working capital fund system; proprietary technical data rights; and lack of incentives and expense sharing between the public and private sectors to create incentives for a best-of-industry effort.

Political barriers to reform revolve around maintaining inefficient but politically important legacy DoD depots. Legislative barriers to the efficient management of the DoD’s depot operations includes Title 10 USC, Section 2464 that identifies core logistics capabilities to be inherently governmental; Title 10 USC, Section 2466 that requires “not more than 50% of the funds made available in a fiscal year to a military department or defense agency for depot-level maintenance and repair workload may be used to contract for performance by non-Federal Government personnel,” regardless of effectiveness; and Title 10 USC, Section 2469 that requires the use of competitive sourcing for depot work valued over \$3 million, but retains the 50/50 requirement set by Section 2455.

Organizational barriers to transformation include lack of a concentrated responsibility in overseeing the whole logistics transformation and the current demographics of DoD's acquisition workforce.

Conclusion

While the global security environment has drastically changed since the first Gulf War, the DoD's adoption of a military transformation with respect to logistics modernization has fallen short of evolving to meet the high stress demands of modern warfare. DoD has released a number of planning documents, reports and articles recognizing the significance of the need for transformation, but it has failed to make a pervasive effort, Department-wide, to implement any real change.

DoD continues to operate a non-state-of-the art, very expensive, inefficient logistics system that requires a logistics transformation. The Department must move to a world-class logistics system and achieve the benefits of dramatic increases in readiness, responsiveness, and dependability, along with significant reductions in costs and errors. The commercial world has demonstrated that these results can be achieved.

Leadership action, however, is required to overcome barriers. This means that logistics modernization must be a true and continued leadership priority. Additionally, the DoD must take maximum advantage of commercial technology to develop state-of-the-art IT systems, and to reengineer and integrate business processes. To accomplish these tasks DoD must better integrate the public and private sectors to leverage the strengths of each. The defense industry, for its part must be proactive in demonstrating the potential benefits of available improvements to DoD. The time for logistics modernization is now, so that the nation can continue to affordably provide warfighters with the support they need.

I. DoD Logistics Today

"Logistics is the careful integration of transportation, supply, warehousing, maintenance, procurement, contracting, and automation into a coherent functional area; in a way that prevents sub-optimization in any of these activities; and in a way that permits and enhances the accomplishment of a given goal, objective, or mission."

***Lt Gen William G. Pagonis
Director of Logistics during the 1991 Gulf War***

No area needs transformation more than DoD logistics, and without such a focus further transformation efforts across DoD will likely be unsuccessful. In fact, the former Army Chief of Staff, General Eric K. Shinseki has said, "you cannot have an Army transformation without a logistics transformation." This precept can be unarguably broadened—you cannot transform the Department of Defense without transforming logistics. And, while transforming many military disciplines there are often few proven precedents, in the logistics world, many of the necessary tools and concepts have been developed, tested, and proven in the commercial sector.

The Department of Defense (DoD) is one of the largest and most complex organizations in the world. DoD's budget dwarfs that of the world's largest corporation and it employs millions of people that operate worldwide. More importantly, the DoD supply chain accounted for \$162 billion in spending in Fiscal Year 2006, and managed a supply chain inventory of \$85.6 billion (over 5 million different secondary items) (Bell 2007)—orders of a magnitude of more inventory items than the largest retail corporations (Government Accountability Office 2003b). There are approximately 1 million uniformed, civilian, and contracted employees, that receive more than 54,000 requisitions, process nearly 8,200 contracts, and conduct business with approximately 24,000 suppliers each day supporting 280 ships, 14,000 helicopters, 330,000 vehicles and 900 strategic missiles to fulfill their mission (Office of the Undersecretary of Defense (Logistics and Materiel Readiness) 2008a). DoD maintains an inventory of 5.2 million different items and 60 inventory reporting systems (comparatively, Home Depot has around 50,000 items and one inventory system). While each element of the process (ordering, procurement, transportation, maintenance, finance, etc.) is digitized, these processes are often segmented, and are spread out across 600 different and non-interoperable information systems. Optimization, when it occurs, takes place at the element or sub-element level, rather than the system level. The current "system" is largely an ad-hoc mix of government and industry, with little cost visibility or performance accountability. An integrated (end-to-end) system does not exist as it does in "world-class" commercial systems.

If the DoD supply chain were a for-profit company, it would easily be in the top ten firms of the Fortune 500 (Estevez 2006). However, unlike these commercial firms, the DoD supply chain can be called upon to support operations anywhere in the world, for indefinite periods, and on very short notice.

DoD's Vision

The DoD's logistics' community believes that logistics transformation is necessary, a recognition brought about by (1) an understanding the capabilities of a world class commercial supply chain, coupled with (2) the stresses of supporting two major conflicts. DoD's current logistics strategy is currently focused on internal operation, often without a direct relationship to warfighter requirements. The following policy documents demonstrate this recognition within DoD, and offer the strategies to pursue it.

Quadrennial Defense Review, September 2001

The 2001 Quadrennial Defense Review (QDR) Report stated, "a transformed U.S. force must be matched by a support structure that is equally agile, flexible, and innovative." The QDR report also recognized that the implementation of Performance Based Logistics (PBL) was a proven strategy to compress the supply chain and improve readiness for major weapon systems and commodities, and directed its implementation (Department of Defense 2004).

Focused Logistics Joint Functional Concept, Dec. 2003

The Joint Requirements Oversight Council (JROC) approved the Focused Logistics Functional Concept in December 2002. The concept describes a comprehensive, integrated approach for fundamentally improving the way logistics functions will be performed in order to dramatically improve the timeliness and quality of logistics support. Focused Logistics (FL) defines the joint logistics capabilities that are necessary to deploy, employ, sustain and re-deploy forces across the full spectrum of operations. As envisioned, FL is the ability to provide the Joint Forces Commander (JFC) the right people, equipment, and supplies in the right place, at the right time, and in the right quantity across the full range of military operations. Critical to the success of this concept is the use of a network-centric logistics information system; linking the operator and logistician across joint forces, Services and support agencies, the commercial sector, and coalition partners; that would provide timely and accurate information that both operators and logisticians can use to integrate and synchronize operations and logistics. This logistics information system would not only establish a common picture for logisticians, but would also supply vital information to the JFC's own Common Operating Picture (Department of Defense 2003).

DoD Management Initiative Decision (MID) #917 October 2004

Management Initiative Decision (MID) #917 directed the Services to implement six pilot programs to test PBL processes, allowing for a more detailed look at the benefits of the PBL model, and to develop criteria for expanding the use of PBL to other legacy and/or new systems. These pilot programs helped to demonstrate that buying performance in the PBL model will ensure that weapon systems that are responsive, ready and reliable (Department of Defense 2004).

DoD Logistics Transformation Strategy, December 2004

The DoD's Logistics Transformation Strategy set forth a number of strategies the logistics community needs to implement in order to best serve the military's adoption of network-centric warfare. This warfare strategy envisions distributed adaptive operations,

wherein each element (or unit of action) can autonomously perform particular tasks or it may coordinate with other elements that perform parts of the task. As envisioned, these distributed operations will require a far more integrated vision of logistics transformation than previously addressed. The Logistics Transformation Strategy builds upon lessons learned in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), the initial U.S. applications of distributed operations.

The DoD Logistics Transformation Strategy concentrated on the following emerging logistics concepts:

- **Focused Logistics (FL)**— Focused Logistics is the ability to provide the joint force the right personnel, equipment, supplies, and support in the right place, at the right time, and in the right quantities, across the full range of military operations.
- **Force-Centric Logistics Enterprise (FLE)**— The FLE is DoD's mid-term vision (2005-2010) to accelerate logistics improvement, enhance support to the warfighter, and align logistics processes with the operational demands of the twenty first century. This vision includes efforts such as new depot maintenance partnerships, the condition-based maintenance plus (CBM+) initiative, total life cycle systems management (TLCSM), end-to-end distribution, executive agents (EA), and enterprise integration (EI).
- **Sense and Respond Logistics (S&RL)**— S&RL is the vision of an integrated IT system that will sense, predict, anticipate and coordinate logistics actions that provide competitive advantages spanning the full range of military operations across strategic, operational and tactical levels. To accomplish this, S&RL will rely upon highly adaptive, self-synchronizing, and dynamic physical and functional processes, employing and enhancing operational cognitive knowledge development, sense-making, and decision support.

DoD Directive Required Incorporation of RFID throughout DoD (beginning January 2005)

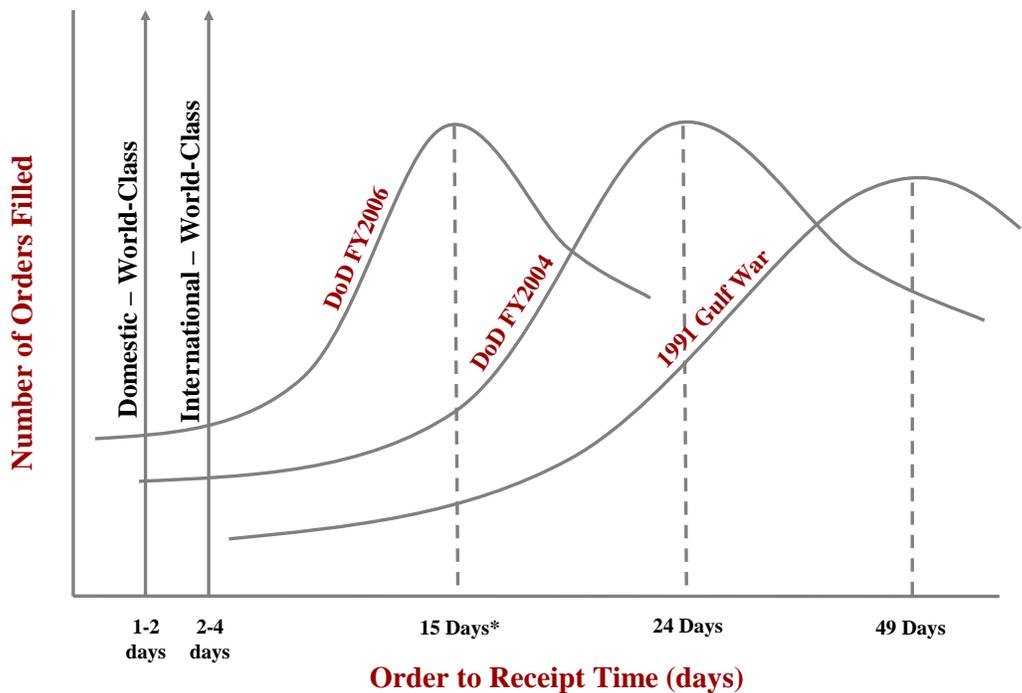
On July 30, 2004, the Under Secretary of Defense (Acquisition, Technology, and Logistics) issued a policy directive mandating the use of passive Radio-frequency identification (RFID) on solicitations for delivery of materiel after January 1, 2005 (Wynne 2004). More specifically, the policy requires RFID tags to be placed on all individual cases, all cases packaged within palletized unit loads, and all palletized unit loads (Office of the Undersecretary of Defense (Logistics and Materiel Readiness) 2008b). All major retail corporations utilize RFID to wirelessly track their logistics network, allowing employees to know where any given product is worldwide at any time.

Despite DoD's individual policy efforts, its logistics transformation remains fragmented and has only produced limited results. A number of factors, however, highlight the continued attraction of logistics transformation: the lackluster performance of the current logistics system; the high and rising cost of maintenance and support for new and legacy systems; the increased flexibility/agility required in the new (and largely unpredictable) military environment; and, the ever-increasing downward budgetary pressure.

Given the circumstances, we believe DoD has a clear need and desire to move away from its traditional logistics model towards a fully integrated system that leverages the tools and capabilities used by “world class” logistics providers.

DoD’s Logistics Performance Still Far from World-Class

The size and scope of the DoD supply chain has stymied effective DoD logistics transformation. While DoD has made some progress, it still lags behind world-class logistics performance. For example in 1991, during the build up to the Persian Gulf war, the average order to receipt time was 49 days. In comparison, the average order to receipt time in fiscal year 2006 was 15 days (which itself was down from 24 days in fiscal year 2004). Although this is a marked improvement in performance, the DoD still falls well short of international world-class international delivery standard of 2-4 days (Bell 2007). Figure 1 shows the steady improvement of customer wait-times within the DoD and compares those metrics to the standards that have been established in the commercial marketplace.



* Testimony of Honorable Jack Bell, DUSD, Logistics and Material readiness July 10, 2007

Figure 1. Logistics Results: “Successful,” but not World-Class (Bell 2007).

DoD, for the most part, continues to use traditional sustainment strategies. These are focused on conducting business transactions to procure parts and services, in an effort to ensure maximum weapon system availability. The military service has to estimate and compute its requirements; then procure, store, and when required, ship the necessary parts. This means that DoD customers (military services and agencies) focus on ensuring

that they have enough spare parts and inventory to meet any need or requirement (often referred to as a “just in case” system). This approach typically results in large inventories, brought about by increased demand (the whiplash effect¹) and “supply push.” As a result, the DoD bears the high costs and risks associated with forecasting, ordering and maintaining inventory, warehousing, managing obsolescence, transportation, reliability analysis, configuration management and field engineering. Another problem with the “just-in-case” approach is that Original Equipment Manufacturers (OEMs) and vendors have perverse incentive to give low priority to reliability, resulting in weapons components that have low availability, in turn requiring the DoD to purchase more parts from the producers. Finally, because the DoD assumed the high logistics management burden, DoD resources had to be realigned from core competencies to focus on supporting the supply chain.

