The Future Logistics Enterprise

Roadmap to Transformation

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About ChainLink Research

ChainLink Research is a Supply Chain research organization dedicated to helping executives improve business performance and competitiveness through an understanding of real-world implications, obstacles and results for supply-chain practices, processes, and technologies. The ChainLink Inter-Enterprise Model is the basis for our research; a unique, real-world framework that describes the multi-dimensional aspect of links between supply chain partners.

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Introduction

Objective of This Paper

This paper will articulate and validate the Future Logistics Enterprise (FLE) vision and objectives for readers such as industry suppliers and partners, members of Congress, members of other government agencies, and fellow members of the Department of Defense who need to understand the challenges, and align with the FLE goals.

Approach: Frame and validate the Future Logistics Enterprise objectives and approach by comparing and contrasting them against industry efforts and best practices, and highlighting the lessons learned and implications for the Future Logistics Enterprise initiatives.1

Executive Summary

The Future Logistics Enterprise is a set of synergistic and integrated initiatives, managed by the DOD and sponsored by the Joint Logistics Board (JLB), which is headed by the Deputy Under Secretary of Defense for Logistics and Materiel Readiness, The Honorable Diane K. Morales. The members of the JLB are the most senior ranking DOD logisticians.

Joint Vision 2020 (JV 2020), issued by the Joint Chiefs of Staff described a future military capability based upon speed, precision, lethality, and information dominance. JV 2020 identifies “Focused Logistics” as a critical requirement to project and sustain forces. The Services and Defense Agencies have initiated numerous actions in pursuit of the objectives of JV 2020. The 2001 Quadrennial Defense Review documented the need to accelerate DOD transformation efforts to meet emerging threats and established ambitious goals for rapid engagement of forces. The attacks of September 11, 2001, and the

1 Content for this research came from: documents and interviews with senior professionals who are responsible to the Future Logistics Enterprise policy and leadership; interviews and research on several hundred private sector and public sector programs that have relevancy to the FLE.
War on Terrorism have given a sense of urgency to accelerating change. The Future Logistics Enterprise is a crucial cornerstone of this required transformation.

DOD Logistics Transformation Imperative

Logistics is recognized as a foundation and key enabler of the warfighter’s ability to project force. It is critical for the DOD logistics community to drive programs of on-going improvements. Today:

- $88 billion is spent each year in total on DOD logistics
- $64 billion is spent each year on sustaining weapons\(^2\) alone
- $58 billion is spent on research and development\(^3\)
- $72 billion is spent on weapons procurement
- On average, it takes 18 days to fulfill an order
- The DOD has 600 legacy logistics systems with 400 million lines of un-integrated legacy code
- There is over $50 billion in logistics inventory

Non-aligned processes from supporting organizations and stovepipe management between processes (such as acquisition to maintenance) prevent the realization of return on investments, lengthen the time required for weapons introduction, and increase the sustaining costs.

The new global realities and changing national security requirements that have arisen since the end of the cold war create the need for today’s military to operate in multiple modes of agile deployment. Beyond the DOD’s own continuous focus on improvement, Congress continues to support fundamental logistics transformation in support of the warfighter. In September, the joint session of Congress stated, “The unparalleled strength of the United States armed forces and their forward preparation has maintained the peace in some of the world’s most strategically vital regions. The threats and enemies we must confront have changed and so must our forces. The structure to deter massive Cold War-era armies must be transformed to focus on how an adversary might fight rather than where and when a war might occur.”

\(^2\) Sustain is only support, not investment in new systems or weapons.
\(^3\) October 2002 appropriated by Congress for 2003 budget.
The warfighter’s requirement as outlined by the 2001 Quadrennial Defense Review is to have a ready and capable force—employ in 96 hours and deploy in 7-14 days—versus the 3-6 month timeframe of the past. The recent 28-day response time to Afghanistan illustrates the benefits of such a strategy: alignment with allies, and success with little loss of life. The 21st century deployment sequence and footprint looks significantly different from the past. Air and ground troops lead, in parallel with infrastructure (pull model), versus the past model of creating the fixed infrastructure base and then projecting warfighters (push model). This evolution is being driven by the changing political and economic landscape, with significant parallels in the private sector, as illustrated in Figure 1 below.

**DoD Logistics Transformation Imperative**

![Diagram](image)

**Figure 1**

The implications of this strategy have far reaching consequences for logistics personnel, weaponry, technology, and supplier relationships. This strategy allows a higher degree of responsiveness and more assured success for today’s conflicts. In addition it demands the next generation of weaponry and process innovation and the transformation of DOD Logistics - with benefits in the cost of operation - but more...
importantly further enhancing the warfighter goals of winning the battle while minimizing loss of life.

**The Industry Parallel**

Over the last ten years, entire industries have transformed from vertical integration of designing, manufacturing, delivering, servicing, and proprietary information technology development to a strategy of virtual value chain management. Within these virtual environments firms have created and funded ‘centers of expertise’, based on the pursuits and implementation of best practices. Best practices are those that are validated by tangible, demonstrated benefits.

Firms have achieved higher levels of success in three major business objectives:

- Profit – maximum results with minimum expense or effort
- Time-to-Market – getting innovation into the market place and into use rapidly and effectively
- Customer-for-Life – aftermarket service, upgrades, enhancements, and modification of the product to help the customer achieve the full lifetime asset value and return on their investment

In contrast, the United States Department of Defense has largely maintained a strategy of vertical integration. Once the Services take possession of equipment and personnel, they house, train, service, deploy, heal/repair, and retire them - all within their own infrastructure.

Both strategies have distinct advantages and disadvantages. The Defense department has constraints regarding security, legislation, and the need to stand at a level of readiness that incurs substantially more cost than the private sector. The Department of Defense objectives are more complex than private industry—from operational availability, to sustaining troops, to nation building—all the while balancing innovation with the slower process of legislation.

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4 The emergence of 3rd party providers—in manufacturing, logistics, and IT—has created multi-billion dollar corporations that span the globe. Most of these firms did not even exist in 1985 or were at an insignificant scale compared to their current market and global position.
Historically, the military has been, and continues to be, a chief investor in technology innovation, and has acted as an underwriter of R&D frequently leveraged in the ‘parallel universe’ of the private sector. Now, within the initiatives of the FLE are efforts to embrace some of the highest-impact capabilities and knowledge from the private sector in order to become more agile and cost effective, while still meeting National Defense requirements. Technology will move from the commercial sector to the government, translating commercial advances in supply chain techniques to comparable areas in the Department of Defense logistics chain.

**Executive Summary of Findings:**

- The FLE initiatives are framed to enable the next generation of force projection capability that confront the current and future realities of conflict and combat in the 21st century.
- The Future Logistics Enterprise embodies the best practices and strategies from both industry and the DOD.
- The FLE’s proposed policies and practices comprise extremely high payback initiatives with low risk. The concepts and practices at the heart of these initiatives have been successfully implemented previously in both DOD and industry.
- The scale of change, though massive, also has precedent in global industrial transformations. These industries have not only gone through major transformations in how the entire industry operates, but are exemplified by cross-enterprise cooperation between industry competitors and cross-enterprise integration between supply chain partners.
- The collaborative approaches advocated by the FLE programs can have major benefits to the US economy by creating new revenue opportunities for industry. The infrastructure, technology, and services required to support FLE, will take logistics capabilities to a new level that will enable expanded business opportunities for the private sector above and beyond their business with the DOD.
- Sharing information with the private sector through a Total Life Cycle Management approach will net gains in research and development, reduced cost in procurement and maintenance, and improved service responsiveness.
The focus and resolve of top leadership—from the President and Congress to the Department of Defense—has lent power and urgency to these initiatives. This has created a climate of learning and engagement, which has a direct, positive, and beneficial impact on the projects and operations within the Services.

Early accomplishments in the transformation:

There are already early accomplishments that point the way to success:

- Deep commitment, across the highest levels of the DOD, for broad and sweeping transformation of DOD logistic capabilities through the six comprehensive initiatives of the FLE that focus on total integration of weapons life cycle design, sustainment, and more effective, integrated deployment management.
- The implementation of best-in-class logistics systems in the Navy and DLA.
- Elimination of over 400 logistics legacy systems.
- The creation of an end-to-end integration strategy across the whole DOD in order to focus on customer satisfaction across the Services.
- The creation of an enterprise architecture based on best operational and IT practices.

In addition, specific management focus groups and working groups have been created that have already delivered on their policy objectives.

