A LEAN SUSTAINMENT ENTERPRISE MODEL FOR MILITARY SYSTEMS

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As existing weapon systems age and the costs and cycle times on the maintenance, repair, and overhaul of these systems increases, various organizations within the U.S. Department of Defense are conducting independent studies to help the system become more efficient. Current research efforts on maintenance repair and overhaul operations focus on individual elements of this "sustainment" system. However, to more effectively solve the sustainment problem, research should be conducted on the whole enterprise, from raw material suppliers to final product delivery. To accomplish this objective, the authors developed a new "lean" framework for military systems sustainment. The goal of this model is to minimize non–value-added activities throughout the entire enterprise.

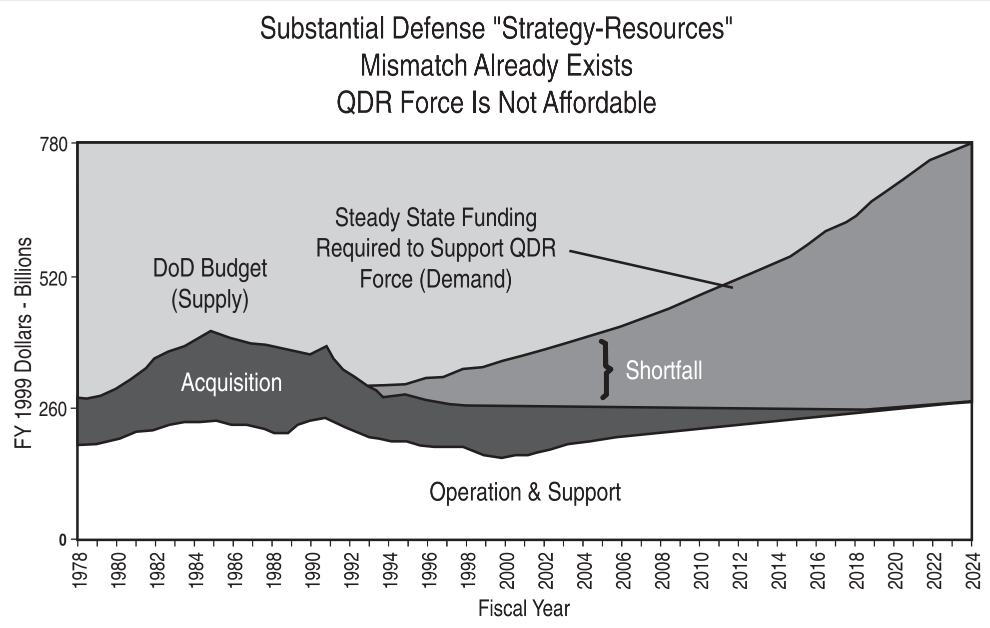
Since 1990, the Department of Defense (DoD) has reduced its budget by 29 percent. This reduction has greatly impacted weapon system acquisition and in-service support (Cordesman, 2000). Reduced budgets have forced the military branches to extend the life of current legacy systems with significant reductions in acquisition of replacement systems. In addition, current weapon systems are faced with escalating operations and maintenance costs. These "sustainment" costs are due to:

- Increased operational tempo.
- Increased mean time between maintenance (MTBM) cycles due to increased operational requirements.
- Increased life extension of existing weapon systems due to delays in new system acquisition.
- Unforeseen support problems associated with aging weapons systems.
- Material shortages because of diminishing manufacturing resources and technological obsolescence.

As sustainment costs increase, there is less funding available to procure replacement systems. An analysis conducted by the DoD (Gansler, 1999) concluded that, unless mission requirements and the operational tempo are reduced, or there are significant increases in the budget, the operational maintenance cost portions of the budget will equal the total current (net present value) budgets by the year 2024 (Figure 1). This chain of events has been illustrated and characterized in Figure 2 as the DoD death spiral. To waive off this death spiral, DoD must find innovative solutions to support legacy systems that are cost effective and flexible. The DoD must economically manage these system lifecycles in order to address obsolescence and modernization issues without degrading readiness, cost, and performance objectives.

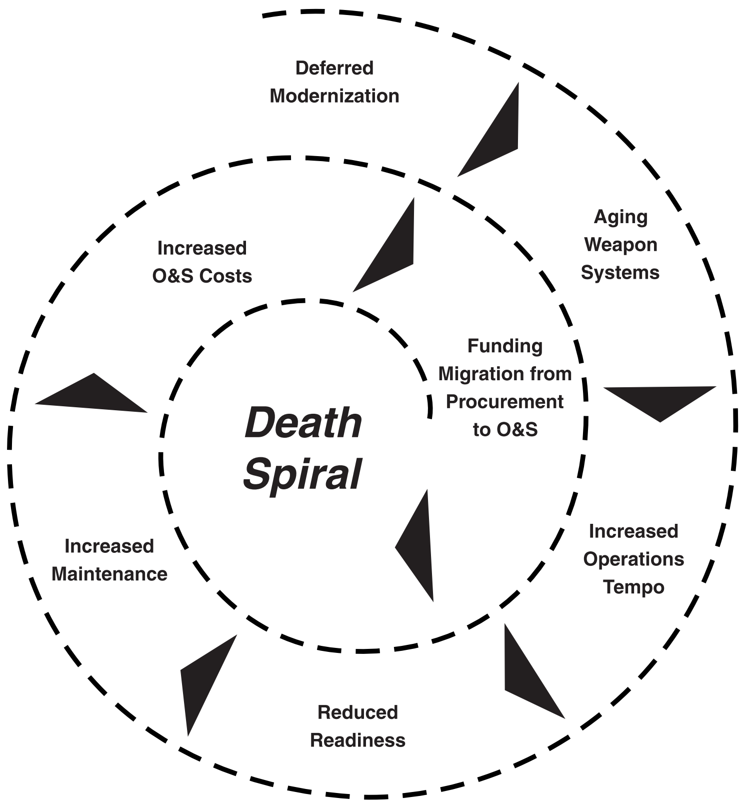
Along with DoD budgets, the defense industry sector has shrunk dramatically. In order to effectively compete in a significantly smaller market, the industry has seen a large number of corporate mergers. With the restructuring of the new industry base, many of the supply chain networks no longer exist. Second and third tier supply chain businesses have gone out of production. The defense industry sector is changing, and their associated supply chain network is eroding rapidly.