Commercial best practices, on the other hand, have set high standards in logistics, with customer wait-times of 1-2 days domestically and 2-4 days internationally, high-reliability, and narrow distributions. For example, UPS Worldport sorts, routes and tracks 300,000 packages per hour; FedEx Global Hub lands an aircraft every 90 seconds and then moves packages through 300 miles of conveyor belts; Wal-Mart and Dell utilize sense-and-respond supply chains which allow them to react to customer demand within hours; Dell makes a desk-top computer every 5 seconds in response to custom-tailored internet orders; Wal-Mart keeps 60,000 suppliers continuously informed about the variation; Benetton dramatically transformed its total production process to rapidly respond to changing customer demands (Harrington 2005; The Economist. 2006).

The commercial world has achieved these impressive results, in large part, by implementing an integrated digital supply chain, enabling asset visibility from the manufacturer to the end user created from the ground up and using centrally managed networks. Wal-Mart, for example, built global communication and relationship networks with their suppliers that ensured reliable material flows, while reducing—and in many instances virtually eliminating—inventories. In this case, suppliers were incentivized to get on board with Wal-Mart’s supply chain strategy because it would ultimately lead to less supplier time and resources dedicated to managing the supply chain and greater profits. Wal-Mart became the world’s largest retailer in 2006, with 312.4 billion in sales, and operating in 15 countries, serving more than 138 million customers each week (Johnson 2006). Wal-Mart prides itself as being a leader in world-wide supply chain management, with a visible network of worldwide suppliers, warehouses, and retail stores that behave as “a single firm with near real-time information” (Russell 2007). Wal-Mart’s integrated data systems enable bi-directional communications that are mutually beneficial and allow the chain to prepare and stock shelves without a huge surplus of inventory.

Unlike the commercial sector, the DoD has not transformed its 2,005, generally non-interoperable, logistics business systems into a reliable, integrated network of logistics systems to coordinate their vast mission of providing for the warfighter (Government Accountability Office 2005a). As a result, DoD is still far from world-class and, in

¹ The “whiplash effect” can be defined as you move up the supply chain, when each entity strives to achieve local optimization, i.e. maintain enough safety stock on hand to meet any projected demand, there often results an overall distortion in demand with excess inventories.

general, significantly less capable than the commercial sector, yet at far higher costs for managing its supply chain. Additionally, there are several specific drivers for logistics transformation within DoD, these include:

1. The rising cost of maintenance and support for new and legacy systems;
2. Long customer wait times in support of warfighters;
3. The increased flexibility/agility required in the new (and largely unpredictable) military environment.

When these drivers are coupled with the documented performance improvements and savings that come from emulating commercial “best practices,” there is a clear incentive to move away from the traditional DoD models of support. DoD must shift to a world-class system that is more efficient in peacetime, and can also quickly adjust to wartime demands. With this report we hope to provide a comprehensive approach to modernizing DoD's logistics infrastructure by focusing on technology, policies, processes, and people.

Roadmap

In Section Two, this paper will provide analysis on changes that are driving the current thrust for logistics transformation, including weapons system support challenges, current environmental conditions, national security influences and domestic influences.

Next, Section Three will provide the goals that we believe must be addressed within the logistics transformation effort. Section Four will provide specific recommendations for successful logistics transformation, including: technology development, a modernized infrastructure, changes to business/finance rules, changes to the personnel policy, and a reorganization of joint logistics. Section Five will provide an examination of the barriers (cultural, technical, funding/contractual, political, and organizational) that impact the effort to transform the DoD logistics enterprise. Section Six will offer a brief summary and final conclusion.

II. Changes Driving Logistics Transformation

Logistics is the bridge between the economy of the nation and the tactical operations of its combat forces. Obviously, then, the logistics system must be in harmony, both with the economic system of the nation and with the tactical concepts and environment of the combat forces.

Rear Admiral Henry E. Eccles, USN

In order to understand how logistics transformation can be successful, the wide array of changes which are driving the transformation must be understood. Current changes include operational challenges, structural challenges, weapon system support challenges, environmental conditions, national security influences, and domestic influences; all of which will impact the DoD and its efforts to transform logistics.

Weapon System Support Challenges

Operational and structural challenges (addressed briefly in Figure 2 below) directly contribute to the overall weapon system support challenges the DoD faces today. The combination of high operational tempo and current structural conditions, (such as existing maintenance policies and processes) strain DoD's ability to effectively support weapons systems. These weapon system challenges are discussed below:

Current Structure Does Not Support Rapid Force Projection or Warfighter Efficiently. While the current system generally meets requirements, the lower reliability, availability, and inefficient processes result in higher costs, the present structure does not supply parts and needed materials on an efficient and consistent basis to support rapid force projection.

Requires Large In-Theater Presence. The current structure of DoD logistics requires a massive in-theater presence to maintain the supply chain and support functions for the military. For example, in June of 2006 the United States had 14 combat brigades in Iraq and just over 127,000 total troops. Since a combat brigade is composed of approximately 3,500 troops, this demonstrated that actual combat forces represented only 39 percent of total troops in theater. When combined with available data on support contractors in Iraq (which is estimated to be roughly 150,000 personnel), troops dedicated to combat alone represent only 18 percent of the total force or nearly 1 in 5 people in-theater (Gordon 2006). This example highlights the inefficiency that exists for in-theater support; such a requirement slows down operations and makes support functions more expensive.

Operational Environment Challenges

The present operational environment creates challenges for a logistics transformation that include:

- ***High Operations Tempo.*** Currently engaged in two major theaters of war, the DoD continues to provide logistical support, while working at high operational tempos. High operational tempos put a strain on equipment, which turn requires more frequent maintenance. Presently, the Services are operating their equipment at a pace well in excess of traditional peacetime operations. For example, the Army's truck fleet is experiencing an operational tempo five to six times the peacetime rate, causing excessive wear and required maintenance (Government Accountability Office 2007).
- ***High Maintenance Levels.*** High operations tempo leads to higher maintenance levels, in turn leading to part shortages, reducing availability and readiness. During OIF, there was a lack of necessary parts needed for deployed forces to operate. For example, personnel noted shortages of items such as tires, tank track, helicopter spare parts, and radio batteries. As a result, units had to resort to extraordinary measures such as cannibalizing other vehicles or circumventing normal supply channels to keep equipment in ready condition (Government Accountability Office 2005b).
- ***Large Maintenance Supply Footprint.*** The current logistics support structure requires the forward deployment of a large number of support personnel, supplies, and equipment. This large footprint negatively impacts operations because it inhibits the flexibility and speed of the warfighter.
- ***Turnover of Maintenance Personnel.*** Military personnel inherently have frequent moves, job changes, and are subject to retention issues. This creates a high turn over rate, frequently resulting in a logistics workforce with a lower experience level, at a time when systems are becoming increasingly complex and require higher levels of skill and experience. OIF showed a shortage of qualified maintenance personnel and often untrained or unskilled personnel were brought in to make up for deficiencies. This led to delays in processing (receipt, sorting, and forwarding) and backlogs of supplies (Government Accountability Office 2005b).

Structural Environment Challenges

Structural challenges represent difficulties that are engrained in the policies and processes for DoD acquisition and sustainment and include:

- ***Structural Design Complexity.*** The complexity of advanced, information technology based weapons systems can require a higher skilled labor force to maintain.
- ***Performance/Maintenance Disconnect.*** Most legacy logistics support concepts are not based on the availability/performance of the system, often resulting in perverse incentives to sell more repair parts. Practices such as performance-based logistics could provide incentives for reaching performance metrics, yet a majority of system maintenance contracts still do not incentivize performance optimization.
- ***Discontinuities between Acquisition and Logistics.*** System life-cycle costs are determined in large part by decisions made by both the government and contractors early in a system's development. Logistics considerations early on can have significant implication to both system availability and support costs, but are often not considered in the acquisition process.
- ***Long Waits for Priority Parts.*** Although the average customer wait time has been reduced to 16 days, long delays in getting priority parts is still an issue for many weapon systems, adversely affecting warfighter readiness. Long customer wait times also often lead to a loss of confidence in the delivery of parts, causing numerous requisitions for the same part or cannibalizing of parts from other functioning systems.
- ***Legacy Organic Depots.*** Although there was a reduction in legacy depot capacity during the 1990s, the DoD has great difficulty correctly realigning its depot infrastructure due to political and legal considerations.
- ***Legacy Logistics Business Systems.*** DoD operates a labyrinth of non-integrated, non interoperable, business and administrative systems that makes effective management and oversight nearly impossible as no single, connected source of information exists. Such a disconnect prohibits accurate asset visibility, decreases efficiency, and ultimately increases support costs.

Figure 2: Operational and environmental challenges

Complex, Inefficient Supply

Chains. Current supply chains are highly complex and inefficient, since several different types of systems are used to track and order parts. Often, tremendous backlogs of shipping containers and packages exist due to identification and transportation problems. Order to receipt times for DoD logistics shipments are 4 to 8 times longer than for commercial international deliveries. Information is frequently so fragmented that parts are re-ordered because delivery cannot be confirmed,



leading to high levels of inventory and ultimately wasted space and funds. For example, one recent GAO audit discovered that on average 52 percent (\$1.3 billion) of the Air Force's secondary on-order inventory was not needed to support on-order requirements. Furthermore, about 65 percent (\$18.7 billion) of on-hand inventory was not needed to support required inventory levels. GAO also calculated that the Air Force spends between \$15 million to \$30 million annually to store its unneeded items (Solis 2007). When parts are re-ordered, the additional orders place an undue burden on the supply chain adding even more stress to an already inefficient system.

Limited In-Transit and In-Theater Asset Visibility. Limited asset visibility is another current challenge for DoD logistics. During OIF, DoD did not have adequate visibility over all equipment and supplies transported to, within, and from the theater of operation. DoD has not taken full advantage of RFID tags, has not efficiently managed their use, and has not fully optimized their potential. For example, an audit was completed of four military depots for shipments between December 2007 and January 2008. When auditors examined the shipments, they found that of 197 suppliers whose contracts contained clauses requiring RFID's to be used, 84 (43 percent) failed to apply passive RFID tags to their shipments. Similarly, of the 327 shipments sampled, 144 (35 percent) were sent without an advance shipment notice, forcing depot personnel to manually acknowledge and accept a supply item, thereby eliminating the efficiency of RFID technology in the supply chain (O'Connor 2008). DoD also does not require active tags to be returned or reused even though they are designed for repeated reuse (Government Accountability Office 2006a).

Turnover of Maintenance Personnel. In many cases, high operational levels have led some active duty members to redeploy with less than a year at home to rest and retrain, causing concern that some may choose not to re-enlist and creating problems in meeting recruiting and retention goals (Belasco 2008). As a result, many of the most highly skilled and experienced maintenance personnel are no longer available. DoD is then forced to re-train younger, inexperienced soldiers to provide maintenance support on some of their most technically complex systems. Additionally, civilian personnel

turnover is also a major problem at military depots. For example, as of 2002 over 40 percent of the depot workforce was eligible for retirement between 2007 and 2009 (Government Accountability Office 2003a). In light of such large numbers of older employees, the services may have difficulty maintaining the depots' viability over the long-term.

Contractors Not Incentivized to Improve System Availability. The current DoD support model is based upon using a “supply push” strategy to acquire parts and services in hopes of ensuring maximum system availability. The military services estimate the requirements; then procure, store, and when required, ship the necessary parts to where they are needed. This system is highly dependent upon having large inventories and creates perverse incentives for the Original Equipment Manufactures (OEMs) and vendors. As depicted by Figure 3 below, without performance incentives via performance-based logistics, system availability and logistics response times are severely degraded.

Navy Program	Material Availability		Logistics Response Time	
	Pre-PBL	Post-PBL	Pre-PBL	Post-PBL
F-14 Lantirn	73%	90%	56.9 Days	5 Days
H-60 Avionics	71%	85%	52.7 Days	8 Days
F-18 Stores Mgmt. System	65%	98%	42.6 Days	2 Days CONUS 7 Days OCONUS
Tires	81%	98%	28.9 Days	2 Days CONUS 4 Days OCONUS
APU	65%	90%	35 Days	6.5 Days

Figure 3. Sustainment Availability and Response Time Pre-PBL and Post-PBL (Klevan 2005; Kratz 2008).

Current Environmental Conditions

Globalization. The rapid advancement and spread of technology has yielded an unprecedented access to information, which has in turn contributed to explosive economic growth in the past few decades. A large portion of the world’s population now has instant access to information; spurring knowledge needed to research, develop, construct, and sell goods and services. As a result of these innovative factors, the world gross domestic product (GDP) increased from \$17.4 trillion to \$40.9 trillion and the U.S. GDP increased from \$5 trillion to \$11.7 trillion (The World Bank 2005) from 1989 to 2007.