How this paper is organized

After this introduction, the paper consists of two major sections: “FLE Initiatives” and “Conclusion: Roadmap to Transformation”.

The FLE Initiatives section discusses each of the six initiatives, including goals, challenges, and best practice validation of the strategy. Examples from industry and DOD are used to compare and contrast different (or similar) approaches, illustrate where DOD or industry may be ahead, and highlight the issues, lessons learned, and implications these have for the FLE initiatives.

The final section, Conclusion: Roadmap to Transformation, is the summation of this paper. It draws observations and describes lessons...
and challenges, especially the technology, supply chain and change management issues.

There are significant benefits for the U.S. and its allies from enhancing readiness and responsiveness through the FLE initiatives. The challenges to FLE must be understood and addressed and the initiatives must be broadly embraced and implemented in order to attain success.
The Future Logistics Enterprise (FLE) is the Department of Defense vision for accelerating transformation of its logistics capabilities over the next five to ten years. The primary objective of the FLE is to ensure consistent, reliable support that meets warfighter requirements of end-to-end customer service. The FLE builds upon and accelerates specific, ongoing Service and Agency initiatives to meet the requirements of the Quadrennial Defense Review (QDR) and the National Defense Strategy. The six FLE initiatives are:

- Total Life Cycle Systems Management
- End-to-End Distribution
- Executive Agents
- Condition-Based Maintenance Plus
- Depot Maintenance Partnerships
- Enterprise Integration

These programs are integrated and inter-dependent, with synergies and cumulative benefits. Condition-Based Maintenance Plus and Depot Maintenance Partnerships are in fact some of the cornerstones upon which the overall strategy of Total Life Cycle Systems Management is built. Similarly, End-to-End Distribution leverages the Executive Agent Initiative. Enterprise Integration is a wrapper that enables all aspects of the Future Logistics Enterprise.

Each pillar is enabled by best-in-class technology, architecture, and business process concepts that focus on enterprise and supply-chain wide integration.
How the FLE is Managed

The FLE is accountable to the Joint Logistics Board (JLB) consisting of the DOD's most senior logisticians. They provide executive oversight to the FLE working groups, as well as implementations of logistics operations for the various services they support. Three working groups have been established to drive the FLE programs forward effectively:

- Best Business Practices Group – 'Re-engineer for Success'
- Change Management Group – 'Make it Stick'
- Program Implementation Group – 'Do it Right and Fast'

In addition, through cross-functional, cross-services Integrated Process Teams and project teams coordinated through the working groups, the FLE establishes policy creation and initiatives that drive these world-class concepts forward. A Commercial Industry Advisory Team has been established, which includes top executives from seven leading companies to advise each of the groups on varying topics, drawing from commercial experience.
Total Life Cycle Systems Management

The Initiative

Traditionally the personnel and organizations responsible for weapons systems acquisition and those responsible for sustainment have operated in discrete functional silos. Information and product knowledge has not readily flowed from one area to the other. Weapons systems sustainment requirements are considered during acquisition—however, the lack of ownership of sustainment responsibility by acquisition personnel and organizations can cause sustainment requirements not to be fully appreciated or addressed during the requirements and development phases. This lack of connectivity also creates longer product development and introduction cycles, due to a lack of knowledge and information being provided to the manufacturers about the strengths and deficiencies of current weapons systems and how they actually operate in unique field situations.

The Total Life Cycle Systems Management (TLCSM) initiative incorporates the concept of integration of the whole product life cycle—from design/acquisition, through deployment and sustainment. The initiative makes program managers responsible for the total life cycle (acquisition and sustainment) for new systems. Direct feedback from sustainment organizations will enable effective design-for-sustainment during acquisition and upgrade phases. More involvement from product developers in the total life cycle can also enhance sustainability, since the intimate knowledge of product engineers about the systems can be more readily transferred to operators and repair personnel. This concept exemplifies the dramatic changes the DOD will implement. Life cycle thinking and processes create tremendous benefits such as:

- More effective research and development that dramatically shortens product development cycle times and enhances product functionality
- Substantial reductions in manufacturing costs
- Increased weapons systems operational availability
- More effective and responsive maintenance capabilities
- Reduced sustainment issues once deployed due to an emphasis on maintenance considerations during product design

Challenges Faced
- Inadequate attention to sustainment requirements during specification phase for weapons systems
- Break in responsibility between acquisition and sustainment phases
- Focus on functional optimization versus customer service

FLE Response
- Establish clear responsibility and accountability within the program management office for meeting warfighter performance requirements
- Hold program managers accountable for the overall management of the weapon system lifecycle:
  - Timely acquisition
  - Warfighter requirements
  - Integration of sustainability and maintainability during the acquisition process
  - Weapon system sustainment throughout the lifecycle

Expected Results
- Sustainment that consistently meets or exceeds warfighter requirements throughout the life of the system
- Significantly improved availability and readiness
- Reduced sustainment costs
More value through the life of the asset

**Best Practice Validation**

Total Life Cycle System Management is an important and well-established practice among manufacturers of complex products and advanced industrial users of complex, mission-critical capital equipment.

Manufacturers that build complex products are highly motivated to focus on product life cycle management (PLM). Providing highly reliable products that actually fulfill customer needs is crucial to revenue growth. Controlling service and warranty costs can make the difference between profit and loss. Industries where this is particularly critical include automotive, telecommunications equipment, computer systems, aerospace, and industrial equipment.

PLM is assigned to a product manager—whose duties are similar to the responsibilities of the program manager as defined in the TLCSM initiative. The product manager is given total life cycle responsibility for each product, from ‘cradle-to-grave’. During new product development and throughout the life of the product, the product manager brings together cross-functional teams with representatives from engineering, manufacturing, quality, logistics, distribution, service, and customer support. The product manager must make sure that the requirements of manufacturing and service & support are designed into the product before it is released to manufacturing. After the product is in the field, the product manager may accompany the deployment of the product in the field to ensure easy installation, maintainability, and usability. Ongoing support for servicing the product occurs through process and technology integration to engineering and manufacturing.

PLM measures profit and overall product metrics like utilization, maintenance costs, and life cycle use. Because product managers are accountable for the life-time profitability of the product, they are usually keen to make sure everything possible is done to minimize warranty and service costs, and to make sure enhancements and upgrades are compatible, maintainable, and easy to install. In addition, the product manager is responsible for the success of the product in the market place. This makes them pay a great deal of attention to the actual reliability and performance of the product in the field and drives the
product manager to deeply understand requirements from the customers’ perspective.

Product life cycle management philosophies are relevant in the DOD logistics enterprise. The military is concerned with effective management of time, money and people, in order to manage total cost of ownership while delivering warfighting capability through weapons systems; the private sector product manager is concerned with managing time, money and people, in order to deliver profit. The nuance is one of outcomes: the DOD Program or Weapons Systems Manager is concerned with delivering an operational weapons system to the warfighter, with success measured as combat effectiveness in the operator’s hands.

Total life cycle process management is crucial to users of complex, mission-critical capital equipment in industries where downtime costs are high and availability is critical such as semiconductor manufacturing, automotive manufacturing, aerospace manufacturing, and oil-field development. At semiconductor firms like Intel, Advanced Micro Devices, and Texas Instruments the purchasing department takes ownership and joint responsibility—along with equipment engineers, manufacturing, and quality assurance—for the performance of manufacturing equipment in the plant throughout the life cycle of the equipment. Purchasing develops programs for continuous improvement of the performance of manufacturing equipment to focus on:

- Improvement goals
- Maintaining a consistent global approach to technical and service issues
- Providing cross-fertilization of experiences across functional groups and across manufacturing sites to ensure process consistency
- Measuring and driving improvements and enhancements
- Return on Asset

Purchasing also benchmarks equipment performance and compares it with competitors to drive best-in-class performance. This in turn drives better quality and follow-through on commitments from their suppliers. As a result, equipment downtime has been cut by over 50% in some firms, enabling increased utilization—a powerful source of competitive advantage in any capital-intensive industry.
Program managers at the DOD are charged with similar responsibilities. Modern weapons systems are complex, mission-critical capital equipment, and operational availability is critical. The program manager must find a way to translate a limited pool of time, money, resources, technology and capacity into a complete and optimal package of warfighting capabilities.

To support a total life cycle approach, major corporations have developed an integrated network of solutions including product specifications, engineering change orders, field service failure data, and histories of maintenance and enhancements to support the lifetime of the product and development of next generation solutions. These integrated information structures are widely deployed in the automotive, semiconductor, high-tech/electronics, medical appliances, and airline industries.