With over 60 percent of the total aircraft system life-cycle cost associated with operations and aircraft maintenance, and as aircraft systems age, there is great opportunity to optimize sustainment costs



(Note: From Dr. J.S. Gansler, USD(A&T), *Acquisition Reform Update*, January, 1999.)

Figure 1. DoD Budget Profile



(Note: From Dr. J.S. Gansler, USD(A&T), *Acquisition Reform Update*, January, 1999.)

Figure 2. DoD Death Spiral

(Blanchard & Fabrycky, 1998). With some degree of success, industry and government partnerships have been formed to attempt to address these issues. Examples include the U.S. Army's Modernization Through Spares program (Kros, 1999), Agile Combat Support (Eady, 1997), the Lean Aerospace Initiative (2001), the Lean Sustainment Initiative (2001), and Flexible Sustainment (Performance-Based Business Environment, 1997). These initiatives focus on three primary areas:

1. Modernization through commercial off-the-shelf technology solutions (technology refresh and technology insertion).

2. Manufacturing, production, and logistics methods (Just-In-Time, Lean, and Agile initiatives).

3. Modernization of the industrial base (the Flexible Manufacturing System, Material Resource Planning Systems, and Advanced Manufacturing Technologies).

However, these initiatives focus on individual elements of the sustainment system, not the whole enterprise. The question arises: Are these efforts coordinated? Organizations have the mind set that if it was not invented here it has no value. Therefore, the results of independent efforts often are not used by organizations other than those that are the target of the investigation. These projects overlap, and in many cases multiple initiatives are conducted on the same research areas (General Accounting Office [GAO] Report, 1998).

One approach to the problem is to turn to the "lean" principles for guidance. Using these concepts, the idea is to develop synergies along the whole supply chain, from the original equipment manufacturer to the customer. These lean concepts provide a set of tools and an overriding philosophy on how to transform "lean manufacturing" into a "lean sustainment supply chain." However, in order to effectively coordinate these efforts, and to bring military sustainment into the lean paradigm, a new framework or model for the whole enterprise needs to be developed. In this paper, the authors develop this lean framework/model for military systems sustainment. The goal in the model is to minimize non–value-added activities throughout the entire enterprise.

"These lean concepts provide a set of tools and an overriding philosophy on how to transform 'lean manufacturing' into a 'lean sustainment supply chain.'"

The paper begins with a brief introduction to the lean philosophy, follows with a characterization and analysis of the current military sustainment system, and then proposes a new lean sustainment enterprise model for how sustainment should be structured. Finally, the paper concludes with a brief description of an initiative (the U.S. Navy and Air Force Cartridge Actuated Device/Propellant Actuated Device [CAD/PAD] program) that has some elements of the proposed lean sustainment model. This example is used to illustrate that the proposed model is realistic, and that it can be implemented.

Brief Background on "Lean"

"Lean" was first defined in 1990 in a book, entitled *The Machine That Changed the World* (Womack, Jones, & Roos, 1990), which documents how the Toyota automobile production system became more efficient. Now other industries, including the aerospace and pharmaceutical sectors, are applying the concepts (Liker, 1997). Several characteristics are:

- Lean is a dynamic process of change driven by a systematic set of principles and best practices aimed at continuously improving the enterprise.
- Lean refers to the total enterprise: from the shop floor to the executive suite, and from the supplier to customer value chain.
- Lean requires rooting out everything that is non–value-added.
- Becoming lean is a complex business. There is no single thing that will make an organization lean.

Lean can mean "less" in terms of less waste, less design time, less cost, fewer organizational layers, and fewer suppliers per customer. But, lean can also mean "more" in terms of more employee empowerment, more flexibility and capability, more productivity, more quality, more customer satisfaction, and more long-term competitive success (Nightingale, 2000). In short, lean is focused on value-added activities.

How does an enterprise know if it is lean? Benchmarking oneself against best internal operations, external direct competitors, external functional best operations, or generic functions regardless of industry, can be one measure of the relative value of one's leanness. In addition, appropriately chosen metrics are the performance characteristics that are used to assess whether or not an enterprise is lean. Examples might include reducing cycle time, lowering costs, minimizing waste, and improving quality. Some of the demonstrated metrics used to measure improvements in production/manufacturing as a result of applying these lean concepts include (Lean Aerospace Initiative, 2001):

- Labor hours: 10 to 71 percent improvement.
- Costs: 11 to 50 percent improvement.
- Productivity: 27 to 100 percent improvement.
- Cycle time: 20 to 97 percent improvement.
- Factory floor space: 25 to 81 percent improvement.
- Travel distances (people or product): 42 to 95 percent improvement.
- Inventory or Work in progress: 31 to 98 percent improvement.
- Scrap, rework, defects or inspection: 20 to 80 percent improvement.
- Set up time: 17 to 85 percent improvement.

