AN EVALUATION OF THE PRIME VENDOR SUPPORT APPROACH TO U.S. ARMY WEAPON SYSTEM SUSTAINMENT

By

Russell F. Miller

B.S. Electronic Engineering University of Alabama in Huntsville, 1990

Submitted to the Alfred P. Sloan School of Management and the School of Engineering in Partial Fulfillment of the Requirements for the Degree of

Master of Science in the Management of Technology

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ABSTRACT

In recent years the Department of Defense (DOD) has launched several initiatives to contain support costs for weapon systems. Recently a new weapon system sustainment concept advanced by industry, known as Prime Vendor Support (PVS), has been either under consideration or already adopted as a means of reducing support costs.

PVS requires that the DOD relinquish the weapon system support processes to the prime vendor. The research reported in this thesis presents a comparative evaluation of the support processes associated with two weapon systems., one currently in the process of implementing PVS the other still supported by the conventional organic Army support system. The Lean Enterprise Model (LEM), developed by researchers at MIT under the auspices of the Lean Aerospace Initiative, is used to assess these two distinctly different support processes, to determine whether and to what extent the PVS concept offers any tangible benefits to the Army. The LEM, which represents a framework for organizing, storing and retrieving lean principles, practices and metrics in the aerospace industry, presents a template for best practices that are applicable to the defense sustainment community. The LEM is adapted to the government environment, by proposing a two dimensional model. This model calibrates the LEM for the unique Army environment and is then used to generate a "degree of leanness" index for each major sustainment process. These measures reflect, in essence, lean effectiveness ratings. The rating process itself draws upon extensive field interviews with personnel associated with these two weapon system support processes. The resulting "degree of leanness" (lean effectiveness rating) measures are used to compare the two weapon system support concepts.

The major finding of the research is that the PVS concept offers significant advantages, reflecting considerable cost savings, compared with the conventional support model. The "degree of leanness" (lean effectiveness rating) measures indicate three-fold improvements over existing processes, particularly in the reliability-related processes.

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Table of Contents

TABLE OF FIGURES

1 INTRODUCTION

The Cold War for decades provided the stimulus behind the large Department of Defense (DOD) budgets. But as the Cold War ended, the DOD budget was looked at for the peace dividend. The Bush administration began the search for the peace dividend with the "streamlining process" and made some progress in reducing the DOD bureaucracy. The objective was to get the cost of acquiring new weapon systems lower as well as reducing escalating support costs for legacy weapon systems. The Clinton administration in 1992 continued to review DOD acquisition policy, and was decidedly determined to reap the peace dividend. Again the target was the DOD acquisition and support policies. These policies were thought to be fraught with waste and were generally considered to be the source of the high acquisition and support costs. It is generally believed that the logistics support processes, or the "cost of ownership," as they have come to be known, account for 60% of total life cycle costs of the typical weapon system.[1] Therefore, it is not surprising that this area of weapon funding is being looked at for substantial cost savings.

Clinton's first Defense Secretary, Les Aspin, began with the bottom-up review in an effort to start with a clean piece of paper and revalidate the need for the DOD acquisition infrastructure. Aspin never had time to implement the changes suggested by the bottom-up review, before resigning his position.

Clinton's second Defense Secretary, William Perry wasted little time in getting on with the changes suggested by the bottom-up review. At the same time the Vice President began the National Performance Review (NPR) to streamline the government. One of the focal points of the NPR was again the DOD acquisition policy. The DOD initiatives and the process of changing it began in 1993, continue today, and are known as Acquisition Reform. One of the latest proposals to come out of acquisition reform, but whose genesis is found in the defense industry, instead of from within the government, is an initiative called Prime Vendor Support (PVS).

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[1] House and Senate Appropriations Committees (1998)

1.1 Prime Vendor Support: Overview

What is PVS and what benefit can it offer to the Army? Variations of PVS support-like services exist throughout the aerospace industry, but the Army battlefield application being considered here is unique. PVS is essentially the outsourcing of weapon logistics support services, which encompass those services associated with post-production or sustainment.