**Implications for the DOD and Industrial Partners**

Industrial partners must be able to provide a **total solution**—either by themselves or through strategic partnerships—that include the services and infrastructure necessary to meet sustainment needs throughout the life cycle.

An excellent program already initiated with Boeing is the FIRST (F-18 Integrated Readiness Support Team) program. This program has a 20% cost avoidance goal through partnership with the U. S. Navy. There is a significant expanded role for Boeing in their relationship with the Navy, which is supported by the Priority Information Agreement (PIA) to ensure security. A performance-based contract is also in place to allay NAVAIR concerns about the risk of transfer of significant responsibilities. FIRST is implementing a significant set of integrated systems to not only operate the life cycle’s maintenance responsibilities, but also to support governance of the program.

TLCSM will provide a competitive advantage to those firms who participate, by providing them with on-going visibility to the requirements for maintenance and, more importantly, visibility into how weapons perform in the field, positioning the participating firms well for developing the next generation of product.
Conclusion:

This initiative highlights key issues for the FLE:

- The interdependent nature of the FLE initiatives. These initiatives are integrated, synergistic and interdependent on each other.
- The FLE objectives cannot be accomplished without cross-enterprise integration. This must cut across silos within DOD, and reach out to industry partners. The Enterprise Integration Act of 2002 helps enable this kind of integration by funding information standards to enable more accurate communication across industry.
- Critical industry/DOD collaborative agreements.
- Confidentiality issues for the private sector.
- Safety for private contractors operating in a theater of war.
- Significant change management issues within DOD personnel, including union workers (not an insignificant hurdle) as processes change and knowledge transfer (both ways) occurs.
- The graying DOD workforce—particularly in the depots—gives urgency to the need for cross-fertilization with private sector trading partners. This cross-fertilization helps the DOD overcome institutional inertia – set ways of thinking and doing that are inherent in an aging workforce. At the same time, it helps preserve what is most valuable from this workforce, the priceless collective knowledge of experienced DOD artisans, which is in danger of being lost forever as they retire.

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6As of this writing, the Enterprise Integration Act of 2002 had been approved by the U.S. House and is pending in the Senate.
End-to-End Distribution

The Initiative

Reliable distribution is a prerequisite for continuous combat effectiveness of deployed forces. The providers of the various elements of distribution within the DOD logistics chain have traditionally optimized their own individual functions within the delivery chain without having a clear focus on or accountability for the warfighter’s time-definite delivery requirement. The result is an unacceptable end-to-end cycle time from source to warfighter, creating a heavy materiel-tracking burden for the warfighter.

In addition, when delivery is unreliable, there are cascading negative impacts. Warfighters order significantly more materiel than is actually required, on the assumption that only a portion will actually be delivered. This frequently leads to a logistic footprint that is much larger than is actually needed, and consumes lift capacity for materiel that may not really be required in-theater. Maintenance activities also require full deliveries of needed materials before the work can commence. Uncertainty in pipelines leads to unreliable maintenance and repair schedules with consequent negative impacts in weapons systems operational availability.

Total cycle time and warfighter (customer) focus are paradigm shifts—they highlight for all the participants the total process view and what is broken in the system. In a stovepipe view, each organization strives to improve their part, but they miss the total picture. In fact even significant improvement in their parts may have no impact on the total.

Lack of synchronization at a ‘hand-off’ can create long queue times where materiel may be waiting for transport for days. The lack of visibility into delays at a hand-off and the failure to provide a revised time-phased availability of material after passing through bottleneck is more than a problem of delay. Schedule uncertainty creeps into the logistics chain and undercuts confidence in the total system, even though the source of the delay may be explicable, and the impact of the delay both quantifiable and predictable.

In contrast, an integrated view enables end-to-end coordination.
Total cycle time initiatives transform processes by:

- Identifying and highlighting end-customer requirements
- Identifying the proper customer satisfaction goals and metrics (perfect order: complete, on-time delivery to the end customer)
- Reducing or eliminating coordination glitches in the process, therefore reducing time and cost
- Significantly reducing inventory and carrying costs, since significant quantities are no longer positioned ‘just in case’

Under the umbrella of end-to-end distribution, U.S. Transportation Command and the Defense Logistics Agency are in the process of redesigning and streamlining the Department of Defense global distribution system through a program called “Strategic Distribution.” The focus is on synchronizing supply and transportation processes at the strategic (wholesale) and theater (retail) levels. Customer Wait Time to Northern Europe has been reduced by 13%, to Bosnia by 37%, CWT to Japan is down by 13%, and shipments to Korea have seen a reduction in CWT of 16%.

An illustration of the benefits of an end-to-end focus can be found at the Singapore Airport. Rather than looking at on-time arrival for the airplane, officials decided on a total cycle time goal for the air passenger - total transit time; not just on-time landing, but the total process through unloading the plane, baggage handling, and airport cab departure. These were very fragmented organizations that were brought in to participate. Visualize hundreds of independent cab drivers, airport operations, and the airlines themselves insisting they had no way to accomplish the goal. Once an end-to-end process team went to work on the problem, data on incoming planes as well as the number of passengers on-board could be accessed and the unloading equipment, baggage handlers, cabs, etc. were deployed in appropriate numbers, in line to pick-up waiting passengers. The result was a seamless flow for the customer. This is an example of how industry has moved from months to sometimes one-day delivery performance.

The end-to-end distribution initiative aims to provide more reliable delivery by synchronizing the flow of materiel across the entire chain. It will optimize the entire end-to-end process, rather than just the individual pieces, by synchronizing policies across organizational boundaries for acquisition, sourcing, positioning, and transportation. It
also will support surge requirements by focusing on demand management techniques and by leveraging private sector capacity during large deployments. Enabled by Enterprise Integration, End-to-End Distribution breaks down the barriers between the stovepipes in the chain to develop a coordinated and optimal approach that reliably meets the delivery requirements of the warfighter.

**Best Practice Validation**

The military faces a number of end-to-end distribution challenges that are not typically found in industry. The military requires very rapid delivery to remote, hostile locations with inadequate infrastructure. There are similar challenges in raw materials industries operating in remote areas such as mining, logging, oil exploration, and certain food commodities (coffee, cocoa, bananas, etc.). They often have to deal with local politics and build their own infrastructures. But rarely, if ever, do they have to move into a location within a matter of hours or face an enemy who is trying to disrupt the flow of supply.

The objectives of employ in 96 hours and deploy in 7-10 days does have some significant parallels in industry. Through extensive supply chain transformations, industry has created fundamental approaches to readiness:

- **Mass Customization:** Postponement of kitting or building based on demand-driven and lean manufacturing principles. Sometimes called Build-to-Order.
- **Build to Stock:** Inventory prepositioning. (Similarities to pre-positioned assets)
- **Flexible Capacity:** Outsourcing and subcontracting

These models differ in their approach but strive to create the highest level of readiness based on the market, end customer, or product requirements.

*Mass customization* strives to determine the lowest level of inventory buffer allowable to meet customer demand. Products are typically built to a sub-assembly level where their applicability is high. They can then be used in a variety of products and configurations. Planning focuses on the capacity of manufacturing and logistics, and optimizes routes and processes, rather than finished goods. One has to be very good at demand planning, collaboration with trading partners, and
understanding the requirements of a customer in order to excel at this strategy.

Assembling a Joint Task Force is an application of mass customization. Forces are configured to meet the specific threat, or requirement, drawing on the capabilities of the individual services or agencies. Warfighting capability is, in effect, maintained in buffer, available to support a variety of configurations. Then, in response to a threat, the Joint Force is designed, configured, and deployed, in a rapid-response mode, an approach far more flexible than a reliance on fixed, standing warfighting forces. The Joint Force Deployment Process is a classic demand planning process.

Build-to-Stock focuses on inventory readiness. Inventory readiness approaches are based on ‘must haves’ or products with long lead-times where the cost of waiting would be exorbitant—like semiconductors and optics.

In the military, forward positioning and prepositioning of assets is an application of build-to-stock that approaches the issue of warfighter flexibility and mobility by placing needed materials closer to the point of requirement. The Maritime Prepositioning Force (MPF) of the Marine Corps carries 15 days of supply, and is available to supply a notional unit by sea at all times. War reserves and strategic reserves and inventories are also planned and managed carefully to support sustained force projection. Readiness-based sparing, an inventory planning approach designed to optimize against weapons system operational availability, instead of item availability, is another build-to-stock approach being employed by the military.