	GM Framingham	Toyota Takaoka
Assembly hours per car	31	16
Assembly defects per 100 cars	130	45
Assembly space per car	8.1	4.8
Ave. inventory of parts	2 weeks	2 hours

(Note: From World Assembly Plant Survey, International Motor Vehicle Program, MIT, http://web.mit.edu/ctpid/www/impv.html)

Figure 3. Example of Mass Production vs. Lean Production

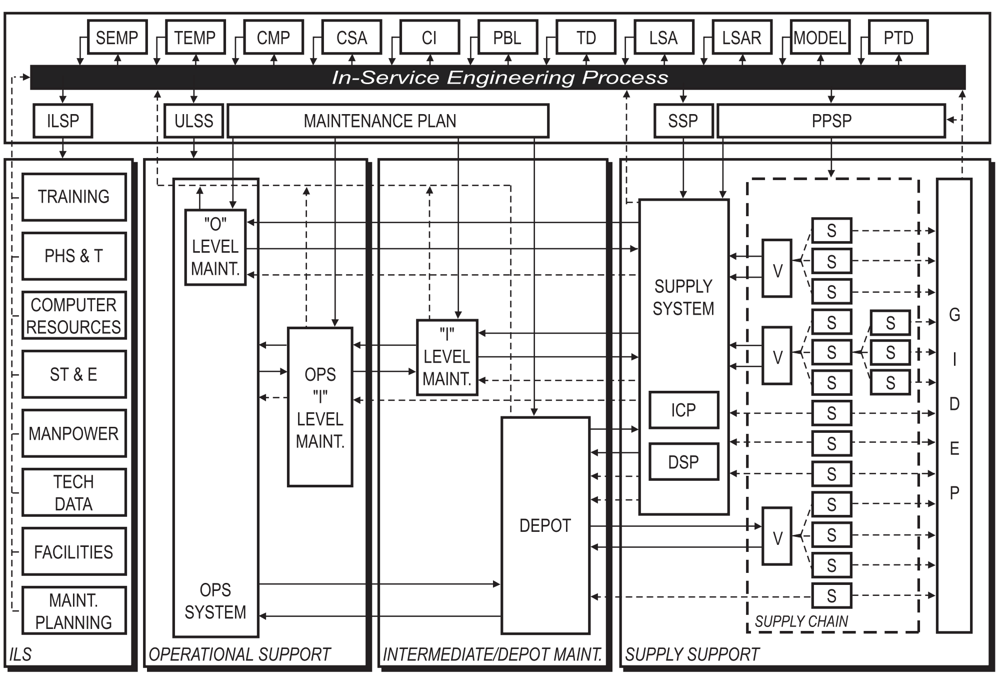
- Lead time: 16 to 50 percent improvement.

To illustrate the benefits of being lean, Figure 3 shows the distinction between traditional mass production measures of performance for a General Motors plant in Framingham, Massachusetts against the lean production measures involved in a Toyota Takaoka.

Characterization of the Current Military Sustainment System

The current military sustainment system can be characterized as comprising four major elements: (1) Supply Support, (2) Intermediate/Depot Maintenance and Operational Support, (3) Integrated Logistic Support (ILS), and (4) the In-Service Engineering process. This current model, shown in Figure 4a, illustrates the coordination among these sustainment organizations.

Referring to Figure 4a, the Supply Support function consists of the supply chain, supply system, and the Government Industry Data Exchange Program (GIDEP). The supply chain is comprised of the vendors (V) and suppliers (S) that provide consumable materials and refurbishment services to the supply system and depot. The item manager has overall responsibility for inventory management, handled through Inventory Control Points (ICPs). Inventory locations are referenced as Designated Stock Points (DSPs), which maintain spares and consumable inventories.



(Acronyms are defined in Appendix)

Figure 4a. Current Military Sustainment Model

The Intermediate and Depot Maintenance functions consist of those maintenance organizations responsible for keeping weapon systems in a serviceable condition. The Designated Overhaul Point (DOP), also known as an organic military depot, performs maintenance that includes servicing, inspection, test, adjustment-alignment, removal, replacement, reinstallation, troubleshooting, calibration, repair, modification, and overhaul of weapon systems and components (Jones, 1995; Blanchard, Verma, & Peterson, 1995).

Maintenance data and failure analysis is provided to the In-Service Engineering Process. Intermediate maintenance organizations provide operational support services at the customer's base of operations. Depot maintenance organizations perform maintenance, repair and overhaul (MRO) services to the weapon system and its associated components. The depot procures consumable materials from the supply system and commercial sources.

The Integrated Logistics Support function is a composite of all support considerations including "system design for sustainability" and the logistics infrastructure that is necessary to ensure effective and economical support of a system throughout its existing life (Blanchard, 1998). The primary objective is to achieve and maintain readiness objectives. Logistics includes all of the support elements necessary to sustain the weapons system, including such elements as training and support; packaging, handling, storage, and transportation (PHS&T); and computer resources/support.

The In-Service Engineering Process, at the top of Figure 4a, is responsible for maintaining the system configuration of the product and identifying post-production support plans (PPSP) and product improvements associated with the operation, maintenance, and integrated logistic support of all weapon system support elements. Other responsibilities include the evaluation, definition, and testing of solutions to possible PPSP problems using systems engineering processes in an effective and expeditious manner to support required readiness objectives for the remainder of a weapon system's life cycle (International Council on Systems Engineering [INCOSE], 1998).