For the DoD, globalization presents many advantages and some disadvantages. Like the private sector, the DoD gets better performance through innovation, collaboration, and information sharing via globalization. Also, lower costs, less expensive labor, access to manufacturing methods, and even domestic job creation stand as additional advantages.

Globalization has produced many benefits, but can also aid adversaries and terrorists, who can now access sophisticated technologies and sensitive information to, for example, trigger roadside bombs or conspire more securely.

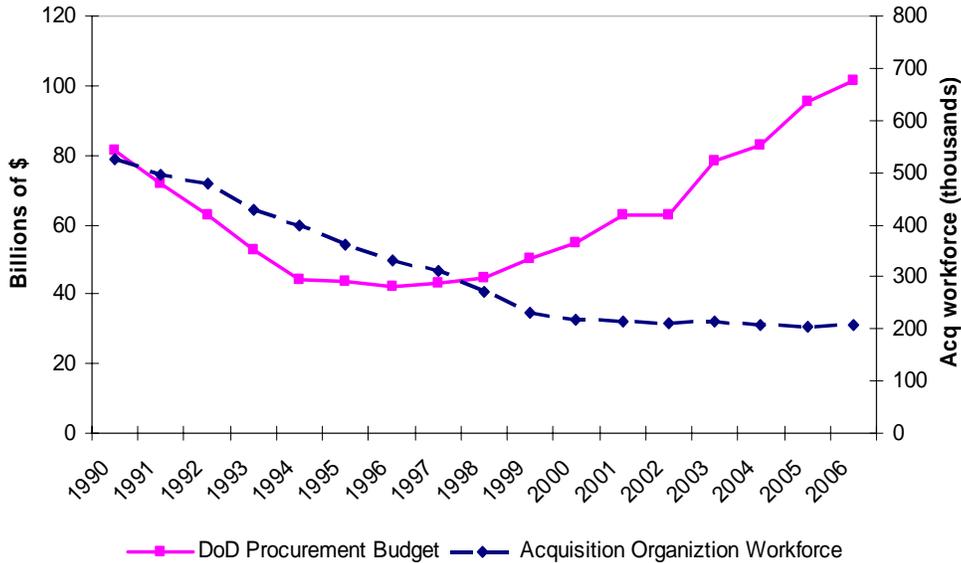
Isolationist Trends. While many embrace globalization as an avenue for opening up the world to innovation, many “isolationists” in America oppose outsourcing any defense projects for reasons of national security and economics. In some cases they are protectionist looking to protect jobs, and in others they fear that sensitive technology will fall into the wrong hands. As a result, domestic firms are often prohibited from using their best sources for materials and are restricted from access to cutting edge research and development abroad. This isolationist belief severely undermines the strength of American international relationships as many of America’s allies are now becoming more engaged in advanced scientific and industrial research and development. Globalization will ultimately help fulfill DoD's needs as defense budgets are likely heading towards a major downturn. The globalized defense market can be used to gain efficiencies by sharing development costs and having common production lines (for economies-of-scale). In order for the DoD to equip a state-of-the-art military, it cannot ignore the advantages that can be had by globalization.

Changes in the Defense Industrial Base. As a direct result of the defense budget cuts of the 1990s, the defense private sector consolidated its existing industrial base through mergers, acquisitions and vertical integration. In many cases, the DoD now has to deal with a limited number of suppliers, inhibiting competition and innovation. Currently, only six of the fifty pre-consolidation era prime contractors remain in business. The consolidation increased the efficiency of the surviving firms by reducing costs through combined operations such as sales, purchasing, and overhead allocations allowing for significant cost savings and removal of risk (Malburg 2000). The practice of vertical integration, where companies seek to buy upstream suppliers and downstream buyers for the purpose of satisfying a common need, has become prevalent as a new measure for cutting costs and increasing efficiency. In some cases, the consolidation has created a virtual monopoly for those with the expertise and infrastructure to operate within the government procurement system, and to provide the needed support (Davis 1996).

Government Workforce

DoD faces three human capital challenges in its efforts to transform logistics: acquisition workforce cuts, demographics and personnel requirements for support functions.

Acquisition Workforce Cuts. Due to budget cuts at the end of the Cold War, the DoD’s civilian workforce was significantly reduced via voluntary turnover, retirements and freezes on hiring authority. Between fiscal years 1989 and 2002 the civilian workforce shrank by approximately 38 percent. The acquisition component of the workforce was hit especially hard. As can be seen in Figure 4 below, despite major increases in the defense budget in the years following these cuts, commensurate increases in acquisition personnel did not occur (Walker 2003). Such personnel reductions place additional pressures on the remaining acquisition employees to perform. As a result, personnel involved in logistics transformation may be struggling to complete numerous other tasks.



Source of workforce data: DoD IG Report D-2000-088 Feb 29, 2000 & DoD IG Report D-2006-073 April 17, 2006
 Source of budget data: Annual Defense Reports, available at http://www.dod.mil/execsec/adr_intro.html.
 Procurement supplementals for FY2005 and FY2006 not yet reflected in Annual Defense Reports were obtained from Congressional Research Service Reports.

Figure 4. Procurement Budget Compared as with Acquisition Workforce Size.

Demographics. As of 2006, Baby Boomers represented over 64 percent of DoD’s workforce, while generation X and Y civilian personnel only represented a combined total of just 28 percent (Office of the Undersecretary of Defense (Logistics and Materiel Readiness) 2007). As of 2008, 18 percent of the civilian acquisition workforce (20,000) employees were eligible for retirement. In addition, another 20 percent (22,500) will be eligible to retire within the next five years (Anderson 2008). These demographic conditions highlight the potential knowledge gaps may exist as many older generations of workers may not be current on modern, cutting-edge supply chain management methods which could negatively impact DoD's effort to transform logistics. This situation also highlights the serious need for active recruitment of acquisition personnel as the older generations retire.

Personnel Requirements for Support Functions. As noted in Figure 5 below, the tooth-to-tail ratio, or the ratio of DoD personnel that are dedicated to support activities versus those who are reserved exclusively for combat is staggering. When combining maintenance and logistics functions (the tail), 40 percent of the workforce is represented as compared with only 15 percent for those who fill a combat role (the tooth), creating a tooth-to-tail ratio of 40:15, or about 2.6 support personnel for every soldier in combat.

Occupation	# Civ		# Mil		Total		%	
	1996	2005	1996	2005	1996	2005	1996	2005
Maintenance/Engineers	233	198	445	402	678	600	27%	29%
Administration	262	270	119	207	382	476	16%	23%
Service, Supply, and Procurement (Logistics)	132	92	152	127	283	218	12%	11%
Combat	12	8	324	296	336	304	14%	15%
Health/Medical	28	28	131	112	159	140	6%	7%
Technical	114	76	91	50	205	128	8%	6%
Comm/Intelligence	6	7	137	118	143	125	6%	6%
Other/Unknown	50	8	180	60	229	69	9%	3%
Total	874	687	1,599	1,370	2,472	2,057	100%	100%

Figure 5. Distribution of DoD Workforce.

At the same time, there has also been a fundamental shift in the roles and responsibilities of the workforce. Market-based sourcing strategies, such as competitive sourcing, outsourcing, and privatization, along with the requirement for more service contracts has altered the role of government employees from “doers” to “managers of doers.” As applied to logistics, government employees went from operating the supply chain, to monitoring those who carry out the day-to-day functions needed for support.

National Security Influences

Threat Changes. Although there is a possibility that a peer competitor may emerge resulting in Cold-War-like tension, the risk of inter-state war appears to be very low for the foreseeable future. The much more likely threats have been described as “irregular,” referring to all types of unconventional methods of violence, to include acts of a military, political, psychological, and economic nature (USMC 2006). Asymmetric warfare, worldwide terrorism networks such as Al Qaeda, and weapons proliferation pose a number of threatening challenges the DoD must prepare to defend against, further complicating logistics transformation efforts.

New Missions. Along with threat changes, new missions have arisen as additional challenges for the DoD. A twenty-first century military must be capable of responding to a wide range of crises when called upon. Homeland defense, missile defense, stability and reconstruction, cybersecurity, non-kinetic operations and humanitarian efforts are just some examples of the new missions being taken on by the U.S. military all of which will require a highly responsive logistics infrastructure.

Technology Changes. Because of rapid technology change, the DoD must be agile and able to take advantage of technological advancements as they occur (particularly with respect to supply chain operations). The increased reliance of the DoD on advanced

technologies coupled with adversaries increasing access to them has significant implications for the DoD logistics infrastructure.

Domestic Influences

Economics. The United States faces numerous long-term domestic budgetary challenges that include the recent responses to the financial crisis as well as underlying increases for mandatory spending on programs such as Social Security and Medicare stemming from the aging of the baby boom generation. These rising costs will create an inevitable downward pressure on future DoD budgets. Even though defense budgets are currently well above the Cold War average, they will likely decline significantly based on past historic trends. This will serve to constrain the funds available for recapitalization, modernization, and transformation of the military.

Defense Budget Shifts. Mismatches between requirements and funds consistently threaten the DoD funding and make long-term planning difficult especially for projects as large as transforming the whole of DoD logistics. The Congressional Budget Office projected personnel as well as operations and maintenance budgetary expenses to rise thirty percent and twenty percent respectively, while funds invested in research, development, testing and evaluation are expected to decline by one-third in the same period (Congressional Budget Office 2006). This will negatively impact the logistics transformation effort as additional spending in research will be needed to fully develop the next generation of supply chain information management systems and technology.

Technological Advances. Rapid technological advances will continue to shape DoD's capabilities into the future. This rapid change has had, and will continue to have, an impact on the defense industry and the military as changes in advanced information technologies, quantum computing, nano-technologies, bio-technologies, and robotics transform the world. With proper planning, DoD can integrate these advancements into its logistics modernization efforts.

III. Goals for Logistics Transformation

The DoD will require a different logistics infrastructure and strategy to support the military in the 21st century than the one that developed during the Cold War period. The new environment will be unpredictable, with a demand for rapid response that could, as current operations demonstrate, endure for years. To be successful, we believe a transformed logistics infrastructure must be responsive, enable timely deployments, reduce the in-theater footprint, re-engineer and integrate business processes, provide total asset visibility, leverage the strengths of the public and private sectors, improve weapon systems availability and cost significantly less.

Be Responsive to Warfighter Requirements

As missions change, requirements will change. In the twenty-first century, warfighter requirements will vary as the U.S. military will be operating in more different conditions, against more different opponents, and, perhaps with different goals than it has ever had before. For the military to be successful, its supply chain must also be able to adapt and respond. If such a capability does not exist, the effectiveness of the fighting force is diminished and ultimately this will negatively impact operations. A modernized logistics system must be responsive to warfighter requirements and serve as a catalyst for ensuring mission success.

Enable Timely Deployment of Expeditionary Forces

For expeditionary forces to be effective, they must be agile. Since expeditionary forces will strive to deploy within days, logistical support must be equally responsive, and help, not hinder, the ability for the force to reach their forward operating location in the quickest and most efficient manner possible. As the DoD's logistics enterprise currently operates, it is generally the limiting factor for expeditionary deployments, and generally is unable to meet the desired operational timelines. In an environment with the potential for multiple military operations, in different geographic locations and climates, responsive logistics support is imperative to ensure success for the expeditionary warfighter.

Reduce the Requirement for People, Equipment, and Supplies in Theater

To support the operational need for greater mobility and faster responsiveness, the military must reduce the large traditional logistics footprint required to deploy, sustain, and maintain theater forces. The requirement for support personnel, equipment and supplies in theater must be reduced overall. Excess inventory shipped to one theater may be un-needed, or wasted, and, at the same time be unavailable in another theater. Eliminating these problems will decrease costs and improve efficiency, while providing more flexibility for redeployments or other operational contingencies as they arise.

Develop State-of-the-Art IT Systems to Re-engineer and Integrate Business Processes

Non-integrated, non-interoperable logistics systems create a significant challenge, preventing the DoD from efficiently managing and optimizing its logistics enterprise. As

a result, forces in the field routinely stock lots of parts and order needed parts multiple times to make sure they get what they need—contributing directly to DoD’s inventory of over \$60 billion in spare parts. To overcome this inefficiency and waste, DoD must implement a world-class logistics information system, to replace its current set of more than 1,000 different information systems. This will significantly reduce the overall cost, but will also greatly improve the readiness and responsiveness of defense systems.

Provide Total Asset Visibility at All Times

Following the commercial sector’s lead, the DoD has initiated several programs to implement total asset visibility (TAV), yet TAV is still far from a reality. TAV will allow logisticians and planners to oversee inventory through every step of the supply chain, thus reducing backorders, repetitive orders, errors, and shortages. For example, there were numerous problems in the Operation Iraqi Freedom (OIF) theater, such as, backlogs of hundreds of pallets and containers of material at various distribution points (Government Accountability Office 2005b).

Through the use of technology such as RFID, the DoD has begun to see the advantages asset visibility provides, but the use of such technology must be implemented throughout the entire supply chain. Despite over ten years of investment in asset visibility technology, DoD has yet to achieve adequate asset tracking in supply delivery to theaters of war, or in bringing material for repair back to U.S. facilities. As a result, military readiness is degraded and warfighter effectiveness is reduced.