Capacity management approaches are designed to preserve flexibility to respond to unforeseen or unplanned requirements. Outsourcing and sub-contracting are established approaches in the commercial sector to preserve the ability to spike throughput. “Mothball” capacity is expensive, so creativity is required to secure access to capacity on-demand, without the associated expense of full-time ownership.

The DOD is leveraging private sector assets in order to manage and provide flexible capacity. For example, under the auspices of the Civil Reserve Air Fleet, the DOD has contracted to obtain commercial
airframes to augment lift capacity in a time of National Emergency. Under a contract with McKesson, a pharmaceutical distributor, the DOD has in effect procured access to an entire commercial supply chain to support the distribution of medical supplies.

Most organizations operate in mixed modes in order to get the right blend of responsiveness with fewer assets. DOD applies this same blending to achieve required capabilities. At the DLA, commodity managers segment supply and apply differing service standards to each.

Within the retail sector, organizations like Wal-Mart and Target are not only deploying end-to-end distribution strategies within their enterprises, but more significantly they are driving the modus operandi of the whole industry. Initially Wal-Mart, the largest corporation in the world, was content to manage a ‘request/commit’ process—placing orders to their suppliers, requesting timely deliveries, and negotiating improvements. Their readiness goal is to never be out of stock—even of the smallest item—driving the creation of the largest commercial database housing every item in stock, by every store around the globe. By the mid-nineties they moved to a strategy of providing visibility to the downstream suppliers on customer demand/consumption patterns\(^7\) to help ready their suppliers to meet demand.

Now, the major retailers are in an end-to-end distribution mode. Many large retailers employ what is called ‘private label’ manufacturing. Few people have missed the commercials touting products specifically designed for Target, sold only in their stores. This approach is employed with about 40% of retail products today. It means the retailer engages with the manufacturers, designers, and transporters—usually sourcing from Asian manufacturers. In this case the customer (i.e. the retailer) is responsible for managing end-to-end distribution through the international trade logistics process. In today’s heightened security world, this requires total visibility and detailed adherence to international trade laws—through border crossings, trade modes, and trading partners.

\(^7\) RetailLink is the system created by Wal-Mart, used daily by its entire supply base for visibility at the stocking level.
The auto industry is also going through similar transformations, attempting to deploy readiness in global, lean approaches. From an automotive manufacturing perspective, the challenges to maintain profitability in a highly competitive market drive manufacturing to attempt to hold only enough inventory to meet short-term customer needs, yet be responsive to customized orders. The implementation of supply chain software and Supplier Relationship Management (SRM) with real-time planning to suppliers enables lean production. From a service perspective, automotive manufacturers, working through multiple layers of service partners, must be highly responsive to emergency repairs. The aftermarket network responsiveness and profitability has improved with service parts planning software.

Computer manufactures are probably the closest to being truly lean with global manufacturing and monitoring of production and inventories. They must also deal with global trace-and-track issues as well as trade compliance. They accomplish this through top-of-the-line technology and trading partner processes.

The “big five” firms in each of these industries are of such a large scale that they are transforming thousands of suppliers, carriers, freight forwarders, and technology support firms (software and hardware application vendors). These dominant organizations not only participate in standards efforts, they drive and frequently underwrite them. The Unified Code Council (UCC) has standards efforts in motion in all the major industries. The National Institute of Standards and Technology (NIST) supports many initiatives that enable industry technology and data standards. In addition, most of these organizations are now piloting techniques to support standards-based, end-to-end visibility.

**Implications for the DOD and Industrial Partners**

Over the last fifteen years, the manufacturing sectors in particular have tried to implement new strategies to fuel their growth. In order to control costs and at the same time improve responsiveness, industry has been on an obsessive campaign of improvement. These same philosophies may be applied to DOD’s End-to-End distribution challenge in order to achieve a more lethal, agile, and effective force projection capacity:
-**Customer Focus**—the ‘voice of the customer’ process modeling, integrating customer-centric response times, service levels, and other service metrics into the process (e.g. on-time delivery, fill-rates, quality, perfect order fulfillment). These concepts may be applied in the military with the focus on the warfighter, Performance-Based Logistics and Service Level Agreements.

-**Total Cycle Time reductions**—process as well as information cycle time reduction across the enterprise and through the whole supply chain. In the 80’s concepts like process re-engineering and total cycle time reductions (JIT/QC) emerged. They are useful reference points for the DOD’s emphasis on end-to-end distribution and Customer Wait Time, and may be applied to end-to-end processes like maintenance and repair cycle times, order fulfillment cycle times, and joint deployment cycle times.

-**Data Resource Management**—this includes the extended enterprise as well as the support of industries standards bodies like the UCC, RosettaNet and NIST initiatives etc. This will allow full value from technology investments—the data between trading partners will be in a ‘clean readable format’, substantially reducing information cycle times and IT maintenance costs.

-**Supply Chain Process Synchronization**—an emphasis on the lateral flow of information and material across the enterprise, crossing stovepipes and reaching beyond the four walls of the individual functional participant. Today, at DOD, this is best exemplified by the Financial Management Enterprise Initiative in combination with the FLE collaboratively developing an Enterprise Architecture, which will ultimately enable true end-to-end distribution.

-**Network Optimization**—reducing the number of warehouses and supply sources or factories, and designing routes and planning inventory depots that optimally support the required service levels of customers.

-**Virtualization/Outsourcing**—entire industries have been reshaped by the adoption of this approach: The semiconductor industry is a case in point, where pure design companies outsource the manufacturing to foundries; or the computer industry, where most OEMs once did their
own design and manufacturing of semiconductors, storage devices, monitors, etc. Now these are all done by contract manufacturers and third party logistics providers (3PL’s) who manage inventory and distribution. In the military this has been applied to fuel and medical logistics.

A critical point for the DOD is that these approaches do not operate flawlessly from the start. Management techniques are not uniformly applied and communications between trading partners is not yet ideal, although these are currently major focuses for most industries. They require significant personnel training, collaborations and IT enablement. The DOD approach to end-to-end distribution needs to judiciously implement these approaches since the consequence of logistics chain disruptions has much greater impact in combat.

**Conclusion:**

Cross enterprise working groups who are tasked with defining and creating total cycle time reductions and customer focused goals—not stovepipe achievements—have created significant progress in the organizations that use them. DOD is no different. By embarking on a process to synchronize the flow of materials across the logistics chain, DOD is on a path to dramatically impact the ability to project and sustain the force with minimal footprint.

Inherent in this paradigm shift is the need for all participants in the logistics chain—customers and suppliers alike—to accept ownership for their link in the chain. End-to-end distribution customers must define their needs and state their expectations clearly. End-to-end distribution suppliers and fulfillment agents must implement a customer-oriented support infrastructure to provide the necessary customer support all the way to the warfighter, not just to the next “hand-off.” DOD is driving to provide end-to-end logistics support through integration and synchronization the end-to-end distribution system across all participants to meet the warfighter’s requirements.
What is critical for success beyond the strategies listed here is a significant focus on adopting a Unified/Role-based Architecture.\textsuperscript{8} This fundamentally gives the stakeholder (whether an individual or organization) a framework to see total scenarios or processes—such as order trace-and-track, status of transactions, ownership, alerting, real-time decision support, performance metrics for continuous improvement and true visibility to priorities. The Executive Agent can be a primary driver and user of this unified concept. Most major supply chain initiatives within industry have this kind of IT architecture focus at their core.

\textsuperscript{8} This concept will be discussed in the section on Enterprise Integration.
Executive Agents

The Initiative

Executive Agents (EA) are responsible for providing common services or materiel support to Service Component. In the past, lack of a clearly defined process for assigning and tracking EA responsibility—combined with the variety of ways Joint Force Commanders assigned common support missions to Service Components—has resulted in confusion and complicated the Combatant Commanders’ planning processes. This presents significant challenges to the Combatant Commanders and warfighters who are depending on this logistic support. Operational availability, mission responsiveness, and agility suffer as a result.

The EA is responsible for end-to-end support—they drive the logistics and delivery processes across organizational boundaries in order to ensure that the total end-to-end system is responsive to the needs of the Combatant Commanders (i.e. getting the right materiel to the right place, at the right time, in the right quantities). In the absence of systems that support customer visibility and priority, the EA has to compensate for a lack of a unified enterprise framework.

The EA initiative advocates a formal, consistently applied EA assignment process, and supports the broader End-to-End FLE initiative. This process will define and align the EA’s roles, responsibilities, resources, and capabilities to be much more responsive to the needs of the Combatant Commander’s and warfighters across the full spectrum of operations.