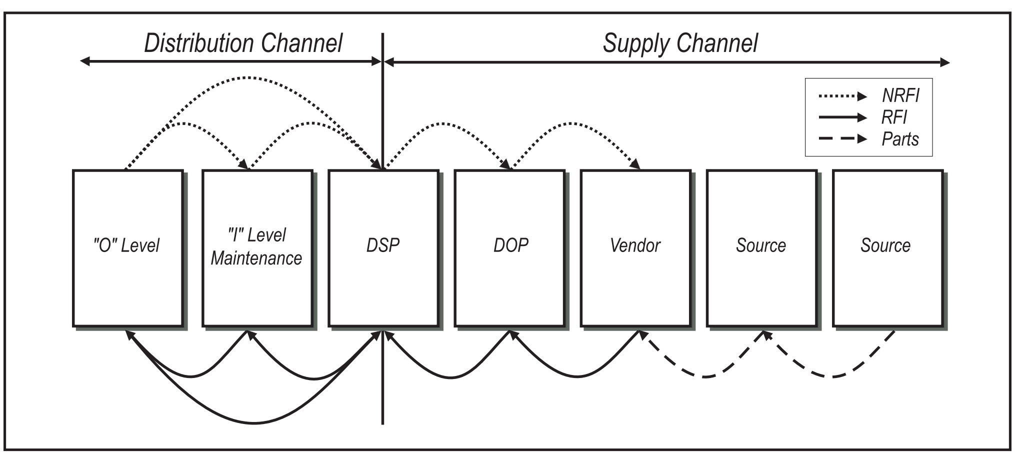


Figure 4b. Military Sustainment Model Supply Chain (6 Levels)

ANALYSIS OF THE CURRENT MILITARY SUSTAINMENT MODEL

To illustrate the inefficiency and complexity of the current military sustainment model, Figure 4b shows the system from the perspective of the distribution channel and the supply chain. In that figure, the distribution channel on the left includes the processes necessary to provide a "Ready for Issue" (RFI) spare part to the war fighter, including the technical maintenance services provided by the maintenance sustainment organizations. The supply channel on the right includes the processes necessary to replenish the RFI stock inventory required to support the distribution channel. This process includes replenishing the consumables, the maintenance, repair, and overhaul of RFI spares, and the associated lower level supply chain activities. Note that there are seven levels for the distribution and supply chain. Another perspective of this complexity is illustrated in Figure 4c, which places the item manager in the center of the complicated supply channel and distribution channel activity. Such a model

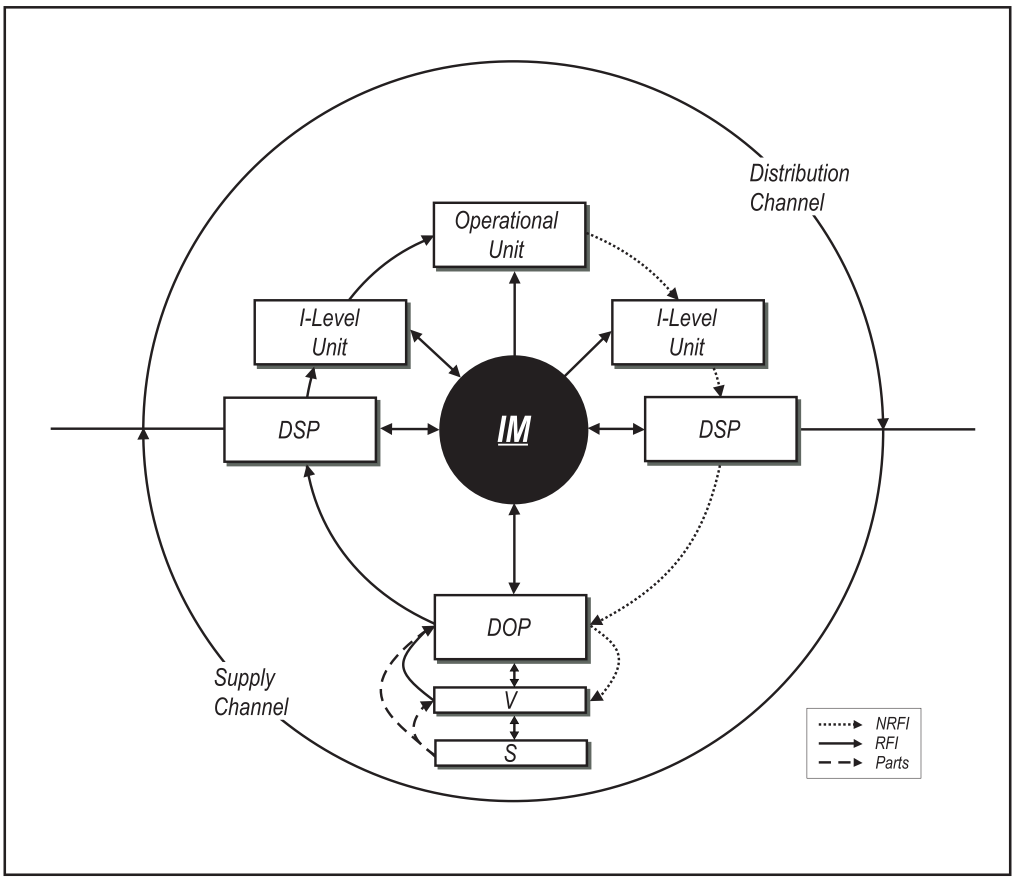


Figure 4c.
Military Sustainment Model Distribution and Supply Channels

is good for the support of large, slowly changing platforms and systems, but it possesses negative characteristics.

- It is a 7-tier sustainment system.
- It contains uncoupled processes.
- It has fragmented organizational structures.
- It possesses uncoordinated supplier and distribution channels.
- It is a push, not a pull, oriented system, which violates one of the fundamental principles of lean.
- The model is not responsive in today's maintenance, repair and overhaul environment.

The complexity of the channels in Figures 4b and 4c indicates there is an opportunity to integrate many of the system functional elements to effectively meet supply system and fleet requirements concurrently. The proposed Lean Sustainment Enterprise Model is a new framework that is based upon the lean paradigm.