A contractor, generally but not necessarily the prime or the Original Equipment Manufacturer (OEM), is the organization that is contracted to provide the PVS services. The Army leadership believes major benefits of PVS include dramatic cost savings and a single point of accountability for weapon support.[2] The Secretary of the Army also claims that PVS has the potential for huge savings.[3] Along with the cost savings is another claimed benefit that grew out of the NPR, reduction of Army acquisition personnel. Dr. Kelman, who assisted in the National Performance Review, testified to the Congress:

> "I want to state that it is crucial as we begin to pursue the recommendations of the NPR to reduce the Federal Work Force by 252,000 people, that many of the positions we are seeking to reduce are intended to be procurement positions."[4]

So PVS holds the promise of saving dollars and reducing Army personnel through gains in logistics support efficiency.

1.2 Motivation for this Research for the Army

Of course, with any outsourcing decision there are many factors that must be considered. Perhaps paramount to the Army, even above the cost savings and personnel reductions, is

[2] Kern, LTG Paul J., (1998) "Prime Vendor Support: Wave of the Future", *Army RD&A*

[3] Walker, Secretary of the Army (1998), The Subcommittee on National Security Committee on Appropriations, Federal Document Clearing House Congressional Testimony

[4] Dr. Steven Kelman, (1994) Acquisition Policy Reform, hearing before the Military Acquisition Subcommittee of the Committee on Armed Services, House of Representative, One Hundred Third Congress

the issue of loss of "direct control" of the weapon's support. The agency control under PVS will be limited to the extent that the *PVS contract* now becomes the means by which the weapon system support is directed.[5] As an agency goes through the process of deciding to outsource these services, the decision is extremely important. Also if a PMO were to implement a PVS support concept, and the project ended in failure i.e. the PVS concept did not provide savings or perhaps readiness suffered, there will be concern of how to reestablish the capability within the government.

The motivation for this research is to investigate whether the PVS concept does offer clear benefits to the Army and whether those benefits outweigh the additional costs of implementation. Current PVS proposals demand that local commanders inform their PVS contractors of all movements of hardware. The supporting PVS contractor must be kept aware of prevailing support conditions and locations so that adjustments to the support processes can be made. But this could pose security problems for the commanders.

Reduction of personnel is also an appealing benefit with PVS. However once the Army's support personnel are replaced by the PVS personnel, and the PVS concept does not succeed, reconstituting the Army support structure may be very difficult.

Therefore before such a major outsourcing decision can or should be considered, the current Army support processes should be thoroughly studied and understood. Can they be improved? Is it necessary to outsource this support? Are the PVS contractor's processes better than those of the Army? Can significant savings be generated? What makes a good PVS candidate? Can a generic Performance Work Statement be prepared that will ensure the PVS concept covers all important support functions? These are the questions that are important to the Army and form the motivation for this thesis.

1.3 Research Goals

This research will focus solely on a comparative evaluation of an existing sustainment system, (Weapon System A), and a new sustainment system, characterized by the Prime Vendor Support (PVS) concept, associated with Weapon System B. Specifically, the

[5] Kern, LTG Paul J., (1998) "Prime Vendor Support: Wave of the Future", *Army RD&A*

logistics and support functions, processes or operations associated with these two very similar Army weapon systems will be examined. The first, Weapon System A, is an existing weapon system managed by a project management office (PMO) that is not currently faced with the prospect of the PVS challenge. It has enjoyed a somewhat stable environment over the last few years and is projected to have an extended life until the year 2024. The Army logistics agency processes currently being used to support this system will be assessed to gain an understanding of current Army support processes.

Weapon System B, unlike Weapon system A, *is* being challenged by a potential PVS contractor. In recent years it has experienced an unacceptable level of sustainment support, accompanied by rising support costs. For these reasons, the PVS contractor submitted an unsolicited proposal to the Army, offering the PVS support concept as an alternative to the existing system which was failing to meet the Army's expected requirements.

The primary goal of this research is to assess these two support processes and determine if the PVS concept associated with Weapon System B is preferable and why this new sustainment model is preferable, if indeed it is.

A second goal is to identify criteria that may be useful in selecting PVS candidate systems in the future. Finally a third research goal is to identify critical issues that would comprise a PVS-based Performance Work Statement.

1.4 Research Approach

Research focuses on a comparative analysis of two Army weapon systems and their associated logistics and sustainment functions, and processes. In performing this research lean production principles originally developed within the context of the auto industry and which have been adopted by an increasing number of industries worldwide, including the aerospace industry, will be adopted as the basic analytical framework. The key logistics and sustainment processes used to support Weapon System A and Weapon System B will be critically evaluated to assess their performance when measured with lean business practices.