Better Integrate the Public and Private Sectors to Leverage the Strengths of Each

The private sector is integral in virtually every phase of providing logistics support to the warfighter. In theater, this is evidenced by the fact that there are over 160,000 contractors supporting a force of approximately 150,000 soldiers in Iraq. Effective integration of the public and private sector is essential for providing “world class” logistics support to the warfighter.

Improve Weapon Systems Availability

Traditional DoD logistics does not incentivize contractors to improve the reliability of systems and therefore, the DoD often lacks vital parts, which results in limited system availability. Traditional DoD sustainment strategies focus on conducting business transactions to procure parts and services by using a “supply push” strategy in hopes of ensuring maximum availability of required spares and replacement parts. By shifting to a PBL model, a contractor is incentivized to do whatever it takes to ensure the system as a whole is functional at a particular rate; such an approach enables DoD to buy specific levels of system availability. In order to improve current weapon systems availability, DoD must shift to a performance based, incentive driven approach to supply chain management.

Cost Significantly Less

Operation of DoD’s transformed logistics infrastructure must cost significantly less than operating the current system. DoD will likely face, at best, a budget with limited growth, and more likely cuts in the future; efficiency and cost effectiveness must be a top priority

for any transformation project. Ultimately, DoD will have become accustomed to doing more with less. Inefficiency and waste in the current supply chain is significant as huge inventory stocks, insufficient oversight and monitoring capabilities, and delayed availability, cost DoD substantial amounts of money every year; funds that could be used for other force structure modernization projects. DoD must ensure that at the completion of its logistics transformation effort, substantial, long-term cost savings is achieved.

IV. DoD Logistics Transformation Will Require: A Development of Key Technologies

We have come a long way since the days when entering the logistical net meant asking the supply sergeant, “Got any?” “Gonna get any?”

Gen John A. Wickham, USA

DoD’s efforts to modernize logistics to date have focused on increasing system efficiency, reducing the mobility footprint, migrating toward performance-based support contracts, and implementing enterprise resource planning (ERP) systems. These efforts will produce improved, linear supply chains with that will operate within traditional, hierarchical command and control structures. However, duplication of effort and lack of supply visibility throughout the system mean that DoD often maintains excess supplies, frequently ordering stock from a third party rather than redirecting supplies within the distribution network. Consequently, DoD needs to move towards a more adaptive system that will provide the precise, agile support required for the distributed, network-centric operations that DoD envisions—an adaptive “Sense and Respond Logistics Network.”

The term Sense and Respond as a business concept first appeared in 1992, describing a desirable type of organizational behavior of service-centered companies that collaborate with their customers, anticipate, and respond to their requests (Haeckel 1992). This notion was borrowed from the life sciences, where organisms are described as having the capability to “sense and respond” to events that may either pose an opportunity or threat in their environment. Over time, this concept has evolved into a managerial framework for large enterprises that are facing rapid, unpredictable change. Under these circumstances the only strategy that may be appropriate is for companies to attempt to sense their customers needs early and then preemptively respond to them (Haeckel 1999).

With the realization that “demand-pull” is inherently more efficient than “supply-push,” commercial enterprises (e.g. Wal-Mart, Dell, and Amazon.com) implemented adaptive concepts to their supply chains. Wal-Mart is now able to follow every single gallon of laundry detergent it sells, from when it enters the supply chain to its final sale, and FedEx or UPS enable customers to track their packages as they are delivered anywhere in the world (Perera 2007). Military planners and civilian leaders believed this model could be applied to defense logistics, making the system more adaptive and responsive, and better able to support network-centric warfare. This approach has come to be known as Sense and Respond Logistics (SRL).

As envisioned, SRL is focused on achieving a network-centric, knowledge driven environment where information technology provides superior and relatively seamless connectivity of data, information, and awareness. The objective is to develop an adaptive logistics system, allowing forces to access support from supply nodes distributed across the battlefield. Robust and flexible transportation networks, enabled by situational awareness of requirements, demand, and location of forces, mitigate risk and uncertainty. It was believed that SRL would provide a competitive advantage across the strategic,

operational, and tactical levels of war through predictive, anticipatory and interpretative measures (Office of Force Transformation 2004).

SRL as defined by the Office of Force Transformation

Sense and Respond Logistics is a transformational network-centric concept that enables Joint effects-based operations and provides precise, agile support. Sense and Respond Logistics relies upon highly adaptive, self-synchronizing, and dynamic physical and functional processes. It predicts, anticipates, and coordinates actions that provide competitive advantage spanning the full range of military operations across the strategic, operational, and tactical levels of war. Sense and Respond Logistics promotes doctrinal and organizational transformation, and supports scalable coherence of command and control, operations, logistics, intelligence, surveillance, and reconnaissance.

Implemented as a cross-service, cross-organizational capability, Sense and Respond Logistics provides an end-to-end, point-of-effect to source-of-support network of logistics resources and capabilities. Within Sense and Respond Logistics, every entity, whether military, government, or commercial, is both a potential consumer and a potential provider of logistics. It delivers flexibility, robustness, and scalability for Joint expeditionary warfare through adaptive, responsive, real-time, demand and support networks within U.S., allied, and coalition operations.

Office of Force Transformation Concept Document “Operational Sense and Respond Logistics”

6 May 2004

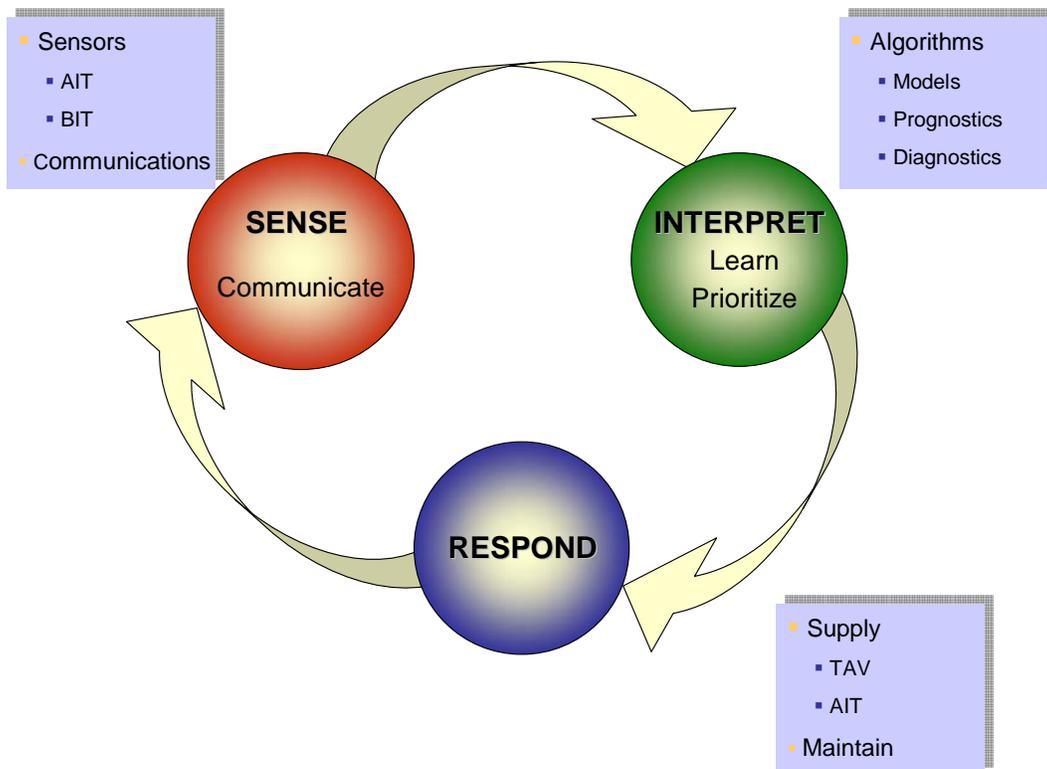


Figure 6. Sense and Respond Network.

As envisioned, all SRL network nodes will be both a consumer and a supplier of real-time information in an integrated logistical and operations system. Sensors will track supply usage or equipment status. These sensors will be ubiquitous, monitoring, for example, armored vehicle turrets, vehicle gas tanks, batteries, and cases of meals ready-to-eat. The collected data will be provided in real-time to in-theater logisticians for interpretation. Using models and algorithms, that consumption data will be compared against the planned rate, and modified projections could be made as to when a unit may need more ammo or an engine may stop working. Moreover, the supply chain will be able to respond to changes in projection to ensure the appropriate supplies will be ordered and delivered where they were needed. With the visibility of the entire inventory, the supplies for highest priority missions could come from other units, with lower priority missions (Perera 2007). Figure 6 illustrates the sense and respond cycle.

Although the promise of SRL is real, and most of its technology has been demonstrated, there is still much R&D work to do before it can be fully implemented. For example, DoD has implemented a RFID policy, but currently these devices only provide asset-tracking abilities as opposed to consumption information. These RFID tags, and their readers, still need some additional technological development before they can be used ubiquitously to satisfy the SRL vision. To adequately develop a true SRL capability, additional funding for research and demonstrations must be made available.

Key Technology Areas that Require Further Development:

Improved Sensing. Much of the improved sensing capability is being developed under the rubric of some Automated Identification Technologies (AIT). AIT are comprised of a suite of tools and devices (barcodes, contact buttons, RFID tags, scanners, imagers, and readers) that collect, aggregate, computer and communicate data to enable accurate, timely visibility of assets (in motion and at rest). Use of AITs integrated with a supply chain database system will significantly improve asset visibility.

One of the newer technologies being implemented in DoD is passive RFID. This promising technology will be used to enable better inventory management and accountability. Although passive tags only store a limited amount of information, they do not require an imbedded power source to operate. To be activated, these tags need to receive a radio frequency signal from reader devices to enable the passive RFID tags to send back the information stored on them. Once the radio signal is received, a small amount of the reader's signal power is temporarily stored and then used to generate the tag response. Despite having a limited useful range of 3 to 10 feet, the projected price of a tag – a few pennies – makes use of passive RFID tags attractive.

The use of AIT devices can support business mission areas as diverse as depot maintenance, overhaul, and repair, flight line maintenance and flight safety critical part pedigree management, and item unique identification (IUID) for property accounting. If these devices were combined with integrated environmental sensors, such as temperature, vibration, etc., they could be used to help monitor the health of systems, and as inputs to prognostic algorithms.

There are still technical issues with AIT that include security, electromagnetic compatibility, range, readability, durability and cost, that limit their use within the DoD.

Improved Modeling and Algorithms. We believe the Sense and Respond Concept includes another step that should be explicitly stated, i.e. interpretation of data. This phase is dependent on the use of models that can, based on the analysis of the “sensed data,” make accurate demand predictions at the tactical, operational, and strategic levels. While being valuable, these projections made on historical data can be enhanced by the use of innovative intelligent agents. Intelligent agents are software programs, that work autonomously in conjunction with other programs and systems, respond to changes, and have the ability to infer and learn. They would provide context-related knowledge, which would be a basis for improved decision-making. Academic researchers have only recently explored the use of intelligent agents to assist in managing supply chains (Amouzegar 2007-2008). As this technology matures it will provide a significant enhancement to the DoD SRL.

Most people agree with the goals of sense and respond, there are, however, still some technology investments that need to be made. In the current fiscal and operational environment proponents can expect to face resistance, which will take senior leadership support overcome, so that DoD’s supply chain can fully leverage the technology available in the twenty-first century to improve support for the warfighter.

A Modernized Logistics Infrastructure

In the performance of its complex worldwide mission, DoD’s performs a variety of interrelated and interdependent business functions, using as many as 3,700 business systems—over 2,000 of these system support the management of DoD logistics alone (GAO 2006). In the past, development of these systems was done within functional stovepipes, in effect creating islands that supported a specific function, such as order-entry. A system was developed to solve the specific problem without respect for any of the other functional areas that may be related. Afterward, the organization realizes these islands needed to communicate and interact with other functions, and as a result, integration projects were undertaken. In the end, these disparate efforts have generated highly customized systems than are generally not well integrated or interoperable with one another, and are each inflexible to change. Until DoD can successfully transform these business operations into one cohesive system, it will continue to confront the pervasive, decades-old management inefficiencies it has always experienced. Consequently, transformation of these business systems is integral to transforming its logistics management.

Continue to Evolve to Service Oriented Architecture (SOA). In July 2007, the Secretary of Defense recognized the importance of developing a Business Enterprise Architecture that supports federation “by improving system-level information and capturing the targeted environment and planned Enterprise services and associated information in support of a Service-oriented Architecture” (DoD 2008). Service Oriented Architectures (SOA) enable a set of loosely coupled services to work together seamlessly, taking advantage of today’s ubiquitous connectivity and open standard, to provide various functionalities to end users.

The Government Accountability Office describes SOA as “an approach for sharing functions and applications across an organization by designing them as discrete, reusable, business-oriented services. These services need to be, among other things, (1) self-

contained, meaning that they do not depend on any other functions or applications to execute a discrete unit of work; (2) published and exposed as self-describing business capabilities that can be accessed and used; and (3) subscribed to via well-defined and standardized interfaces instead of unique, tightly coupled connections” (GAO 2006).

A SOA provides a flexible software framework that unifies business processes by modularizing large applications into services. When implemented, a SOA will help create a federated DoD logistics environment, where resources and applications are united, while maintaining their individual autonomy and governance. Moreover, any client, from any device or any operating system will have the ability to access any service or create a new business process that other system users can access.