The Proposed Lean Sustainment Enterprise Model

In order to achieve a truly lean approach, some organizational structures within the current military system must be integrated. The proposed Lean Sustainment Enterprise Model (LSEM) calls for the consolidation and integration of the following sustainment functions: In-Service Engineering, Integrated Logistic Support, Intermediate/Depot Maintenance, Operational Support, and Supply Support. This realignment of the military sustainment system mirrors a commercial MRO operation. The goal is to achieve significant customer service levels while reducing total ownership costs. The new organizational framework allows close coordination between the operational community and the supporting sustainment network required to meet evolving lifecycle support requirements.

The proposed enterprise model is illustrated in Figure 5a. The key attribute of this framework is that it is organized around three primary sustainment structures: Operational Sustainment, Sustainment Engineering, and MRO operations. These three structures are consolidated into one Life-Cycle Support Facility, shown in the center of Figure 5a. The three structures are not explicitly illustrated in Figure 5a; they will be explained later. Rather, the authors chose to use the traditional acronyms (such as ILS [Integrated Logistic Support]) within each structure so that a direct comparison can be made between this new framework and the current military sustainment model. The supply chain that feeds this new facility is illustrated in Figure 5a to the right of the facility; and the Operational (O) Level and Intermediate (I) Level Maintenance activities that benefit from the Facility are illustrated on the left (as the Operational Support function).

"In order to achieve a truly lean approach, some organizational structures within the current military system must be integrated."

Within the Life-Cycle Support Facility, there exist the traditional ILS functions, such as training; packaging, handling,

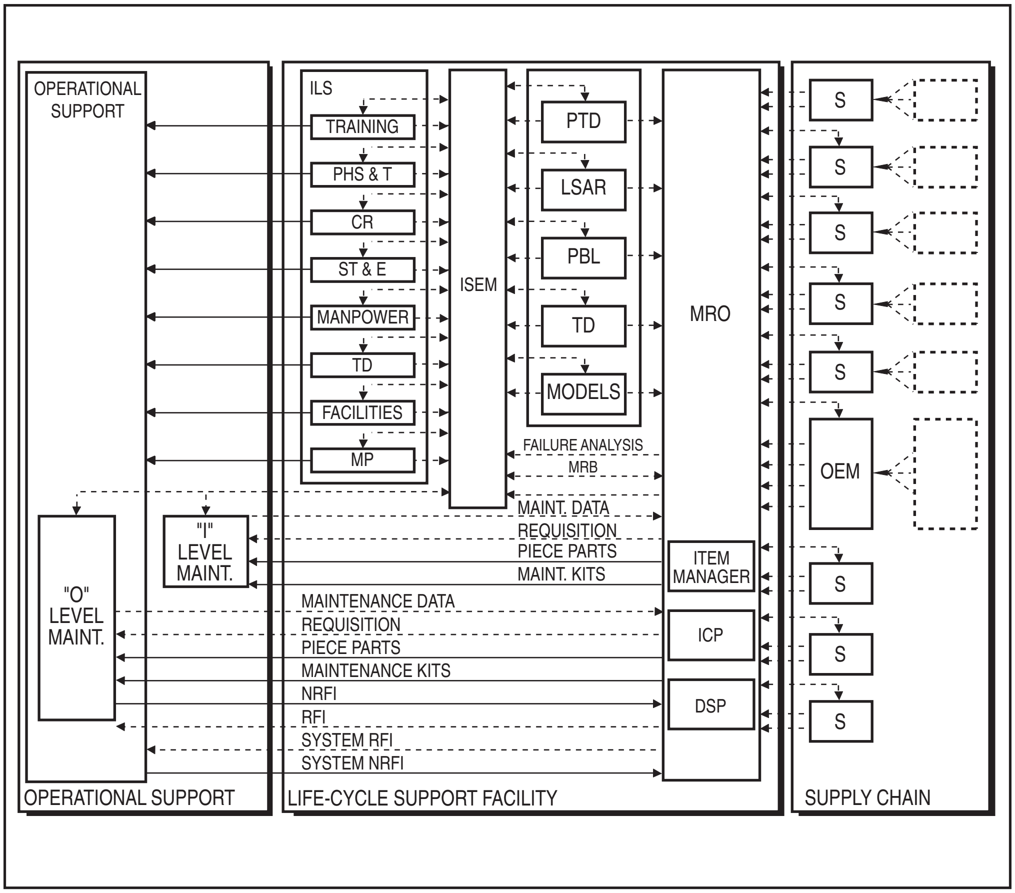


Figure 5a. The Lean Sustainment Enterprise Model

shipping, and transportation (PHS&T); and the computer resources (CR), among others. These functions are now part of what the authors call the first structure, the Operational Sustainment structure. New information systems technologies allow many of these stand-alone ILS elements to be combined and integrated into a net-centric environment. Sophisticated interactive technical manuals are rapidly evolving to include training and elaborate diagnostics capabilities.

Advances in both enterprisewide and specialized logistics engineering applications software packages are being designed with open architectures that would allow an integrated digital environment. These advances in information technology potentially could eliminate many traditional logistic infrastructure bureaucracies that were established during the Cold War. Operational sustainment processes must be reengineered to effectively use these new technologies and applications.