Best Practice Validation

In private sector industries that have large, complex projects, the project manager takes on a role similar to that of the Executive Agent. The Executive Agent is responsible for an aspect of force deployment—for example bulk fuel—and these force deployments are essentially large, complex, rapid, adhoc projects. But the Executive Agent also has broad responsibilities over time to continuously improve the processes and practices to support the warfighter.
When project managers take an intensely customer-centric viewpoint and when they possess the skills and tools needed to coordinate all of the members of the supply chain, they have obtained impressive outcomes. Best practices from industry in project/program management include:

- **Alignment of projects/programs to overall strategy** – involvement in strategic planning, organizational fit, project sponsorship by senior management
- **Measurement and continuous improvement**
- **Advanced project management tools and techniques**
- **Human resource development** – project management training, cross-training, integrated product teams, conflict and issue management
- **Organizational learning** – continuous improvement processes, driven by strategic priorities

Armed with the tools and learning above, program and project managers in the private sector have successfully fulfilled EA-like roles:

- Contractor project management
- Facilities construction
- Multi-year exploration and construction
- Large IT project management
- Oil exploration and construction of deep sea drilling platforms
- Discovery and development of mines
- Management of plant line design and implementation in semi-conductors and pharmaceuticals
- Partnership or account executive role from a contract manufacturing or outsourced logistics (3PL or LLP) firm

An emerging practice in the private sector is the creation of a new executive function—the Chief Process Improvement Officer (CPIO). Companies as diverse as 3M, Honeywell, Black & Decker, Telstra, Ashland, Delphi Automotive, Air Products, ServiceMaster, and ITT Industries have created CPIO positions to drive cross-organizational process improvements. Some have realized significant benefits—for example Telstra, an Australian telecommunications firm, is projecting a savings of $245M during the first three years of their process improvement initiatives. The emergence and success of CPIOs, who have accountability for cross-organization process improvements, represents a solid validation of the new philosophy and approach embodied in the Executive Agent initiative.
**Implications for the DOD and Industrial Partners**

One of the most important aspects of the Executive Agent is warfighter focus; taking the view of the customer. Outcomes for the customer are most successful when a professional is empowered with an unswerving dedication to meeting customer’s needs—always letting that be the guiding voice in their decision-making and communication processes.

There is a something of a paradox in the degree of freedom of action the EA needs to be effective. In the theater of war, the variability and urgency of new circumstances and constantly changing logistical challenges requires the EA in charge to be very flexible and creative. At the same time the Combatant Commanders must have a very reliable set of services delivered in a very consistent manner, with consistent performance. The consistency requirements should be framed in terms of un-ambiguous delivery metrics and other customer-facing attributes. But when it comes to implementation, innovation must be encouraged—there will never be a ‘one-size-fits-all-circumstances’ methodology. Here is where the role of the EA can be enabled as well with a more open IT architecture. Changing political and battlefield landscapes will always be a reality that must be dealt with, as well. Nevertheless, knowledge-sharing and ‘best-practice’ sharing between Executive Agents and their organizations will help DOD logistics organizations continuously learn from experience and improve. The EA will collaborate with the TLCSM program manager to ensure that the long-term improvement of sustainment processes are engineered into the processes and product.

**Conclusion:**

The Executive Agent role is very much integrated with and dependent on the successful implementation of Enterprise Integration and especially End-to-End Distribution. Executive Agents become both the change agent for and the recipient of benefit from these other initiatives. EA’s are the ultimate arbiters of cross-functional process quality and systems.
Condition-Based Maintenance Plus

The Initiative

Condition Based Maintenance Plus (CBM+) advocates the use of modern maintenance methodologies to dramatically improve the DOD’s ability to predict and prevent weapon system failures. This includes the addition of sensing and monitoring technologies for both new and legacy weapon systems and incorporates consideration of operational and environmental factors in preventative maintenance decisions. It also encompasses the challenge of data gathering and transmission in a distributed environment, and represents an integrated approach to driving weapons systems availability.

CBM+ will be integral to the success of Total Life Cycle System Management (TLCSM) by requiring that the right technology and maintenance capabilities be designed into weapons systems from the start. CBM+ in turn provides detailed data, analysis, and conclusions about failure modes to help recommend improvements to system designs and processes. CBM+ will also provide timely, point-of-consumption demand data to improve overall logistics systems responsiveness. The expected result is much higher weapons systems availability at a reduced sustainment cost, with a much smaller footprint.

Best Practice Validation

The private sector has developed a rich body of knowledge regarding maintenance methodologies. For many industries maintenance is a secondary activity. In contrast, because weapons systems operational availability is at the heart of force projection, maintenance of those systems is a necessary core competency for the DOD. The CBM+ strategy is best validated by examining industries where maintenance is a critical core competency and where maintenance requirements are similar to those of the weapons systems that the DOD must maintain.

Challenges Faced

- Difficulties in predicting weapons systems failures
- Long, unreliable repair cycle times
- Lack of integration between repair and other logistics processes

FLE Response

- Updated monitoring and prediction technology
- Environmental/usage factors in failure prediction
- Training and tools to maintain complex systems
- Improved prognosis/diagnosis techniques
- Remote maintenance technologies/processes
- Serial item management

Expected Results

- Improved maintenance decisions
- Maintenance well-integrated with overall logistics processes
- Dramatically increased operational availability and readiness throughout the weapon system lifecycle
- Significantly reduced costs
These industries have realized dramatic improvements from advanced maintenance methodologies including Condition-based Maintenance (CBM) and Reliability Centered Maintenance (RCM). RCM was originally developed to help airlines create maintenance programs for new types of aircraft before they entered service. It has proven successful in developing maintenance programs for complex equipment and is much more effective than traditional trial and error approaches.

Commercial aircraft must be maintained over their life of 25-40 years. Because the consequences of equipment failure are life threatening, maintenance is taken very seriously. RCM principles and advancements to aircraft design resulting from detailed RCM analysis have enabled the civil aviation industry to improve its safety record from approximately 60 crashes per million take-offs in 1960, to less than 2 crashes per million take-offs today. During this same period, maintenance labor costs have been reduced dramatically. The DC-8, developed before the advent of RCM, required more than 4 million labor hours before reaching 20,000 operating hours. In contrast, the Boeing 747, a larger and more complex plane, requires 66,000 labor hours during the first 20,000 operating hours – almost a 100-fold reduction in maintenance labor.

Airlines meet the added challenge of managing high cycle repair across the globe with advance demand forecasting and multi-echelon service parts planning systems as well as cross-enterprise partnerships (e.g. United can give parts to Continental, or American’s repair fleet can service USAir planes). Other manufacturers of complex equipment in remote locations (e.g. mining and oil-field equipment) or with very high downtime costs (e.g. semiconductor fabrication where downtime costs can exceed $1M/hour) have developed technologies that are designed
into their equipment for remote monitoring, failure prediction, remote diagnostic, and remote collaborative repair. For example, oilfield service provider Halliburton Energy Services uses satellite communications, wellbore telemetry, downhole sensors and 3-D visualization software to allow remotely located technical experts at Halliburton to collaborate with personnel at the drilling site to redirect the drilling processes and improve production. Some mining sites monitor the performance of engines in large haul trucks in real-time and transmit this information via radio to the computer systems of the maintenance planners. Often the maintenance planner is aware of an impending problem on a truck engine before the operator.

By employing a philosophy of predictive management using failure pattern/consequence analysis and demand management these industries have developed tightly focused maintenance procedures that improve operating performance by ensuring that the most effective forms of maintenance are selected for each asset. Routine maintenance labor is typically reduced by 40% to 70%.

**Implications for the DOD and Industrial Partners**

In order to successfully implement CBM+, those who intimately understand first-hand the maintenance needs of weapons systems will become even more deeply involved in the requirements and design phase. Program managers with total life cycle responsibility will drive cross-functional teams, with personnel from both the DOD and its industrial partners, to become more effective at developing new advanced maintenance processes for weapons systems.

Successful implementation of CBM+, in particular the improvements to failure prediction and preventative maintenance scheduling, will help the DOD understand and fulfill demand for service parts and resources. Real-time point-of-consumption data provided by CBM+ generates nearly instantaneous notification of new demand to the logistics chain, analogous to real-time Point-of-Sale (POS) data in private sector supply chains. The predictive capabilities inherent in CBM+ will greatly improve the accuracy of demand planning. This powerful combination of real-time point-of-consumption data and forward-looking predictive capabilities will result in smoother and more timely, end-to-end distribution of required materiel, with more reliable maintenance schedules and ultimately a smaller footprint.
Integration of CBM+ with TLCSM also focuses on parts reductions, component rationalization, and standardization—to reduce costs and enable maintenance and repair. Industry has focused on design-for-manufacturing as well as maintainability. A simplified bill-of-materials has been one of the chief enablers.