U.S. Army Logistics Modernization Program

The Logistics Modernization Program (LMP) is the U.S. Army’s principal initiative to modernize their logistics information systems and transform their acquisition and inventory management processes. LMP is accomplishing these goals by replacing the Army’s 30-year old legacy systems, the Commodity Command Standard System (CCSS) and the Standard Depot System (SDS), with an Enterprise Resource Planning (ERP) system that utilizes the private industry’s best business practices. Under a 12 year, \$680 M contract with Computer Sciences Corporation (CSC), LMP is scheduled to reach full operating capacity (FOC) by 2011. Once operational, LMP will serve as the cornerstone of the Army’s Single Army Logistics Enterprise (SALE) program, a converged solution that will link several Army ERP systems together to create one end-to-end logistics network and achieve total asset visibility (TAV).

Despite the program’s overall success, LMP encountered implementation and operational problems after its initial “go-live” launch in July 7, 2003. Cultural resistance, improper training strategies, unfamiliarity with service contracting and unnecessary software tailoring caused inaccurate data, unqualified financials and cost overruns. In order to assess the validity of LMP, the Army instituted a strategic pause in 2006. Under the pause, officials addressed issues of cost and inaccurate data. The Army transferred authority of LMP from the Army Material Command (AMC) to the Program Executive Officer for Enterprise Information Systems (PEO EIS), which was managing the other ERP programs associated with SALE. The strategic pause was lifted in early 2007 and the final three program deployments were scheduled to be completed by September 2010.

Currently, LMP is deployed at 14 locations nationwide with approximately 4,300 users and is operating at 80% total functionality. After the fourth and final deployment in 2010, LMP will extend across 104 locations to 22,000 users. The program will manage over \$40 B in goods and services, processing over 100,000 transactions daily. At 100% functionality, LMP will be one of the world’s largest and most complex ERP systems in operation.

Accelerate Implementation of Logistics' Enterprise Resource Planning (Linked to finance, personnel, contracts, etc.). DoD must also address its current business systems, which are disconnected, disorganized and inefficient.

Enterprise Resource Planning (ERP) is a generic name of a software-based business management system used to power crucial business operation functions and processes. ERPs evolved to address the issue of non-integrated legacy systems and generally use multi-module application software for improving the performance of the internal business

processes. They are used to integrate business activities across functional departments, from product planning, parts purchasing, inventory control, product distribution, fulfillment, to order tracking. As a result, ERPs maintain the referential integrity of all of the transactions within this single system. This allows users to standardize and streamline business activities, reducing inventory, improving customer relations, and integrating financial information, while achieving security, reliability and accessibility (Carver 2006).

Both commercial companies and DoD organizations have experienced dramatic improvements from implementing ERPs. IBM's Storage System Division, for example, cut the time it took to re-price its product inventory from 5 days to 5 minutes. At the same time, shipping and replacement time was cut from 22 days to 3 days, and customer credit checks were cut from 20 minutes to three seconds. When the Navy's Air Systems Command implemented an ERP, it eliminated 52 legacy systems at a projected cost savings of \$10M to \$15M per year while increasing performance. For instance, the approval time for aircraft engineering change proposals dropped from 87 days to 25 days. Finally, Nestlé USA's ERP implementation resulted in more accurate demand forecasts and the capability to accurately forecast requirements. Improvements to their supply chain allowed the company to reduce inventory, cut expenses on reallocation of products, and generate \$325M in savings (Dredde 2007). For successful logistics transformation, DoD must more quickly adopt ERP systems to functionally integrate logistics across the enterprise.

Provide the Necessary Communications Bandwidth. The DoD's implementation of the new knowledge-based, network-centric force structure has placed increasing demands on existing communications capacity. Increased bandwidth (the measure of available data communication resources), facilitates the rate and capacity of communications and/or data transfer, and has become increasingly critical. Transformed DoD logistics, particularly with the continued evolution towards sense and respond, will be data intensive, and high bandwidth will be necessary to support increased capacity, high-volume data exchange required for real-time updates.

From 1991 through 2003, DoD experienced a ten-fold increase in the demand for telecommunication bandwidth from satellites to support the war-fighting combatant commands, the military services, and defense agencies. Many believe another five-fold or six-fold jump in demand is highly likely by 2010 (Government Accountability Office 2003c). If the need to increase bandwidth is not addressed, the full potential of logistics transformation will not be achieved.

Assure Security (Physical and Cyber). DoD operates in a global, mobile, and interconnected information environment. The transformed logistics environment will depend on extended, shared, critical information infrastructures. The U.S. defense industry must rely on industry global partners from around the world. Some of these foreign companies provide the most advanced technologies – a trend that is likely to increase over time. The multi-tiered, network-centric, global supply chain creates a strategic advantage, as well as a weakness—greater exposure and vulnerability.

In cyber-space, sophisticated adversaries who have demonstrated both their intent and ability to access IT systems for espionage and the criminal theft of data threaten DoD

information systems. Defending the DoD's networks and information against these attacks is a serious challenge. These adversaries – who often have the backed by foreign intelligence services, transnational groups, or organized crime – are well resourced and trained (Barger 2008).

As DoD transitions to a SOA, new information assurance (IA) challenges are introduced. The capabilities enabled by SOAs, interoperability and extended network-centric data sharing can often become new points of vulnerability. Implementing standards and standard protocols can restrict the number security capabilities an adversary attacker must defeat; once defeated they may gain access to a large number of systems. Moreover, SOAs must continue to address the more routine information assurance challenges including reliability, availability, and non-repudiation (Wisnosky 2008).

As DoD transforms its logistics security must be a prime consideration, particularly with the greater dependence on information systems. Only with such security diligence will the Department be able to truly realize the savings and benefits extended, geographically dispersed supply chain that must continue to operate in the face of the exigencies of war.

Distance Support and Training. . Expansion of distance support and training for logistics personnel will also be a key component of successful infrastructure improvement. The most recent report on modernizing the DoD logistics workforce noted the importance of providing enterprise logistics competencies through education, training and developmental assignments. The report recommended that current training and education programs be mapped in addition to a review of proficiencies without training and education (Office of the Undersecretary of Defense (Logistics and Materiel Readiness) 2007). While these measures are important, the report ignores the need for increased distance support and training. DoD must examine and improve the methods by which it delivers training to personnel.

While it is true that in many areas sufficient training and support is indeed available, its accessibility to logistics personnel may not be feasible. A truly integrated, enterprise logistics infrastructure must not only provide end-to-end logistics support for the warfighter, but also end-to-end access to user-support and training for those personnel involved in its day-to-day operations. As the supply-chain is distributed across a wide variety of geographic locations, DoD must be able to provide user support regardless of location.

Training must be on-going and adaptable as new methods, systems and policies are implemented. To keep all members of the supply-chain infrastructure updated this information must be made available in a virtual environment. For example, the Defense Acquisition University (DAU) has done an impressive job at creating online training programs for acquisition professionals. The Acquisition Community Connection (ACC) portal allows for sharing of informational materials, policies, presentations and other training and support related information that is easily accessed from the Internet (Defense Acquisition University 2009). Such a resource could be expanded to permit a one-stop-shop for all logistics transformation procedures, policies, training and even support. Additionally, such a tool could allow for the sharing of best practices across the logistics community, permit open lines of communication, and encourage networking between the various stake-holders involved in the supply-chain. A truly successful enterprise

transformation is not only about changing the architecture of systems and information technology, it is also about changing the infrastructure, organization and accessibility between all members of the logistics community to encourage the free flow of information and ideas.

Changes to Business/Finance Rules

Along with infrastructure, the DoD needs to address many business and financial issues that hinder logistics transformation.

Streamline Contracting and Finance Mechanisms. Defense acquisition is complex, requiring knowledge of federal acquisition regulations, specialized accounting and reporting requirements, and, in some cases, the need for security clearances. These requirements create a slow and burdensome process (the F-22 development, for example, spanned 24 years, and the V-22 achieved its initial operating capability after 27 years of development). Moreover, they help create exceedingly high barriers to entry for new firms, making it difficult for the DoD to leverage the rapid pace of technological development in the commercial sector. In addition, financial rules regulating DoD's use of funds should be reformed to provide the necessary flexibility to program offices, so that they can make the appropriate tradeoffs and optimize life-cycle performance and cost.

Optimize Use of Performance Based Logistics (PBL). We believe that one of the key methods by which DoD can transform weapon system support is with greater use of Performance Based Logistics (PBL)². The goal for PBL is to provide the U.S. military with a higher level of logistics efficiency and effectiveness, to improve accountability, and to develop products that are more reliable. Based on the experience of the private sector and the pilot programs conducted in DoD, it has been demonstrated PBL support offers the best approach for long-term support of weapon systems, and their subsystems.

Unlike the commercial sector, DoD's customary methods to contract for logistics support do not incentivize performance improvements. The military services projected their requirements; then procured, stored, and shipped the necessary parts. This meant that their customers (military forces and agencies) focused on ensuring that they had enough spare parts and inventory to meet any requirement (a "just in case" system). This approach often resulted in a "whiplash effect"³, and when compounded by a "supply push," resulted in large inventories. Since, with this approach the customer, bears the costs and risks for maintaining inventory, warehousing, managing obsolescence, transportation, reliability analysis, configuration management, and field engineering, the Original Equipment Manufacturers (OEMs) and vendors were incentivized to sell more spare parts, and maintenance. Performance and reliability improvements were often

² The *Defense Acquisition Guidebook* defines Performance Based Logistics as "...the purchase of support as an integrated, affordable, performance package designed to optimize system readiness and meet performance goals for a weapon system through long-term support arrangements with clear lines of authority and responsibility. Application of Performance Based Logistics may be at the system, subsystem, or major assembly level depending on program unique circumstances and appropriate business case analysis."

³ The "whiplash effect" can be defined as you move up the supply chain, when each entity strives to achieve local optimization, i.e. maintain enough safety stock on hand to meet any projected demand, there often results an overall distortion in demand with excess inventories.

delayed (they could to be incorporated in the “next” generation of the system). As a result of these factors, it is difficult to provide truly cost-effective, integrated logistics support using DoD’s traditional model, which often resulted in weapon systems with very low availability rates.

DoD’s logistics task is complicated by the presence of various stakeholders who have individual accountability or control for certain segments without a single entity with accountability and control of the entire enterprise. For example, the Defense Logistics Agency, Services, Service MAJCOMs, Depots, and Program Office all have different budget requirements, restrictions and priorities, which needlessly complicate support effectiveness. In numerous pilot programs where DoD has tested the PBL model, logistics has seen clear improvements in performance criteria and lower costs.

Program	System Description	PBL Owner	Total Cost Benefit (\$M)
C-17	Transport Aircraft	Air Force	\$477
F/A-18	Fighter/Attack Aircraft	Navy	\$688
AH-64	Attack Helicopter	Army	\$100
TOW-ITAS	Integrated Mobile Missile and Targeting System	Army	\$350
Sentinel AN/MPQ-64	Mobile Air Defense Radar	Army	\$302
CH-47 (UK)	Cargo Helicopter	UK Ministry of Defence	\$250

Figure 7. Savings from Implementing PBL. (Fowler 2009).

When implemented, PBL shifts the focus of the government’s efforts from transactions to identifying performance outcomes and assigning the active management of the sustainment process (e.g. forecasting demand, maintaining inventory, and scheduling repairs) to the support provider. This shift incentivizes the supplier to improve the reliability of systems, and reduce inventories of spare parts as the contractor stands to make more profit from such improvements. From the government’s perspective, PBL results in optimizing total system availability, minimizing costs (See Figure 7) and decreasing the logistics footprint.

The following is list of attributes we believe differentiates PBL from more traditional support arrangements.

- ***Delineates outcome driven performance goals.*** The objective of PBL programs is to buy measurable outcomes i.e. those measures of effectiveness used to define the outcomes. In contrast, traditional support arrangements focus on procurement of physical items.
- ***Ensures responsibilities are assigned.*** A PBL effectively switches most of the risk and the responsibility for supply chain management from the customer to the supplier, for the system, or part, that is managed.
- ***Reduces cost of ownership.*** PBLs, when properly implemented, will reduce the cost of ownership of DoD weapon systems, while improving readiness.

- ***Provides incentives for attaining performance goals.*** Each PBL should be unique and tailored to its program or situation, and strive to be a “win-win” for both the customer and the supplier.

Case of the F/A 18 E/F Super Hornet

The use of PBL to support the F/A 18 E/F Super Hornet yielded significant results. The vision for the sustainment strategy was to focus on implementing a comprehensive support plan that would meet readiness requirements, reduce resource utilization and lower costs. To accomplish this goal, the program office applied the PBL concept at the sub-system/component level instead of using a single PBL contract at the system level.