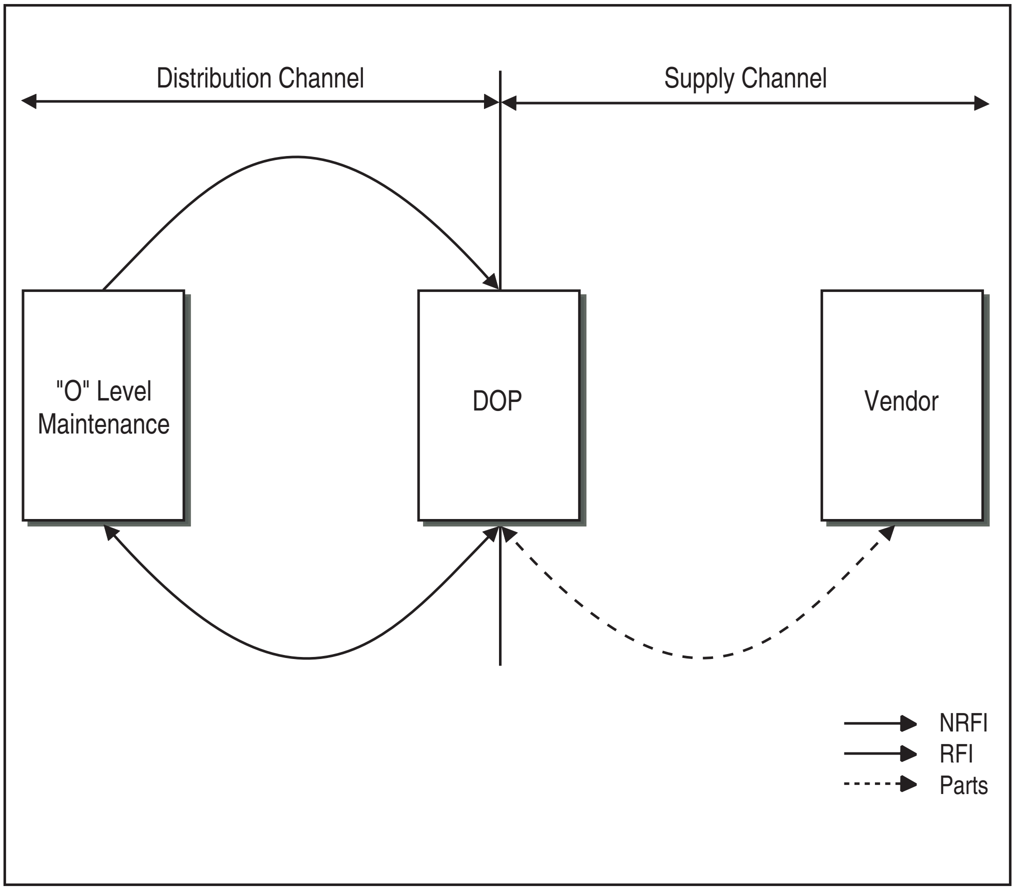


Figure 5b.
Lean Sustainment Enterprise Model Supply Chain (3 Levels)

The second structure within the life-cycle facility, Sustainment Engineering, provides engineering services to the other structures, primarily the MRO structure. The Sustainment Engineering structure uses an Integrated Systems Engineering Management (ISEM) framework to maintain such traditional functions as provisioning technical documentation (PTD), product baseline (PBL) maintenance, technical data (TD) packages, and engineering models. Intelligent engineering analysis software tools could provide system engineers the capability to monitor and correct operational sustainment problems, such as technology obsolescence, aging systems, reliability performance degradation, and maintenance engineering management. System effectiveness management practices are used to automate and monitor sustainment technical performance measures for rapid problem identification and resolution to minimize cost and mission readiness impacts.