The lean production practices referred to above, used as the framework for analysis, is the Lean Enterprise Model (LEM).[6] The LEM is an evolutionary best practice framework that can find universal application in a support process analysis. The Massachusetts Institute of Technology (MIT) through the Lean Aerospace Initiative (LAI) has been developing the LEM in cooperation with the government and many defense industry partners. It is believed that the current practices contained within the LEM generally encompass all major aspects of support functions, principles and processes.

1.4.1 The Research Scoring Model

The LEM as stated above is an excellent framework with which to assess the current Army agency processes as well as the contractor's (PVS) processes. These processes however are two-dimensional. One aspect or dimension involves a measure of lean effectiveness, or how well does the studied process measure up against the stated lean principles and practices outlined in the LEM. The second dimension is a measure of magnitude of how accommodating the Army environment is in relation to the LEM's principles and practices. These two dimensions will be used to create the scoring of the Army processes. For the sake of this research and this model, the assumption is made that these two dimensions are equally important.

The question now arises; how can the principles and practices of the LEM, borne out of private commercial industry, be effectively applied to both measure and influence these Army support processes? Because the LEM has been the product of auto and aerospace research, its principles, practices, and metrics are not easily adaptive to the Army environment. It seems entirely possible that in the private commercial enterprise these principles and practices can be endlessly applied in the pursuit of continuous improvement. In the Army environment however this is not the case. Therefore to make use of the LEM and its practices, an adjustment or calibration will be imposed that will reshape the LEM so its application in the Army environment is rational. Again this is necessary due to the practices upon which the LEM principles are based. In Chapter 2 these practice adjustments or calibrations are defined and assigned.

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[6] Lean Aerospace Initiative, (1998), The Lean Enterprise Model, Massachusetts Institute of Technology

The lean effectiveness measurement requires no such calibration. It is simply a raw subjective score comparing the studied processes with the lean principles and practices commonly understood and as outlined in the LEM. Each of the support processes associated with Weapon System A and B will receive an effectiveness rating. In Chapter 4 these ratings are defined and assigned. Also in Chapter 4 a Lean Index Score is generated by multiplying the LEM practice calibration number with the process effectiveness rating. These relative scores are then used to assess the support processes. Also, for the purposes of studying the effects the Army environment may have, these calibration numbers may be adjusted or altered in a notional sense to assess optimized support environments.

As an example lets discuss for a moment the issue of Technical Data. The use of technical data in supporting weapon systems is critically important. Because lean practices can be applied to its management, one might assume the management of the technical data can be improved continuously. One then may rightfully assume that full benefit is being realized from the technical data. This however would be a mistake. One must account for the current Army's environment where the Weapon System managers are prevented from acquiring *all* the technical data. How much benefit can be achieved from the perfectly (lean) managed half set of data? In this example the technical data process would earn a high lean effectiveness rating but would be multiplied by the smaller calibration number, indicating the restrictive nature of the Army environment and its effect on the overall Lean Index Score. A pictorial view of this model is provided at Appendix.

1.5 Major Findings

The major findings of this research include the following:

- Current Army support processes are not well understood at the functional level
- There is process duplication in the current weapon system support processes.
- PVS appears to offer substantial benefit over the current Army processes through process optimization, rather than reinvention.
- A PVS candidate selection process can be identified.
- A PVS-based Performance Work Statement development process can be identified.

1.6 Outline of Chapters

Chapter 2 provides important definitions and background associated with this discussion regarding Army weapon systems management and support. Also introduced is the analytical LEM framework with calibration assignments. Data gathering methods and data qualifications are also provided.

Chapter 3 presents the processes currently in use in the Army in support of Weapon System A. In addition the PVS processes being proposed for Weapons System B are also provided. Key similarities and differences between these two sets of processes are given. Also the rationale for and the consolidation of the 36 current Army support processes into the four major PVS processes is provided in this chapter.

Chapter 4 provides a comprehensive evaluation of the sustainment systems associated with both Weapon System A and Weapon System B, by using the Lean Enterprise Model as the basic analytical framework.

Chapter 5 summarizes major conclusions derived from the earlier comparative evaluation of the two sustainment "models" for Weapons Systems A and B. Also the research goals are revisited and a concluding discussion is presented on a broader interpretation and implications of the major findings. Recommendations and additional opportunities for research in the area of PVS and current Army support processes are suggested.