The implementation involved the use of multiple PBL contracts with multiple OEMs. Such an approach seeks to provide the best value, long-term support solution for specific F/A-18 systems, sub-systems, and components—a commercial “best practice” that is often used by low-cost airlines such as Southwest. The largest PBL contract under the integrated sustainment umbrella was the F/A-18 Integrated Readiness Sustainment Team (FIRST) contract with Boeing which begun in 2000. The overall goal for this contract was to reduce the Total Ownership cost (TOC), by providing incentives for innovation and efficiency (Aguilar 2005). A new FIRST contract was awarded in December, 2005 that combined the previously separate supply chain management and integrated logistics support contracts. This contract included fleet driven performance requirements, and covers 73 percent of the Super Hornet’s elements. This 73 percent includes 3889 E/F weapons replaceable assemblies (WRAs) and shop replaceable assemblies (SRAs), 653 intermediate level repairables, 349 Support Equipment Items, 170 DLA consumables, 13,080 DLA second source consumables and 10,970 Non-DLA consumables. In Figure 8 below, six examples of availability improvements in F/A 18 support are provided as a result of the implementation of PBL.

Sub-System	Pre-PBL	Post-PBL
Stores Management	65%	98%
Tires	81%	98%
ARC 210 Radio	70%	98%
F404 Engine	55%	100%
APU C/D	70%	90%
APU E/F	70%	100%

Figure 8. F/A 18 PBL Results.

Improvements from PBL as used for the Hornet also resulted in considerable cost savings as displayed in Figure 9. Through 2010, the estimated cost savings from PBL were in the range of \$150 million.

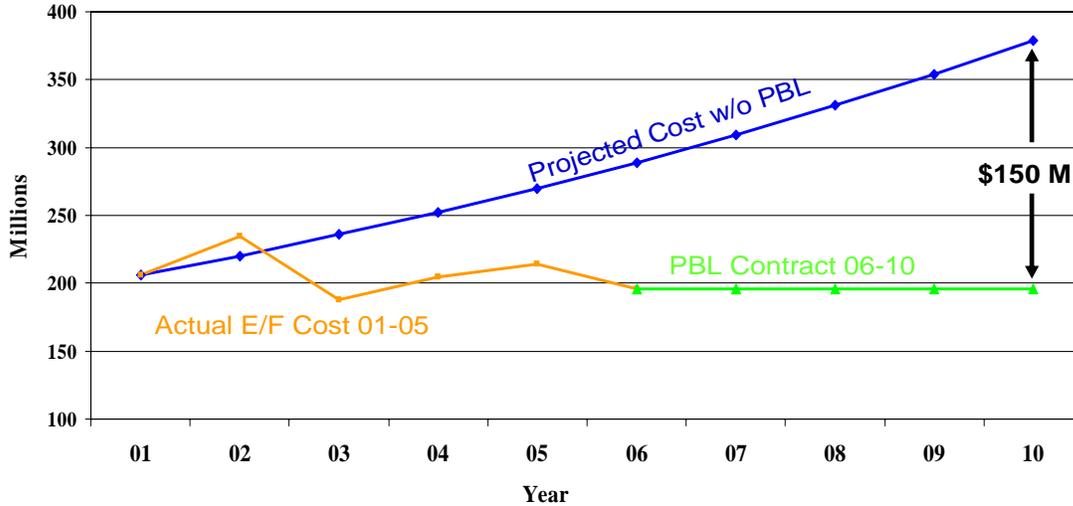


Figure 9. F/A 18 Estimated Cost Savings from PBL.

Finally, the readiness status for the Super Hornet improved considerably from a low of 57 percent to 70 percent or higher as depicted in Figure 10 below.

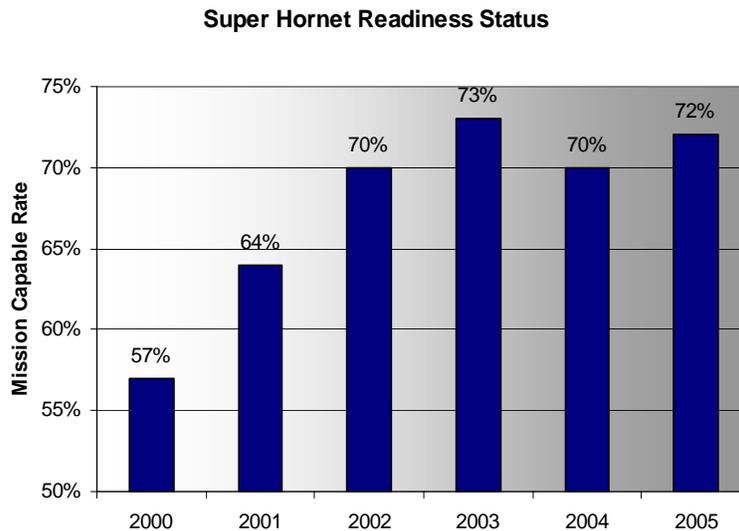


Figure 10. F/A 18 Readiness Improvements During Implementation of PBL.

Case of Navy Aircraft Tires

The Navy’s use of PBL to manage its aircraft tires also exemplifies the benefits of the process. In 1999, the Naval Inventory Control Point (NAVICP) was responsible for maintaining the Navy’s inventory of some 50,000 aircraft tires in addition to numerous other parts. NAVICP had already used PBL to change the way it manages other inventory items and it was decided that future management of the tires would be

completed via performance based logistics (Mahadevia 2006). Through PBL NAVICP contracted Michelin, who teamed with Lockheed Martin, to serve as lone tire logistics integrator for the program. Under this arrangement Michelin/Lockheed Martin were responsible for requirements forecasting, inventory management, retrograde management, storage, and transportation. Tire deliveries were to be guaranteed (at a 95 percent rate) within two business days for requirements within the continental United States, and four days for overseas requirements. Surge capability was guaranteed, at a rate of up to twice the monthly demand rate of each tire type. Team Michelin/Lockheed Martin also provided a 24/7 service center with web-based access allowing for real time requisition status, shipping status, and product support information (Grosson 2006). From July 2001 through mid-2005 the program has successfully delivered over 45,000 shipments consisting of 136,000 tires. By using PBL, customer wait times have averaged about 33 hrs for continental U.S. requisitions, and about 59 hours for overseas requisitions. Prior PBL availability was roughly 81 percent; however, within the first year of this contract on-time fill rates have consistently exceeded the 95 percent minimum and from 2003 through 2005 approached 99 percent (Mahadevia 2006; Grosson 2006).

As can be seen in Figure 11 below, overall tire inventory for the program has dropped from approximately 50,000 tires pre-PBL to approximately 13,000, with only 2,200 of those owned by the Navy. Reduction in inventory is projected to save the Navy over \$46 million over the life of the contract (Mahadevia 2006; Grosson 2006).

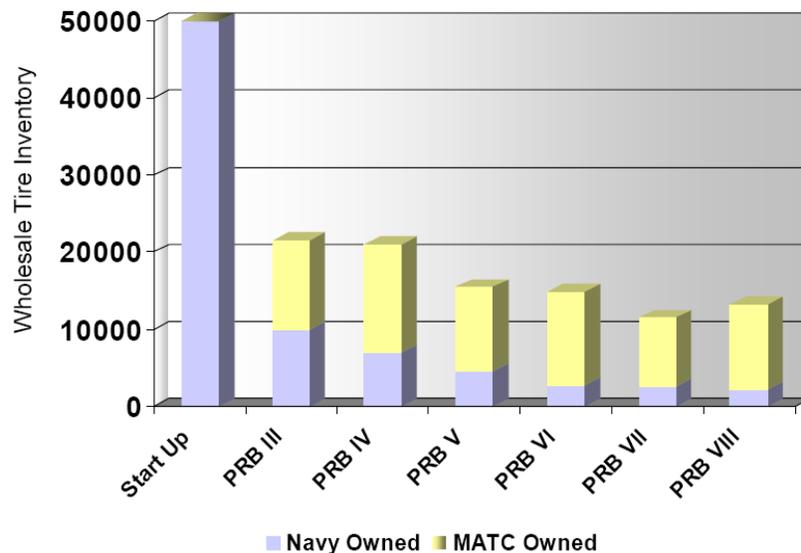


Figure 11. Changes in Tire Inventory due to PBL

The F-18 and Aircraft tires examples demonstrate that PBL can be successful at the system, sub-system and component levels of the supply-chain for increasing efficiency and reducing costs. The DoD should further implement PBL at all supply-chain levels, for both new and legacy systems, department-wide.

Encourage Continuous Process Improvement. Continuous Process Improvement (CPI) is an approach for developing a culture of continuous improvement in the areas of

reliability, process cycle times, costs in terms of less total resource consumption, quality, and productivity. When properly implemented (see inset) CPI will increase quality and productivity, while reducing waste and cycle time. Recognizing these benefits The Secretary of Defense issued DoD Directive 5010.42, 15 May 2008, which requires continuous process improvement via the implementation of Lean Six Sigma. This Directive is new and will take commitment from leadership at all levels to make it an integral part of the DoD logistics culture.

F/A 18 F404 Engine

Continuous process improvement has been widely implemented at Lemoore’s Aircraft Intermediate Maintenance Department (AIMD). Lemoore is responsible for providing intermediate maintenance on F/A 18 components, systems, engines, hydraulics and life support equipment. Through the extensive implementation of Lean maintenance processes for the F/18 F404 engine, Lemoore has been widely recognized by Naval Air Systems Command for its achievements in continuous process improvement. The lean model stresses an evolutionary process of change and adaptation, focused on building mutual-gain processes and relationships with its multiple stakeholders. Key lean principles include perfect first-time quality, waste minimization, continuous improvement, flexibility, and long-term relationships (Shields 1999).

Between June of 2000 and May of 2003, Lemoore usage of Lean process improvement techniques was responsible for decreasing the number of required billets at Lemoore by 65 from 170 to 105; improving overall manning from 63 percent to 100 percent; increasing time on wing from 170 hours to 380 hours; and, decreasing modules that were awaiting maintenance from 148 to 2. The combination of improvements across the department was responsible for reducing operations costs by over \$17m during the three year period. As can be seen in Figure 12 below, the implementation of Lean practices allowed for a significant reduction in engine cycle repair time.

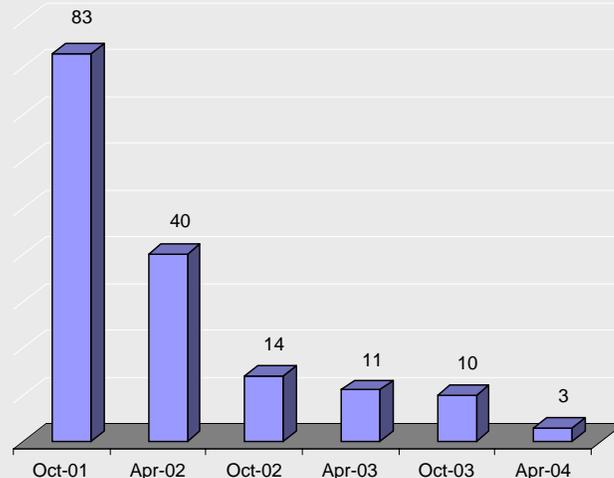


Figure 12. F404 Engine Cycle Repair Time in Days via Lean (Pauling 2006).

Correct Color of Money and Working Capital Fund Issues. “Color of money” restrictions and working capital fund issues must be corrected to permit flexibility and adaptability of funding after the budget process is completed. Currently, DoD funding is

appropriated in specific categories: operations and maintenance, research and development, procurement and construction, and these broad categories can have multiple sub-categories. These “colors of money” provide a control mechanism intended to ensure that funds are only used for their intended purpose. This process however, complicates DoD acquisition by taking flexibility away at the execution level. This control can have unintended consequences, however, such as precluding program managers from making reliability improvements with procurement funds.

The Defense Working Capital Fund (WCF) was established to help the government account for costs and budget outlays. Service Depots that are funded by a WCF fund rely on revenues from sale of their products or services to recover the cost of their operation. The WCF is intended to (1) generate sufficient resources to cover the full costs of its operations and (2) operate on a break-even basis over time—that is, neither make a gain nor incur a loss. Customers use appropriated funds, primarily operations and maintenance appropriations, to finance orders placed with the working capital fund. Depots funded by WCF face several challenges that include: instability in projected future budgets; instability in projected future prices; and instability in projected future operational requirements; and the difficulty in valuing investment decisions. Moreover, existing WCF rules provide users with poor incentives to improve performance by rewarding sales as opposed performance or cost.

Defense Medical Logistics Standard System (DMLSS)

The Defense Medical Logistics Standard System (DMLSS) exemplifies the successful implementation of a VPV model through an advanced ERP system. DMLSS uses automated tools to support the purchase of best value medical items; improve timeliness and ease of ordering medical supplies; share information needed to negotiate preferred pricing arrangements with manufacturers; allow management of inventory; equipment, technology and facilities; ensure visibility of assets in both DoD and the commercial sectors; supply the tools needed to manage patient movement items; all while leveraging the use of RFID technology. DMLSS is operational in all Service military treatment facilities (MTFs) worldwide, and in some Air Force and Navy theater hospitals and Marine Corps medical logistics companies (Business Transformation Agency 2007).