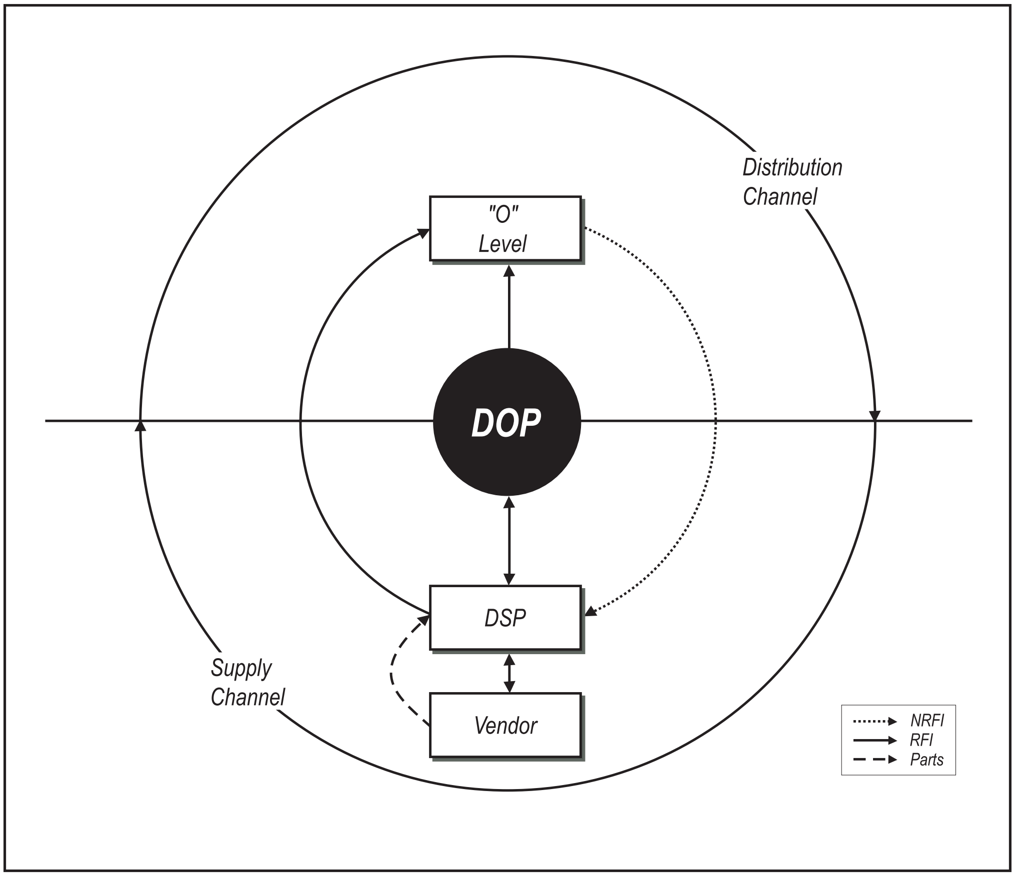


Figure 5c.
Lean Sustainment Enterprise Model Distribution and Supply Channel

The third structure, the MRO structure, provides spares and material support to the warfighter. The MRO organization structure will include inventory management and supply chain management responsibilities, which is why it directly connects to the Supply Chain structure in Figure 5a. The MRO structure could perform remanufacturing services using new lean production concepts, such as Just in Time (JIT), single piece flow, and Kanban-based pull production systems. Many institutions using these lean concepts, including the Lean Aerospace Initiative (2001), have observed significant cycle time reduction and increased service level performance. In terms of inventory management, the traditional military logistics infrastructure designates the ICP organization to perform inventory and asset management. The DSP organization performs warehousing and transportation coordination services for the ICP. These services are now consolidated in the new MRO structure to minimize cost and streamline asset movement. These responsibilities are routinely colocated in most commercial MROs.

From the perspective of the supply chain, Figures 5b and 5c for the proposed model are analogous to Figures 4b and 4c for the current model. Note that with the new model there are just three levels to the supply chain, not seven as in the current model. The new model also places the DOP, the depot performing the maintenance functions, in the center of the supply channel and distribution channel activity. The intent is to have the right part be available at the right place at the right time.

Benefits and Challenges to the Lean Sustainment Enterprise Model

The proposed Lean Sustainment Enterprise Model provides for the remanufacturing, refurbishment, modification/upgrade, testing, failure analysis, inventory control/management, and configuration control of a system and its associated critical subcomponents in one integrated enterprise. Fast depot operations, emphasizing low cost availability with variable volume capacity, allows for standardized product production and refurbishment using focus shops, central purchasing, central distribution, and central processing. The integrated model should result in significant cost savings and improved cycle time performance; and it should outperform a conventional depot, because it integrates the operational system with inventory control and the in-service systems engineering functions.

The intent is that the right part will be available at the right place at the right time. Logistics Delay Time (LDT), a key metric for leanness, should be reduced as lead times and turnaround times are decreased to an absolute minimum in order to obtain low cost, high quality, and on-time material availability. The LSEM has the potential to reduce the cost of inventory and the cycle time of material refurbishment. The LSEM also offers considerable improvements to accommodate product redesigns and material sustainment efforts, which are required to ensure that the useful economic system life will be much longer than that of traditional weapon systems.

Systems Effectiveness Management in the proposed LSEM is a proactive approach to quickly identify and resolve sustainment problems. With over 60 percent of the total system life-cycle cost associated with operations and maintenance, there is great opportunity to optimize sustainment costs (Blanchard & Fabrycky, 1998). The system effectiveness management approach in the Lean Sustainment Enterprise Model integrates failure data with knowledge-based decision models for quick resolution of sustainment problems. Early identification of "out of specification" performance problems of the sustainment system can be used to trigger Sustainment Engineering actions.

> **"The intent is that the right part will be available at the right place at the right time."**

The traditional military sustainment model is based upon systems design characteristics and performance specifications. During the system design and manufacturing development phases, reliability-based provisioning and inventory models are developed to support the initial fielding of these systems. After several years of operations, these models are updated with historical usage data to reflect the changes of the system as it ages. But, in-service failures occur with greater frequency. This increase in system maintenance quickly created stock-out conditions in the supply system. Supplier problems also increased over time due to changing technology and business cycles. However, in the proposed LSEM all levels of system maintenance are monitored, including depot level failure analysis and logistics performance measures. Failure data are loaded into system engineering models for analysis. The analysis provides the basis for product and process improvements and provides a what-if system analysis tool for simulation-based trade off studies.

In the LSEM, initial system deployments are sufficiently sustained because the initial support infrastructure and resource requirements are accurately computed based upon reliability-based system effectiveness analysis. This analysis is effective during early deployment, but it becomes less efficient as the system ages. Thus, real-time data collection and analysis are required to manage the sustainment system efficiently. To effectively collect the necessary data required for a system effectiveness management process, the sustainment system must be completely integrated, as is suggested in the LSEM. The sustainment enterprisewide information system needs to be fully integrated to establish an effective system sustainment management process.

The new systems effectiveness management approach would allow the Sustainment Engineer to quickly identify any problem area and to conduct root cause analysis. All data sources for the analysis can quickly be assessed from this information system. With the simulation-based decision trade-off tools and failure data integrated, as it is in the LSEM, the sustainment engineer is provided with powerful tools for continuous systems engineering process improvement. This approach provides an effective life-cycle management methodology to fully integrate both the Sustainment Engineering Process with normal sustainment operations and maintenance. This integrated approach provides greater efficiencies in organizational coupling and real-time feedback for enterprisewide continuous improvements.

However, the Lean Sustainment Enterprise Model is not without its challenges. Possible barriers include the amount of integration required between the Depot, In-Service Engineering, Inventory Control, and Supply Chain management. Close coordination and integration is mandatory to fully benefit from the concept. Special skills will need to be developed to perform the many new tasks. The level of understanding that is needed to successfully maintain and operate the LSEM will need to be reviewed and addressed in any implementation planning, but the intent is not to translate the opportunity into a job reduction program. Existing personnel, and their skill sets, are in short supply and are just as important as in the old model. So personnel reductions are not recommended in the new paradigm.

Another challenge is that the In-Service Engineer must ensure that ordering times, shipping times, fill rates, maintenance turnaround times, as well as other metrics realistically portray the impact and interaction of the supply, transportation, maintenance, and procurement systems. Determining the range (number of different items) and depth (quantity of each item) of spares to be procured and stocked must be constantly evaluated and adjusted to provide a lean operation.