Significant work has gone into the development of technologies supporting highly responsive repair networks. Most COTS focus on specific solutions for high maintenance industries—aerospace, mining, construction, utilities—and are not a ‘perfect fit’ today. But elements do exist. Creating a major partnership strategy will speed implementations and reduce total cost.

There is a greater role for industrial partners that fully leverage their experience, creating monitoring technologies to predictively manage the process. The best approach is a comprehensive total service offering, including the infrastructure, personnel, and programs to monitor weapons systems and instantly provide remote expertise and rapid deployment.
Depot Maintenance Partnerships

The Initiative

More than 65,000 people work at 20 DOD owned (organic) depots and hundreds of private facilities to maintain and repair our nation's military weapons systems. Over 1,000 private sector firms are involved. The Depot Maintenance Partnership initiative enables DOD organic depots to develop more effective partnerships with the commercial sector, while retaining the critical depot maintenance capabilities required in support of national security.

Congress mandates that the Department of Defense maintain organic capability to rapidly respond to wartime requirements. Organic capability must be continually refreshed and advanced, with new training, new investment, and up-to-date techniques. Due to the increasingly sophisticated nature of weapons systems, there is a growing appetite for expensive capital equipment and highly trained human resources. Depot Maintenance Partnerships target the advancement of a core competency that must be maintained in peace and available in war.

Depot Maintenance Partnerships are "agreement[s] between an organic depot maintenance activity and one or more private industry entities to perform work or utilize equipment." 9 This definition is nuanced, and creates the opportunity for the DOD to pursue a rich set of options. DOD partnerships may:

- Lease DOD facilities and equipment for use in the private sector
- Use government facilities, equipment, and employees to perform work or produce product for the private sector

Challenges Faced
- Budget constraints
- Maintain organic depot facilities and capabilities
- Aging depot workforce

FLE Response
- Comprehensive partnerships with private sector
- Private sector participation at organic locations
- Greater private sector investment in facilities and equipment
- Increased private sector accountability

Expected Results
- Better facility utilization
- Reduced cost of ownership
- Workforce development
- More effective business processes through introduction of private sector business practice
- Private sector capital investment to support latest generation weapons systems

• Rely on work-share agreements, combining public and private sector facilities, equipment, and employees in a joint undertaking

• Fully integrate public and private sector facilities, equipment, and employees in a single production facility

Partnerships have flexible characteristics; the key thread is the use of organic depot maintenance capability to support the partnership.

The Depot Maintenance Partnerships initiative is an appropriate parallel to CBM+, and directly supports the broader TLCSM initiative in encouraging manufacturers to provide total maintenance solutions including the required technologies, infrastructure, and services for sustainment.

**Best Practice Validation**

In an environment of radical transformation, industry has turned to partnerships, not only to manage costs, but also to enhance remote responsiveness, spur innovation and infuse expertise. Similarly, with the DOD, organizations like General Dynamics and Boeing have taken on multi-year depot maintenance roles, relying in many instances on the utilization of organic maintenance capabilities. This private sector approach, the infusion of Maintenance, Repair, and Overhaul (MRO) expertise and resources from external organizations into a “host” organization, is the cornerstone of the Depot Maintenance Partnerships.

Partnership in service, repair, and maintenance is common in certain private sector industries. In the oil and gas industry, Schlumberger IPM offers a complete turnkey service called the Producing Well Improvement Process (PWIP) providing all of the general oilfield operational aspects of a major oil company, including geology, well construction, lease operations, accounting, and abandonment. Schlumberger typically holds no equity in the project. At one project with 1,200 active wells, where the PWIP service program has been in place since 1991, well failure frequency has been reduced by about a factor of 10, from 2.5 to 0.27 failures-per-well per year. Well servicing costs have been reduced from $700M to $270M, a threefold improvement. Partnerships can be managed, even with complexity and
in remote locations, and external entities can be relied upon to deliver resources, expertise, and results.

However, there is more to the DOD approach than the typical “outsourcing” arrangement offered by Schlumberger. While DOD may outsource up to 50% of MRO work by statute, statute also allows for other collaborative arrangements. At the other end of the spectrum from the outsource model, specific DOD partnerships may “reverse” the flow associated with traditional outsource arrangements. Instead of sending work out to combine under the umbrella of a third party, and seek a return through a scale effect, the DOD may obtain the same benefit by drawing complementary work into the organic network. By drawing volume and complementary work through the organic network, DOD secures the opportunity to more fully utilize organic capacity, spur innovation and investment, and further develop and maintain a core competency. By offering private sector partners a potentially larger base of business, DOD induces collaboration within the organic network from the private sector by creating business opportunity for the private sector.

Models for a “reverse” approach can also be seen in the commercial sector, in particular in capital intensive process industries. In pharmaceuticals, competitors use excess capacity to manufacture for one another. Similar arrangements exist in bulk chemicals. Joint ventures are common in semiconductors, sharing the cost of fabrication and process innovation across multiple partners.

The Depot Maintenance Partnership “shared capacity” approach to enhance resource utilization and spur private sector involvement is validated by similar initiatives from other governments. The U.K. Ministry of Defense has established more than 85 public-private partnerships, worth about $2 billion. While the U.K. approach tends to more to the traditional outsource approach, leading to significant differences with Depot Maintenance Partnerships, there are also commonalities. One illustrative example dates back 15 years: in 1987, the Royal Navy turned over 29.5 percent of the Devonport Royal shipyard to a private sector partner. The Royal Navy kept its own naval

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base and part of the dockyard. There is no dividing line between the Devonport facility and the Royal Navy facility.

Supporting depot maintenance partnerships also requires systems. One example is the NAVSUP SMART program implementing APS technology to provide multi-echelon deployment and replenishment, and increased communication with organic and commercial sources of supply. Naval Air Depot Jacksonville (NADEP JAX) successfully deployed an off-the-shelf software package for repair and overhaul management. The same repair and overhaul software system is also being deployed at Naval Air Depots in Cherry Point, North Carolina and San Diego, California, and at Marine Corps Logistics Bases in Albany, Georgia and Barstow, California. It is also in use the U.S. Navy Ship Intermediate Maintenance Activity (SIMA) NRMF base in Ingleside, Texas and the U.S. Air Force Aerospace Maintenance and Regeneration Center (AMARC) at Davis-Monthan AFB in Tucson, Arizona.

**Implications for the DOD and Industrial Partners**

Enhancing depot maintenance capabilities, while maintaining organic capabilities, can be accomplished through several approaches that we have seen in the examples above. But they are not without significant issues for a DOD approach:

- Rather than having DOD specific facilities, the approach is to have strategically placed facilities with advanced high tech diagnostic capabilities and expertise operated with partners, which requires the refinement of a collaborative mind-set.
- Selecting skilled partners who participate in Centers of Expertise, leveraging scale, location and highly trained expertise for increasing effectiveness and efficiencies.
- Consistently using Service Optimization techniques through optimization analysis and implementation of commercial off-the-shelf software (COTS)\(^{11}\) across a diverse group of partners. These are:
  - Service network optimization
  - Service parts multi-echelon planning

\(^{11}\) The subject of service logistics and service optimization is discussed further in the conclusion section on commercial off-the-shelf technology.
Repair, route planning and deployment

- Implementation of Configuration Management and AUTO-ID tags for lifetime traceability and repair history of product from its original lot through enhancements, upgrades, and retirement. This knowledge is critical (and legislated) in the airline industry, supporting predictive maintenance and saving lives.
- Integration to performance and maintenance knowledge bases to create training and share learning. This data can feed the objectives for other FLE objectives—Condition Based Maintenance Plus and Total Life Cycle Systems Management.
- Reliance on performance-managed relationships and service level agreements. Innovative contractual arrangements between the DOD and private firms can help to ensure that the partners are meeting performance requirements and national security needs are protected.

Conclusion:

The Depot Maintenance Partnership Initiative is a reasoned approach to maintaining a core competency by leveraging the capabilities of the private sector. Private sector partners offer commercial best business practice expertise, capital investment, and on-going streams of business to develop DOD organic capability. DOD offers significant expertise in the area of Maintenance, Repair, and Overhaul (MRO), the bread and butter of depot activity. Together, the DOD and private sector partners can generate mutually beneficial opportunities.