2 FRAMEWORK FOR ANALYSIS

2.1 Introduction and Overview

The process of replacing the current support system for any Army weapon system is not a trivial task. However before one can address the issue of replacement and particularly partial replacement, one must fully understand the terminology and the processes associated with such a support system. This chapter will first define all pertinent terms associated with the research reported in this thesis and will further define the specific processes that are to be replaced by Prime Vendor Support. The terms that are discussed will be organized by their application. For those not closely familiar with the Army sustainment infrastructure this chapter is intended to provide the necessary conceptual and practical roadmap as well as general background information, guiding the discussion presented in the subsequent chapters.

2.2 Prime Vendor Support (PVS) Concepts

Prime Vendor Support is unfortunately an act of desperation on the part of the Army to solve its current operational support problems. The problem is weapon system life cycle support costs. These costs are sometimes abbreviated as Life Cycle Costs (LCC) or more recently Total Cost of Ownership (TCO). These are the costs associated with the activity required to keep the weapon system functional and ready for the entirety of its life after it has been handed to the soldier.

Once the need for a weapon system has been decided upon by the Department of Defense and Congress, a Project Management Office is organized to evolve the weapon system from initial requirements generation to design, development and production of the system. Based on past trends, typically this evolution will have involved perhaps 6-10 years of effort by approximately one hundred government employees working in the PMO and hundreds, perhaps thousands more in industry who would be busy detailing complete performance requirements early during the acquisition process.. All the research, development and production activity, although extremely complex, typically account for only 40% of total weapon system costs. Therefore, it is widely recognized that at least 60% of the costs associated with the typical weapon system development and use is expended in its years of use after being put into the hands of the soldier. So, for example, if a typical surface-to-air missile currently requires a total life-cycle investment of $2.5 billion, at least $1.5 billion of that investment will be needed for keeping the missile functional in the field after its design and production have been completed.

Why or how then is it possible that the cost of a complex weapon system that has been extensively live-fire-tested and produced in large numbers can be dwarfed by its cost of sustainment? This is a valid and important question that has in fact motivated this research. The role of the PMO is to design, test, produce and field the weapon. The support or sustainment function is not within the role of the PMO. At the point in time when the PMO presents the weapon to the soldier a transition of management occurs. That is to say, the PMO is no longer responsible for that weapon system. It has now become the responsibility of those military agencies, offices and directorates that must ensure that the weapon will survive through its intended useful life through continuos on-going sustainment. The Post-Production Sustainment activities are all those processes that must be accomplished to ensure weapon system support after production. These activities are implemented within the context of the Integrated Logistics Support elements (defined below). This transition and the quality of the transition can have a dramatic impact on the eventual life cycle costs of the weapon system. Of course, the transition process is not the only source of rising sustainment costs. Other factors and processes driving sustainment costs higher are also discussed below.

Sustainment of a weapon system is not much different from that of any other complex piece of equipment. The family car can be cited as an analogous case. Just as it takes accurate engineering drawings, technical publications, broad industrial production base, distribution channels, and spare parts to maintain the family car, the same is true of the weapon system. The PMO is responsible for documenting the weapon system. This documentation process, if done inaccurately or not at all, will present huge problems for the sustainment agencies. Also exotic designs from one-of-a-kind vendors used in the weapon system, if not challenged by the PMO during the design phase, might set the sustainment agencies up for huge spare part costs and potential procurement non-availability problems later on when the original equipment manufacturers may have disappeared.

One of the major factors affecting sustainment costs is the ever-present issue of component part obsolescence. Quite often, for a number of reasons, many components become obsolete even before production is completed; this adds enormously to sustainment cost and complexity. Most of the weapon systems are typically designed for a ten-year life, but are often extended to 15 and 20 years. This situation further aggravates the obsolescence problem.

In the present DOD weapon system management environment today much of the sustainment support is contracted-out or outsourced. This outsourcing is commonly called Contractor Logistics Support (CLS). Because it is outsourced, there may be very little the government can do to contain costs, which are typically seen to escalate.

Finally, there is the issue of uncertainty. The Army, along with the other Services, have had their budgets unilaterally adjusted downward making any degree of planning rather difficult. The inability to develop coherent operational plans causes a procurement process that cannot and do not take advantage of economies of scale or hinder the ability to buy parts when they are available. These impediments to planning also drive costs upward.