A Case Study: The Joint CAD/PAD Program

To illustrate that the proposed model is realistic and that it can be implemented, the authors searched for an ongoing initiative that has some elements of the LSEM. While no current initiative fully replicates the proposed LSEM, there are some excellent examples. One such case is the U.S. Navy and Air Force CAD/PAD program.

In 1998, the U.S. Navy and U.S. Air Force began a unique management experiment — a joint program to manage the sustainment of the Cartridge Actuated Device/Propellant Actuated Device (CAD/PAD). The CAD/PAD devices are explosive items used in aircraft escape systems and other applications. CAD/PADs all have defined service lives and must be replaced periodically. The joint program was born when visionary managers in the two Services saw the greater value of consolidating their previously separate activities and built the trust needed to overcome the risks of doing business in a new way. The key attributes of the program are:

- Operation as a joint integrated product team/competency aligned organization with the Service affiliation of team members transparent to users.
- Assumption of responsibility by the U.S. Navy, as lead Service, for an important factor (the escape system) in the operational readiness of aircraft in all Services.
- Employment of jointness in the sustainment phase of the life cycle, rather than the more traditional development phase.
- Use of best practices and continuous improvement with a strong emphasis on supporting the customer.
- Management of a commodity, rather than a weapon system.
- Creation as an initiative from the working level, rather than a directive from the top.

"In April 2001, the Joint Program received the David Packard Excellence in Acquisition Award, given for great innovation and results in acquisition."

The Joint Program team consists of operating elements at the Indian Head Division, Naval Sea Systems Command, Hill Air Force Base in Utah, Rock Island Arsenal, and the Naval Inventory Control Point in Mechanicsburg, Pennsylvania. A small, jointly-manned program office, reporting to the Conventional Strike Weapons Program Manager (PMA-201) within PEO (W), manages the program.

In April 2001, the Joint Program received the David Packard Excellence in Acquisition Award, given for great innovation and results in acquisition. The Award recognizes the Program's reengineering of the process for resupplying CADs and PADs to U.S. Navy and U.S. Marine Corps users in the field. The old process was both labor and paper intensive, requiring up to four months from order to delivery. The reengineering team developed an "877" phone system that maintenance personnel use to order directly from the stock point at Indian Head, Maryland, a common practice in the commercial world. The telephone operator is able to validate need in real time using computerized maintenance records. Shipments are accomplished, in most cases, by an overnight commercial carrier, which allows for automated tracking. Actions by intermediate personnel have been greatly reduced and the average cycle time is reduced from 210 days to 7 days.[1]

Minimizing duplication, optimizing joint resources, and applying the best practices of each service have all resulted in numerous savings, estimated by the Program at $825,000 per year. Included in this figure are the savings from combined procurements of items that are common to two or more services, reducing the number of contract actions required and invoking economies of scale. Adoption of a Navy computer system for materiel planning will lead to more precise requirements determination and budget justification for Air Force needs. Under this system, the Navy has been able to defend successfully its annual request for procurement funds by predicting very accurately the readiness impact on specific aircraft of any reductions. The transfer of several former Air Force civilian personnel to the Navy will help preserve the technical and management capability to serve Air Force users. Personnel costs are included in the price of overhaul services for weapon systems and unit components.

CONCLUSION

Reduced DoD budgets are forcing the military to rethink how to manage the life cycle of the military systems. Initiatives, such as the U.S. Army's Modernization Through Spares program, Agile Combat Support, the Lean Aerospace Initiative, the Lean Sustainment Initiative, and Flexible Sustainment, present potential solutions to these budget problems; but they focus on individual elements of the sustainment system, not the whole enterprise. In order to take maximum advantage of the fundamental principles of being lean, a change in the military organizational structure is necessary. The change calls for the integration of the In-Service Engineering process, the Inventory Control Points, and the maintenance, repair and overhaul (MRO) functions to insure that a total systems engineering approach is used effectively in solving all parts of the problem. In other words, the synergistic effects of one solution can be magnified by other solutions in the chain. In utilizing a private industry type of approach, the authors have developed a Lean Sustainment Enterprise Model to provide the necessary framework to conduct research into development of this whole system approach to lean sustainment for military systems.

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ENDNOTE

1. A comment by a maintenance supervisor is typical. Petty Officer First Class Jeanna Saccomagno said, "In the past we had a full time person doing this. Now it takes 10 minutes each month." This saves the Fleet over 45 work years per year.

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APPENDIX

ACRONYMS

CI	Configuration Item
CMP	Configuration Management Plan
CR	Computer Resources
CSA	Configuration Status Accounting
D-Level	Depot Level Maintenance
DOP	Designated Overhaul Point
DSP	Designated Stock Point
GIDEP	Government and Industry Data Exchange Program
ICP	Inventory Control Point
I-Level	Intermediate Level Maintenance
ILS	Integrated Logistic Support
ILSP	Integrated Logistic Support Plan
ISEA	In-Service Engineering Agent
ISEM	Integrated Systems Engineering Management
LSEM	Lean Sustainment Enterprise Model
LSA	Logistics Support Analysis
LSAR	Logistics Support Analysis Record
MP	Maintenance Plan
MRB	Material Review Board
MRO	Maintenance, Repair, and Overhaul
NRFI	Not Ready for Issue
O-Level	Operational Level Maintenance
OEM	Original Equipment Manufacturer
PBL	Product Base Line
PHS&T	Packaging, Handling, Shipping, and Transportation
PPSP	Post Production Support Plan
PTD	Provisioning Technical Documentation
S	Supplier
RFI	Ready for Issue

SEMP	System Engineering Master Plan
SSP	Supply Support Plan
ST&E	Special Tools and Test Equipment
TD	Technical Data
TEMP	Test and Evaluation Master Plan
ULSS	Users Logistics Support Summary
V	Vendor