While this initiative has been enthusiastically supported by Congress, with enabling statutes passed, care must be taken to ensure that a breadth of organizations continue to benefit from the initiative. Judicious use of approaches that broaden partnership participation, like minority and small business set-asides, has been successful. Support can be given to organizations that are able to provide service to the DOD but may not have the easy access to contract opportunities or experience with the DOD. The DOD can be an enabler in developing a new industry segment.

Stronger performance-based methods need to be created, with the use of balanced score card techniques - with the trading partners. One of the supporting structures within the FLE initiative is the use of KPI and balanced scorecards, and here it is critical not only to ensure
performance but also to allay concerns that the warfighter will get improved support and the taxpayer will be protected.
Enterprise Integration

The Initiative

The DOD operates more than 600 critical logistics information systems, containing approximately 400 million lines of code, and costing about $2B/year to support. Many of these are aging legacy systems—the average age is over 20 years. In spite of the numbers of systems, transactions between DOD customers and partners are often paper-based or batch-processed, indicating their lack of effectiveness. There is an urgent need for better integration of the business processes and systems used by organizations across the DOD enterprise and its industrial partners, in order to create a logistics organization that is agile and responsive to the needs of the warfighter.

Enterprise Integration provides the systems foundation on which the other FLE initiatives depend. End-to-end Distribution, Total Life Cycle Systems Management, Condition Based Maintenance Plus, Executive Agents, and Depot Maintenance partnerships all require close integration of systems and processes between all of the players in the chain to achieve their goals. With this integration, errors and cycle times are reduced, and ultimately the enterprise becomes more agile to meet the needs of the warfighter.

The Department of Defense (DOD) Logistics Enterprise exists to support the Warfighter's need for material and information – what, when, and where the Warfighter needs it. To accomplish this, DOD must have interoperable information systems that are integrated at the DOD enterprise level and provide end-to-end actionable data, information, and logistics situational awareness. More than just systems “integration,” the FLE aims to deliver seamless logistics information interoperability and connectivity across combat service support functions.

The FLE is already engaged in significant architecture work, supported by broad based data resource management (DRM) standards. Following best-in-class architectural standards, conformance to military
standards\textsuperscript{12}, as well as the development of new policy, the new architecture will allow significant improvements in flexible, real-time integration. In parallel with the architecture work, the DOD is developing a comprehensive Data Strategy to institutionalize data interoperability across the enterprise.

The DOD is also moving forward with the Database, Systems Realignment and Categorization project. Each service and agency is actively reviewing logistics systems and databases to determine how they contribute to the Future Logistics Enterprise, and has submitted its database and systems realignment plan to the Pentagon. These plans, while respecting service and agency autonomy, will institutionalize portfolio management and ensure the review of all logistics systems and databases. The goal is to identify redundant, unused, and outdated systems and aggressively retire or eliminate them, with a target completion date of 2005.

\textit{Best Practice Validation}

We have already touched on the need for visibility, standards, and reduced information cycle time to support a more streamlined, effective, and deft deployment strategy for the DOD. In the private sector many attempts have been made to create both enterprise-wide and supply chain-wide integration. Due to the virtual nature of industry, the concept of the enterprise (as we have alluded to previously) extends to trading partners, across the strategic portions of the supply chain. So, issues of security, though not as stringent as in the military, have also been dealt with across the private sector’s virtual enterprise.

There are many examples of successful integration efforts in the private sector. Daimler Chrysler integrates their material release process across their supply chain. With manual processes, it used to take an average of one month for a material release issued by Chrysler to percolate through its multi-tiered supply chain to suppliers at the bottom—too late to reflect known changes in market demand. Chrysler now synchronizes electronic material releases with suppliers covering over 90% of its business. Propagation time across the supply chain was reduced to hours. This resulted in a 90% decrease in premium

\textsuperscript{12} Standard C4ISR
freight costs, 6% increase in on-time delivery, 50% reduction in lead times, an average $40,000/year per supplier savings in data entry costs, and an average $325K/year per supplier reduction in obsolete materials cost. Daimler Chrysler’s larger suppliers report annual savings of between $2 million and $3 million as a result of these efforts.

Taiwan Semiconductor Manufacturing Company (TSMC), the world’s largest semiconductor contract manufacturer, directly integrated its order management and PDM systems with the ERP and PDM systems of its customers to exchange product specifications, test results, demand forecasts, purchase orders, purchase order acknowledgements, WIP updates, and ship notifications. As a result, TSMC reduced its customer’s product lead times by 25%, reduced WIP inventory, cut order cycle times by 50%, reduced its customer’s inventory levels by 25%, and increased customer satisfaction.

In spite of successes like these, efforts in industry overall have met with mixed results. Efforts within the enterprise to integrate are based on two distinct methodologies. One is to leverage traditional ERP and enterprise-centric solutions. The other as illustrated in the examples above, is to create a flexible architecture with middleware at the integration layer; above that are business applications and the new emerging ‘real-time business-ware’ (previously called event management solutions). These provide real-time analytics and business intelligence in a continuous mode to provide responsive and highly unified business environments.

Larger and more forward-looking organizations do not depend on the ERP architecture to provide total enterprise integration. ERP tends to be used for the transactional and financial architecture of the firm—managing payments, accounting and the like—with the middleware and best-of-breed applications driving value chain integration. Large retailers and computer manufactures, for example, do not rely solely on ERP. They experimented with ERP and determined that the lack of flexibility in the software, combined with the firms embracing of the multi-enterprise models required in a value chain-wide model, would be better served with best-of-breed applications.

In addition, the Internet, though recently maligned in the press, continues to grow in prominence in supply chain inter-enterprise
integration. Examples of companies that are leveraging web-based technologies for integration include Raytheon Network Centric Systems which uses a web-based supply chain planning and execution system for multi-enterprise collaboration. All supply chain functions for this Raytheon division now collaborate to analyze and manage proper inventory levels and seek opportunities for reduction. At Raytheon Integrated Defense Systems their implementation provides an advanced planning tool over the web for real-time analysis of future activity, which is critical for sourcing the high-risk, highly specialized parts required for defense projects.

Techniques like Data Resource Management, standards adoption, and trace-and-track technologies, like RF/wireless and data translators for logistics, provide integration on all levels.

The private sector has become adept at very rapid, incremental enterprise integration projects—progressing in modest, incremental steps. For example Smiths Aerospace, Electronic Systems division, implemented a web-native planning package within 30 days and validated their baseline data within 60 days. Southwest Airlines implemented Advanced Planning and Scheduling (APS) for U.S.-wide service maintenance in multi-phases. This has the benefits of rapid time-to-benefit, learning and improving as you go, and the flexibility to continually adjust and steer implementation strategies as external changes arise.

One example of Enterprise Integration within the military is the NAVSUP SMART (Supply Maintenance Aviation Re-engineering Team) project, which involves the implementation of ERP systems and compatible APS (Advanced Planning and Scheduling) technology to compute organic schedule requirements in order to provide the Navy repair depot a 'need' date for each component inducted for repair. Information will be passed between the ERP and the Naval Depot Management System (NDMS), allowing planners at Naval Inventory Control Point to obtain status of the repairs from the depot. A squadron’s requirements will be visible to the national and regional logistics chain from the moment it hits the system. The requirement will be tracked as it moves through local issue, expediting repair, or forwarding to an alternate source of supply for fill from national inventory. Retrograde will be visible through a stock-in-transit process
that will track the shipment through the Retrograde Pipeline to the storage site and ultimately to/from the depot repair process.

The SMART Pilot is also implementing APS technology to demonstrate that a COTS tool can perform demand forecasting and inventory planning functions better than current legacy tools and can support business rules that represent the Navy environment. Prior to fleet rollout, the APS tool will be configured to provide multi-echelon deployment and replenishment and increased collaboration and communication functionality with organic and commercial sources of supply. The APS tool provides visibility into overdue repairs and procurements, the ability to model execution plans based on constrained budgets, increased forecasting flexibility, and the ability to simulate and view the impact different conditions/decisions could make on budget execution and support.

**Implications for the DOD and Industrial Partners**

Enterprise Integration encapsulates the most significant overarching opportunity to leverage capability for gains across many military programs. Operational availability is best supported by highly unified systems that support real-time, role-based capabilities. Focus on a flexible architecture and data strategy, while ruthlessly eliminating redundant or obsolete systems, will allow the total logistics chain to respond to evolving needs.