Thus far DMLSS benefits include:

- Replaced multiple Service legacy logistics systems with a single Joint DoD system
- Delivers \$6.40 return to taxpayers in benefits or cost savings for every \$1 invested
- Reduced procurement lead times from up to 45 days to 2 days or less
- Nearly eliminated medical logistics inventory of supplies and drugs at fixed MTFs
- 85% of items delivered in less than 24 hours
- Electronic commerce sales for the MHS increased from \$744M in 1997 to \$2.444B for FY 2006
- Regional contracts resulted in price discounts of over \$185M for FY 2006 (Business Transformation Agency 2007)

Broaden Use of Prime Vendors. DoD should also expand the use of prime vendors (PV). In the PV model, the vendor usually manufactures some products and purchases and stores other manufacturers’ products, as needed. PV contracts are generally awarded to commercial distributors through long-term, indefinite-delivery indefinite-quantity

(IDIQ) contracts. These contracts typically stipulate certain performance metrics. The government customers place their orders with the virtual prime vendor, and the vendor ships the items directly to the customer. PV improves logistics support by taking advantage of the private sector information technology and distribution capabilities. As a result, costs for inventory, inventory management, transportation, and personnel are shifted from the government to the PV, who, in turn, has incentives to minimize those costs. DLA, for example, has used a PV contract to supply C-130 parts since 1996, reducing its \$12 million inventory by 98% in eight years.

Encourage GainSharing. “Gainsharing” can be a highly effective technique for promoting continual performance improvements and cost reductions. Gainsharing allows for a distribution of a portion of the savings that occur through process improvements, by allowing the supplier (this can be either a commercial supplier or government organization) of the service to retain a defined portion of any cost reduction that positively impacts the customer. To achieve cost savings and additional service improvements, the service provider must be empowered to improve processes, such as those that would result in reduced inventories, or greater system availability and reliability. This strategy is necessary to incentivize firms and organizations to make the necessary investment in the short-term to achieve the desired long-term performance improvements and savings.

Changes to the Personnel Policy

DoD, which underwent a widespread downsizing the 1990s following the end of the Cold War, stepped into the 21st century with large imbalances in the skills and experiences of its specialized workforce. The acquisition and logistics communities were particularly afflicted by this downsizing, complicating reform efforts.

A particular stumbling block to reform is the resistance within the government to transition from the “doers” of a service to the “managers of doers” of the service. Although the DoD has, over time, become more supportive of measures to allow the private sector to compete to provide services, large qualifiers limit the effectiveness of the reforms. For instances, services DoD allows must be peripheral to the Department’s core mission, and the government must retain the capability to quickly fill surge demand in-house with government civil service personnel. Moving forward, government personnel must alter their focus from being a direct component of supply chain operations, to a more supervisory position that requires overseeing logistics functions that are being carried out by the private sector.

Reserve Military Personnel for Military Functions. DoD should reserve military personnel for military functions. All too often, military personnel are used to perform functions that can be accomplished less expensively, at equal or higher quality, when performed by the private sector or by civilian personnel. For example, the Army has decided to replace the 45 contractor personnel with 71 soldiers -- to be taken from military positions and trained on Stryker maintenance. According to the Army it believes that having soldiers perform the maintenance instead of contractors will permit “increased flexibility in different combat situations.” However, prior to this decision, the contracted personnel that was hired to perform these same maintenance tasks produced outstanding results. For example, between October 2003 and September 2005

contractors managed to maintain a 96 percent level of operational readiness—despite an increase of mileage usage by some 800 percent. In this instance, the contractors exceeded the Army’s performance goal of 90 percent for operational readiness while ensuring that soldiers would be reserved to perform military functions rather than maintenance.

Optimize Use of Competitive Sourcing. DoD civilian employees still perform functions that are not inherently governmental and readily available commercially. When these tasks, such as payroll services, administrative support, and maintenance functions are competed between the public and private sector (competitive sourcing using OMB Circular A-76⁴), the DoD has achieved significant performance improvements and savings, ranging between 20 and 50 percent (with an average of well over 30 percent)—regardless of whether the winner of the competition is the public or the private sector.

Competitive sourcing is distinctly different from other sourcing options (such as outsourcing, privatization, and public-private partnerships) because these other methods assume that, in a fair competition, the private sector will always provide better service at lower cost than the public sector. In contrast, competitive sourcing assumes that competition between the two providers leads to improved quality at lower cost—regardless of which sector is the winner (Gansler 2003). The data in Figure 13 demonstrates the benefits of these competitions, which on average achieves average cost savings of approximately 30 percent while maintaining—at a minimum—the same level of performance.

	Competitions Completed		Average Annual Savings (\$M)		Percent Savings
Army	510		\$470		27%
Air Force	733		\$560		36%
Marine Corps	39		\$23		34%
Navy	806		\$411		30%
Defense Agencies	50		\$13		38%
Total	2,138		\$1,478		31%

Figure 13. Results of A-76 Competitions in the Military Services.

A more recent study examined the number of competitions won by either the in-house most efficient organization (MEO) or private contractors. The per cent decrease from

⁴ Competitive sourcing occurs when a private sector firm and a government service provider compete to perform commercial activities currently performed by government employees. Just as the private sector would prepare a bid for a job, the targeted government employees form an entity, known as the Most Efficient Organization (MEO), to prepare a proposal; the proposals are evaluated with either the lowest cost provider or best value to the government used as the selection criteria and an award for the work is made either to the private sector or the MEO.

civilian authorizations to government MEO Full Time Equivalent (FTE) column in Figure 14 displays how the introduction of competitive forces can drive gains in productivity and efficiency in government operations—even when the government wins the competitive sourcing. Government proposals submitted by the MEO’s achieved the largest reduction of positions overall, with a 44 percent decrease, while those which did not win proposed 28 percent fewer FTEs—28 percent fewer to perform the very same tasks as were being currently performed (Gansler 2004).

Winning Bidder	Number of Competitions Won	Civilian Positions Competed (Excluding Direct Conversions)	MEO FTEs* (Excluding Direct Conversions)	% Decrease from Civilian Authorizations to Government MEO FTEs
In-House	525 (44%)	41,793	23,253	44%
Contractor	667 (56%)	23,364	16,848	28%
Total	1,192	65,157	40,101	38%

*MEO= Most Efficient Organization (as proposed by government workers)

Figure 14. DoD “Competitive Sourcing” Demonstrated Results 1994 – 2003.

A-76 competitions result in better performance at lower costs, “leaning” of existing government processes, and the creation of competition in the market for government provided services which is usually unaffected by such influences. Further expansion of these competitions should be widely undertaken, DoD-wide, to aid in the most efficient distribution of responsibilities between the public and private sectors throughout the supply chain.⁵

One argument against competitive sourcing is that the actual savings achieved are never as good as those which are estimated during the competition. However, as can be demonstrated in Figure 15, one study of 16 A-76 competitions concluded that Expected Savings (as bid by winner—government or private) averaged 35 percent, while Observed Savings (realized results, including scope & quantity changes) averaged 24 percent, and Effective Savings (realized results on same scope & quantity) averaged 34 percent.

⁵ The competitive sourcing of certain functions (such as those carried out within a combat zone or at a military depot) may require additional policy revisions as these may be subject to very specific rules and/or regulations.

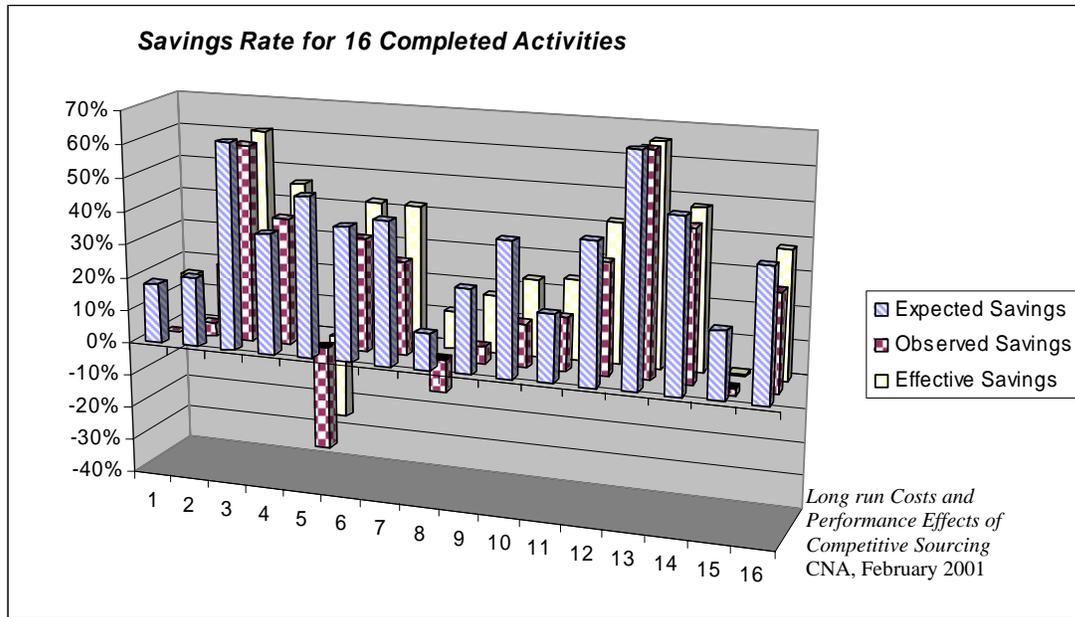


Figure 15. Savings Rate for 16 Completed Activities via A-76 Competitions (Clark 2001).

Reorganization of Joint Logistics to Create Unity of Command and Unity of Effort

Support of the CONUS-based U.S. military forces with a global mission requires an effective end-to-end strategic logistics capability. Today, however, the DoD’s supply chain and logistics responsibilities span several organizations, with no unity of command or effort. Elements may be optimized, but often produce sub-optimized results at the system level. In a step to create an end-to-end supply chain, U.S. Transportation Command (USTRANSCOM) was assigned the additional mission of Distribution Process Owner (DPO) for DoD. While a step in the right direction, greater organizational changes are needed to fully address the current challenges.

Create a Joint Logistics Command. The supply chain needs to be better integrated not only technologically, but also organizationally. As can be seen in Figure 16 below, there is no single organization accountable for the logistics support to the warfighter.

The Present Supply Chain Responsibility

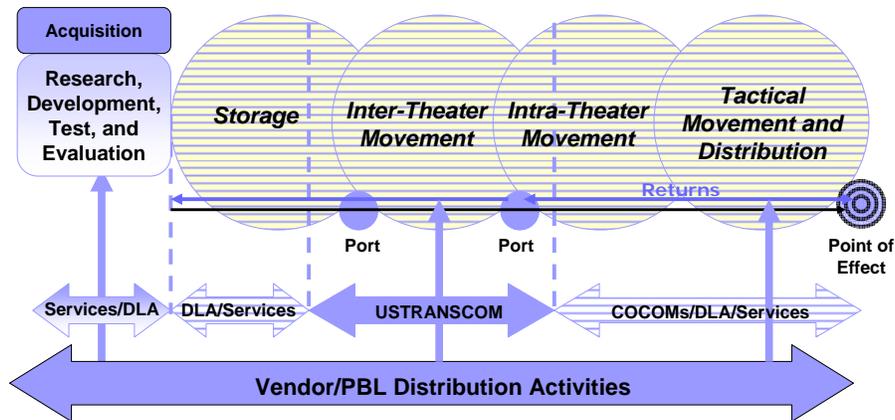


Figure 16. Present DoD Supply Chain Responsibility.

With the current approach, each segment of the supply chain— DLA, TRANSCOM, service commands etc.—is only concerned with optimizing that segment, not necessarily the performance of the entire supply chain. Even if the performance of certain elements exceeds expectations, the failure of other elements to attain their goals negatively impacts the operation of the system overall. Moreover, even if all the segments are optimized, the over supply chain may be sub-optimized.

We believe a joint command, with the authority and accountability for providing essential support to global operations should be created. While the specific composition of such an organization could be seriously debated, a centralized Command responsible for global end-to-end logistics management is necessary to oversee effective logistics transformation. This Command could potentially subsume the current USTRANSCOM mission, absorb the Defense Logistics Agency (DLA), and would be supported by the Service logistics commands (to include their depots) as service components. The Service logistics commands, however, would retain their service responsibilities and continue to perform these functions, as is the case with other service component commands.

A unified logistics command could have the benefit of ensuring that a consistent transformation agenda is pursued, and processes and procedures throughout the supply chain segments are uniform. The command could also create clearly defined joint logistics processes, well-understood roles and responsibilities, and shared logistics command performance metrics that would permit logistics transformation goals to be met across the DoD logistics enterprise (Christianson 2006). Finally, such a command would allow for a single commander that would be accountable for the process end-to-end.

Designate USD (AT&L) as Responsible for DoD CIO. The conflict between two federal laws (the Goldwater-Nichols Department of Defense Reorganization Act of 1986 and the Information Technology Management Reform Act of 1996, also known as the Clinger-

Cohen Act) continue to hamper DoD's efforts at effective business transformation in the broader context—and as a result, logistics transformation. Goldwater-Nichols assigned full responsibility for all acquisition activities to the Under Secretary of Defense (for Acquisition, Technology, and Logistics). Later, the Clinger-Cohen Act changed the process for federal agencies to acquire and manage their information technology and systems, assigning those responsibilities to the Department Chief Information Officer (CIO). These two laws overlap in the area of IT acquisition and introduce an unnecessary level of complication which should be resolved. The Secretary of Defense should place the Assistant Secretary of Defense for (Networks and Information Integration) in the USD (AT&L) organization, and then Congress should modify the Clinger-Cohen Act so he/she can then remain the CIO.