Enterprise Integration also enables a much higher degree of integration with private sector partners. This provides bi-directional visibility and helps the DOD to leverage the global industrial base much more effectively.

Standardization in COTS will only be valuable if cross-department, inter-enterprise, and DOD–industry sharing of knowledge and project management is facilitated. Reassignments, based on expertise, can accelerate time-to-value. This issue and the others mentioned can be solved with concepts like role-based architectural principles.

Today, the concept of ‘role-based’ solutions are taking hold, are being deployed in organizations, and are being provided by the major application provides. Why is this significant for the FLE?
1. The system functions can be organized around the role, not just the individual, allowing sharing of activities and group participation.
2. A process or transaction owner can request, subscribe, and monitor their activities.
3. Roles can be transferred or distributed and deployed across the virtual supply chain.

Within FLE efforts, cross-services priorities focus on data management, for both the customer and the event (e.g. order delivery), which will allow end-to-end responsiveness programs to be successful. The other major force is the “pervasive visibility” environment. Pervasive visibility is real-time capability that pushes data to the subscriber and allows predictive views of events or problems. Subscribers are anywhere, from warfighters on the ground with a handheld Global Positioning Systems to an office making freight arrangements.

**Conclusion**

Industry has not succeeded in fully leveraging their investments in technology, due to organizations that frequently lack long-term focus and hence don’t fully achieve their lofty integration goals. DOD’s ability to create and maintain ‘attention-span’ on long-term projects is, in this case, an advantage that will enable significant progress. However, as industry has learned, architectures and data strategies need to be created that enable the progressive design of business processes—to allow flexibility to create new scenarios without huge changes in multiple systems.
Conclusions: Roadmap to Transformation

In this paper we have validated the FLE’s objectives and approaches by contrasting them with the proven experiences of the private sector. We have also substantiated the central importance of the FLE to the success of the 21st century warfighter. The DOD has within its span of control most of the enablers needed to drive success. There are other supporting entities—within both government and industry—that can enable, as well as derive support from the FLE initiatives:

- Change management focus
- COTS industry enablement
- Technology standards enablement

Change Management

The process changes cited in the industry examples have evolved over a decade or more, although industry would like to project the image of speed to adoption versus perception of slower government models. Though so-called hardheaded management types don’t tend to embrace change management concepts, the issues are very real. The catalysts for change in business may be long-term—such as an industry that is becoming commoditized. The U.S. automotive and semiconductor industries experienced huge threats in the last decade. The very viability of industries that were invented in the U.S. was at risk. Without significant change management and a focus on cost reducing processes, many firms have gone under. Witness years of mismanagement in certain high tech firms—from Sperry Univac to Compaq Computer. Many leading industry firms no longer exist due to this lack of attention. The U.S. Armed services cannot afford such a fate.

FLE brings significant change management issues in logistics and technology. Recognizing the huge impacts—cross-agency and cross-industry—will give the U.S. Government an opportunity to stimulate a positive transformation within government as well as the economy at large. Ecosystem members can play a significant role in making change happen and ultimately help enable success, provided that
priorities, opportunity, and expected roles and outcomes are managed. In fact, including appropriate ecosystem players can ensure a more speedy and successful outcome.

**COTS Industry Enablement**

As mentioned earlier, FLE points to a need for services functionality that can handle the many discrete activities within logistics. The DOD is in a significant position to enable further development of a full range of commercially available, DOD-deployable solutions from leading vendors. This would greatly enable the FLE objectives and over the long run reduce total-cost-of-ownership. Even at the DOD’s size, customized proprietary solutions are expensive undertakings. The reality is that the need has been expressed in the market, but the lack of committed partnership to evolve existing offerings has slowed the introduction of more complete capabilities. Rather than creating proprietary solutions, the support of a COTS evolution can have a very favorable impact in the ecosystem. The ecosystem clearly needs such a solution to participate fully in the partner activities, as well as the greater economy, to support the U.S.’ continued domination in the COTS market.

**Industry Standards**

There are over 10 major standards bodies, from auto/industrial to the UCC\textsuperscript{13}, who are engaged in initiatives that support the goals of the FLE. The DOD’s aggressive support for and alignment with the related industry standards and integration bodies will help enable the success of FLE programs.

**FLE and beyond**

One final thought, which should give significant encouragement to those involved in the FLE: though the scale and scope of the FLE seems daunting, some historical perspective will help here. What is significant to note is that many large-scale transforming industry cycles do occur, usually with a significant amount of cooperation from industry
members. Of interest are the major transformations currently occurring in the retail and automotive industries.

The current retail collaboration initiative began with attempts to address replenishment issues within the eco-system of Wal-Mart, only. Wal-Mart subsequently sponsored CFAR (collaborative forecasting and replenishment) development in 1996. As big as they were, Wal-Mart quickly realized they could not gain the desired benefits by going it alone. Industry standardization was the required enabler for the CFAR processes to take hold. Once the door was opened through the VICS council, the entire industry—competitors to Wal-Mart, as well as the entire chain of manufacturers—started implementing these standards to enable all the supply chain processes. This represents an inter-enterprise integration effort between thousands of firms with hundreds of billions of dollars of supply chain spend annually, as well as global movements of goods through thousands of trading partners and carriers. COTS vendors have been major underwriters of data transformation and standards efforts as well, creating—basically on consignment—the enabling infrastructure to these supply chains.

The automotive industry is also going through a similar transformation with major changes in processes, cycle times, collaborative design, and procurement with partners. Outsourcing of major functions has already occurred, creating the massive scale in the Tier One suppliers, who barely existed 15 years ago.

High Tech has also enabled the creation of new enterprises with the most dramatic moves to the virtual enterprise. Most OEMs no longer do any manufacturing of the system or design of strategic components. Today’s multi-billion dollar contract manufacturers like Solectron, Flextronics, and Jabil were tiny job shops or nonexistent 15 years ago. In addition, global third party logistics firms manage worldwide, large-scale transportation, distribution and service activities. They have systematically worked on supporting these virtual models, enabled by significant IT investments. The results can also be seen in the significantly lowered costs of all things electronic and the substantial improvements in product and service cycle times.

13 NIST keeps track of these various standards efforts.
All these industries, with myriad competitors and tiers of suppliers, as well as ecosystem support—technology and logistics firms—have moved, although not always in concert, to create common standards and approaches to drive collaborative transformation, ultimately improving the enterprise and the entire supply chain.

The FLE is the right framework for the future, based on proven practices, which will enable the DOD's logistics chain to go through fundamental transformation on a level similar to the changes seen in the private sector supply chain. The entire ecosystem will benefit as constituent members of the DOD enterprise and its private sector partners engage and implement these initiatives. In the end, the real winners will be the warfighters, who will gain the support of reliable, agile, and responsive logistics needed for effective dominance—and ultimately the American people who will gain the security of an even stronger national defense.
Acronyms

3PL – Third Party Logistics
APS – Advanced Planning and Scheduling
AUTO-ID – Automatic Identification
CBM+ – Condition-Based Maintenance Plus
CENTCOM – Central Command
CFAR – Collaborative Forecasting and Replenishment
CONUS – Continental United States
COTS – Commercial Off-The-Shelf
CPIO – Chief Process Improvement Officer
DLA – Defense Logistics Agency
DOD – Department of Defense
EA – Executive Agents
ERP – Enterprise Resource Planning
FIRST – F-18 Integrated Readiness Support Team
FLE – Future Logistics Enterprise
IT – Information Technology
JIT/QC – Just-In-Time/Quality Control
JLB – Joint Logistics Board
JV 2020 – Joint Vision 2020
KPI – Key Performance Indicator
LLP – Lead Logistics Provider
NAVAIR – Naval Air Systems Command
NAVSUP – Naval Aviation Supply
NDMS – Naval Depot Management System
NIST – National Institute of Standards and Technology
OEM – Original Equipment Manufacturer
PDM – Product Data Management
PLM – Product Life Cycle Management
PIA – Priority Information Agreement
PM – Project Manager OR Program Manager
POS – Point-of-Sale
PWIP – Producing Well Improvement Process
QDR – Quadrennial Defense Review
R&D – Research and Development
RCM – Reliability Centered Maintenance
RFID – Radio Frequency Identification
ROA – Return on Asset
ROI – Return on Investment
SMART – Supply Maintenance Aviation Reengineering Team
TLCSM – Total Life Cycle Systems Management
TSMC – Taiwan Semiconductor Manufacturing Company
UCC – Uniform Code Council
UI – User Interface
VICS – Voluntary Inter-industry Commerce Standards
WIP – Work-In-Progress