V. Barriers to Logistics Transformation

Cultural Barriers to Transformation

New technological solutions and changing business processes provide many new opportunities to improve the management of DoD. Gaining the potential benefits of transformation will require significant cultural changes within the DoD, even though the organizational culture naturally resists any significant change. Additionally, in the case of the required logistics transformation, since to date the warfighters have been successfully supported there is a reluctance to fix something that “works.” Furthermore, given that logistics is critical to any military operation, these functions are considered to be “core” functions, and as such a common sentiment within the Department is that they should be performed by military or government personnel. There are several other factors that contribute to this resistance:

Push to Protect Jobs. Government employees view many transformation or modernization proposals as an effort to eliminate their jobs. Their instinct, and that of their representatives, is to resist these initiatives.

Don’t Trust Contractors. Several of the necessary changes may require the government to place greater reliance on contractors for support. Many within DoD, however, do not trust contractors. In an operational sense, there is the unfounded belief that contractors cannot be counted on to provide required support in a combat zone—they can just quit. In a broader sense, there is a belief that since contractors are only motivated by profits, they are inherently less trustworthy and reliable than government personnel.

Don’t Trust Other Services. Logistics support has historically been organized to be provided through service “stovepipes.” There is an instinctive distrust that other services or agencies will provide required support reliable in a time of crises. Such mistrust makes transformation more difficult as its success is dependent upon coordination and cooperation between all parties in the supply chain.

Believes Commercial Off the Shelf (COTS) is Inadequate. Generally when organizations use COTS they shorten the development cycle, minimize development risk, reduce “scope-creep,” and leverage the rapid commercial development cycle. Many DoD personnel, however, continue to believe that COTS will not meet all of their requirements, and therefore should not be used. A prevalent feeling within the Department is that COTS solutions only meet “90 percent of government requirements” and need further specification to adequately meet DoD’s needs.

Want to “See” Inventory. Current commercial best practices work towards reducing, and in some cases eliminating, inventory. Military planners, however, are reluctant to trust “just in time” type delivery, and would rather be able to physically “see” their inventory. Such resistance makes transformation virtually impossible as the success of modern, commercial supply chains is hinged upon their ability to fully embrace ERP and SRL.

Don’t Trust Security of IT. While the Internet offers new and valuable options for “real time” exchange of data and information, it also introduces new vulnerabilities from

“hackers” and other breaches from security. Some believe that the potential danger for disruption is too great and DoD should not entirely rely on such systems for supply chain activities.

“Transition is too Hard.” Finally, a large contingent exists within the DoD that believes change inside an organization so big is just too hard. This belief stifles any hope of transformation and must be reversed.

Technical Barriers to Transformation

Breadth and Scale of DoD. The DoD has a scope and scale that continues to present a significant challenge; the legacy systems, processes, and supporting organizations developed over decades, have been optimized to serve subordinate organizations’ goals and objectives, rather than overall DoD logistics management. Consequently, efforts to transform these systems and processes inevitably meet with significant bureaucratic inertia and resistance.

Failure of Previous ERP Systems. Based on the size, scale, and complexity of the DoD’s enterprise-wide business and logistics systems, their implementations can be daunting. These challenges should not be viewed as a reason not to pursue these necessary developments. Although ideally every program implementation should proceed smoothly, failure is a possibility. All too often, the DoD treats the failed implementation of a program as a complete waste, as opposed to deriving lessons learned that will help future implementations.

For example, the Navy failed four times to implement one successful ERP program. Nonetheless, the failed Naval pilot programs allowed the Navy to devise a more in-depth approach in their current work at the Navy’s ERP program office (Government Accountability Office 2005c). Transformation, on the scale required for DoD logistics, can not take place without a commitment to the long-term development of technology by the DoD.

Funding/Contractual Barriers to Transformation

Color of Money. Funding barriers are a reoccurring problem for logistics transformation. One major obstacle is the “color of money.” “Color of money” refers to the statutory requirements that tie funding to be used within a designated period of time, and, only for the funding category for which it was intended. For example, funds that are allocated for research and development can’t be used for procurement or operations & maintenance. Such restrictions limit flexibility when additional funding is needed for one purpose, but the program manager is unable to shift available funds that have been earmarked for another purpose. Color of money regulations should be outcome oriented, thus enabling tradeoffs between operations & maintenance and procurement.⁶ One common problem, found especially in older systems, is the struggle between making capabilities improvements and performing repairs. While funding may be available for operations and maintenance, capabilities improvements would be required to be paid out of a separate operating account and can’t be lumped into activities that would be paid for out

⁶ Currently, Operations & Maintenance money is only good for one year, this restriction should be converted to allow for two years of spending for high cost, long lead spares.

of operations and maintenance designated funds. As a result, program managers are unable to weigh the tradeoffs between repairing a system and upgrading the system.

Working Capital Funds. As previously mentioned, a major barrier to successful logistics transformation is the current working capital fund system that does not provide the proper incentives for continuous improvement, consequently leads to inefficiency and waste.

Technical Data Rights. The issue of data rights also poses a particularly difficult problem. As much of the logistics transformation effort will be predicated upon introducing new and innovative technologies, DoD’s ability to access the best sources available for modifications or support to its logistics enterprise will be negatively impacted by private corporations that retain ownership of data rights. Presently, the possession of technical data rights by contractors instead of the government has limited DoD’s flexibility to make changes to sustainment plans. For example, the GAO identified seven specific weapon systems that encountered data rights restrictions—C-17, F-22, and C-130J aircraft, Up-armored High-Mobility Multipurpose Wheeled Vehicle, Stryker family of vehicles, Airborne Warning and Control System aircraft, and M4 carbine—all of which hindered DoD’s ability to modify their support planning efforts (Government Accountability Office 2006b).

Incentives/Shared Expenses. Finally, existing practices do not properly share both the incentives and expense between the public and private sectors. Expanding use of public-private partnerships would produce a fairer distribution of risks and benefits. These arrangements encourage both parties to work together to achieve what is in their collective best interest.

Political Barriers to Changes with DoD Depots

It is essential for the national defense that the Department of Defense maintain a core logistics capability that is Government-owned and Government-operated (including Government personnel and Government-owned and Government-operated equipment and facilities)...

Title 10 US Code Section 2464

While a push for a logistical transformation may require better use of commercial best practices, legislation and political influence often hinder the privatization of logistics capabilities, particularly at military depots. The “Depot Caucus” is the largest caucus on Capitol Hill, and has created several legislative barriers to the efficient management of the DoD’s depot operations. These include:

Title 10 USC 2464 Core Logistics Capabilities Requirements. Section 2464 of Title 10 identifies core logistics capabilities deemed inherently governmental. This statute commits the government “to ensure a ready and controlled source of technical competence and resources necessary to ensure effective and timely response to a mobilization, national defense contingency situations, and other emergency requirements.” This often conflicts with the idea of using commercial best practices and contracting to advance the logistical transformation.

Title 10 USC 2466 50/50 Depot Rule Requirements. The law that most often stymies efforts to improve logistics transformation is Section 2466, Title 10, *Limitations on the performance of depot-level maintenance of materiel*, commonly known as the “50/50 rule.” Under this law, “not more than 50% of the funds made available in a fiscal year to a military department or defense agency for depot-level maintenance and repair workload may be used to contract for performance by non-Federal Government personnel...” This rule seriously undermined efforts to improve transform logistics through competitive pressure with the private market.

Title 10 USC 2469 A-76 Restrictions. Finally, Section 2469 requires the use of competitive sourcing procedures for depot work valued over \$3 million but maintains the 50/50 requirement set by Section 2466.

Organizational Barriers to Transformation

Distributed Responsibility. While legislation and culture may certainly hinder transformation, organizational barriers already in place act as barriers as well. There is no concentrated responsibility overseeing the whole logistics transformation, also known as a single “belly button” in charge. Additionally, DoD has no single-centralized joint manager for logistics network integration and prioritization of logistics assets (Akin 2005). Because a single point of responsibility for logistics does not exist, it is not clear who is responsible for the logistics transformation effort. Since responsibility for the supply chain is distributed across DoD services and agencies, coordination and cooperation for streamlining current operations is difficult. Until a unified command with a clear leader in place is formed, it is unlikely that the logistics modernization efforts will yield significant results.

Human Capital. The current demographics of DoD’s acquisition workforce is poorly distributed, so that a majority of the personnel are approaching or have already reached retirement age. In addition, new entrants to the DoD workforce are not being hired quickly enough to replenish the flow of outgoing workers. For example, as of 2006, Baby Boomers represented over 64 percent of DoD’s workforce, while generation X and Y civilian personnel only represented a combined total of just 28 percent (Undersecretary of Defense for Acquisition 2007).

In order to fulfill a logistics transformation, DoD needs the right personnel with the right skills. Like a number of other agencies and companies in the private sector, the DoD workforce has relied on the Baby Boomer generation for a large percentage of its workforce. In addition, DoD has done little to effectively recapitalize its workforce with younger employees. In the twenty-first century, logistics personnel may need skills such as experience with systems engineering to successfully oversee life-cycle management and support for modern, complex systems. Yet, such a combination of education and experience is rare within the existing workforce primarily due to its demographic composition.

VI. Summary and Conclusion

While the global security environment and operational military requirements have drastically changed since the first Gulf War, DoD's logistics modernization has failed to keep pace. Although DoD has released a number of planning documents, reports and articles recognizing the significance of the need for transformation, it has failed to make a pervasive department-wide effort to implement any real change.

High and growing unit costs hinder DoD's ability to make the most out of its funding allocations, a particular concern as current budgets are likely to be significantly downsized in the near future. These high unit costs are due in part to DoD's long product realization cycles which are far lengthier than global technology cycles in the commercial sector. Non-state-of-the-art, ineffective business systems reduce asset visibility, decrease efficiency and drive up costs of providing logistics support. In sum, DoD currently operates a technologically dated, very expensive and inefficient logistics system that requires a logistics transformation. Generally speaking, we believe we must shift our focus to producing lower cost, high quality, high performance systems. To combat long product cycles, we strongly encourage a shift to spiral development. Finally, to address technology inadequacies, we recommend a shift to open-systems and enterprise-wide integration.

More specifically, DoD logistics must transform itself to be responsive to warfighter requirements by enabling the timely deployment of expeditionary forces and reducing the requirement for people, equipment, and supplies in-theater. Shrinking DoD's logistical footprint will also allow a more flexible, adaptive response which is key for twenty-first century military operations. Additionally, DoD must develop state-of-the-art IT systems to reengineer and integrate business processes that will allow for the use of total asset visibility at all times along with all other modern, technical solutions for supply-chain management. To accomplish these tasks DoD must better integrate the public and private sectors to leverage the strengths of each. Adoption of the practices and policies noted in this report will lead to great increases in readiness, responsiveness, weapon system availability, and reductions in both costs and errors.

The Commercial World has Demonstrated it Can be Achieved

The DoD logistics enterprise—costing over \$160 billion annually and maintaining an inventory of 5.2 million different items, trumping the size of the world's largest retail corporations—fails to replicate world-class operating procedures and advanced technologies of the commercial sector. While their missions certainly differ, the commercial sector's optimization of integrated, digital supply chains provides a working blueprint for the DoD to develop an integrated logistics systems that increases asset visibility, make massive efficiency gains and foster more accountability. Such an approach would enable the DoD to have more accurate information and to establish performance metrics for improving reliability and availability all while reaping much needed cost reductions.

Leadership Action is Required to Overcome Barriers

Perhaps the biggest barrier to successful logistics transformation is the culture of the DoD itself. Change must begin within DoD with strong leadership to help personnel overcome

their misconceptions about logistics transformation. In addition, political barriers, organizational barriers, technical barriers, contractual barriers, and funding barriers all require leadership to effectively promote change from within. Leadership with respect to each of the areas must be had as in many cases these issues flow across Service lines.

Logistics Modernization Must Be a True Leadership Priority

To undertake logistics modernization successfully, DoD logistics executives must make logistics modernization a true leadership priority. As logistics improvement requires changes at all phases of the acquisition cycle, from development through support, DoD logistic executives must also convince other senior DoD leaders of the importance of true logistics modernization.

The DoD must take Maximum Advantage of Commercial Technology

Many solutions to DoD's supply chain problems already exist within the commercial market-place. DoD has yet to take full advantage of the commercial resources which presently exist. A careful examination of commercial best practices will ultimately allow DoD to utilize existing resources from the commercial marketplace for logistics transformation. Such an undertaking will permit significant cost-savings, shorter development cycle times, and increased access to the most current technology available.

Industry must be Proactive in Demonstrating the Potential Benefits to DoD

Finally, industry must take an active role in highlighting areas of potential improvement within DoD and identify where the lines of intersection between public/private sector supply-chain management exist. Industry must work to better understand DoD's needs, implementation challenges, and long-term barriers to effective transformation. The private sector represents world-class supply chain management. While it may not be overtly obvious how industry techniques can be adapted to DoD's logistics mission, it is the responsibility of industry to find such linkages and capitalize on existing solutions for DoD's current supply-chain problems.

The time for logistics modernization is now, so that the nation can continue to affordably provide warfighters with the support they need.

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