The budgeting uncertainty causes the support agencies to anticipate further budget reductions, as a result of which they may tend to artificially inflate their estimates. This skewed budgeting process of sustainment activity has peculiar effects. In the face of these budget reductions, it would seem highly unlikely that weapon system readiness rates will stay relatively constant at current levels. The readiness rate is a quantitative measure of the ability of a predetermined percentage of a given set of weapon systems to function at any given time. With the sustainment budgets getting reduced, one would expect readiness to suffer, similar to the use of the family car if the family budget did not allow for the replacement of a flat tire. This, however, is not the case in the Army. In the cases investigated during this research, it was found that as the sustainment budgets fell due to unilateral budget reductions, the readiness rates of the weapon system were staying at least steady and in some cases rising. This situation led the Army's sustainment leadership to lose its credibility, demonstrating a lack of understanding of its sustainment processes and costs and created the environment where a PVS concept could be considered.

The act of desperation referred to earlier is the reaction to the continued lack of any reasonable relationship between budgeting and readiness rates. The thought process is that if the Army is incapable of framing the sustainment problem in a realistic fashion then perhaps the industry might do a better and cheaper job doing so. If they cannot, at least the single point of failure will be known (i.e., the contractor). Currently the sustainment mission within applicable Army agencies is so disorganized that a single point of accountability is extremely difficult to find. The sustainment budget is a compilation of the budgets of many agencies that begin at the user level and wind their way up to the level of the Department of Army. In this state of frustration with the budgeting process, is born the PVS concept, which means the surrendering of much of the support activity to the prime contractor associated with the hardware in the hope that there will be some reasonable semblance of a correlation between the budget and the readiness rates, leading to much needed transparency in sustainment costs.

What is the difference between PVS and the CLS concept, which the Army has used for many years? The PVS concept goes significantly beyond the CLS concept. Where CLS might involve only the temporary maintenance or repair of a system or component the PVS concept is intended to include managing the entire sustainment process from spare part requisitioning and procurement to design changes, Technical Publication, Configuration Management Technical Assistance and Depot management. PVS represents the concept of contracting with an OEM or Prime contractor for long-term sustainment of a weapon system, which, according to Army leadership, must meet four criteria: The single point of accountability; ability to respond to contingency or war requirements; generate significant cost savings; and improved reliability through design innovation.[7]

[7] LTG Kern's comments in Army RD&A magazine, January-February 1998

2.3 Key Organizational Elements of the Current Sustainment System

Key elements of the current sustainment system are discussed here in some detail. These elements of the sustainment system and the relationships among them that have a direct impact on how efficiently sustainment operations can be performed.

2.3.1 Project Management Office

The Project Management Office (PMO) is the organization formed shortly after the need, concepts, and cost analysis are sufficiently firm so as to ensure extended development of the new weapon system. This office is typically staffed with DOD civilians and is headed by a military officer. The staff is comprised of three groups: PMO core staff; the contracting, budgeting and cost personnel; and the technical matrix staff. The PMO is typically organized under an acquisition executive office, either a Deputy for Systems Acquisition, as in the case examined in this thesis, or a Program Executive Officer, where both are General Officers. The PMO receives both its funding and its guidance from the Army Acquisition executive located in The Department of the Army (DA) in Washington, DC.

The PMO does not have postproduction or sustainment responsibilities. But as mentioned above, its actions during early weapon system development can have lasting impacts on sustainment costs. A recent policy change that still remains to be fully implemented gives the PMO complete responsibility for funding and managing postproduction costs. What this means is that the funding that once flowed in two streams, one to the sustainment agency for core tasks and the other to the PMO for legitimate PMO reimbursable tasks, will now all flow through the PMO organization. This will be further discussed later in this thesis.

2.3.2 Memorandum of Agreement

The Matrix Management concept was introduced in government work several years ago, brought on by the need for agreements between those offices that have both funding as well as work and those that have the personnel. Typically the PMO receives funding directly from the Army Acquisition Executive through DA in Washington, DC. This funding is in response to the PMO budget request to execute a particular weapon program. The PMO "formal" staff is limited to only those personnel termed core staff.

They include the Budgeting, Contracting and Programming personnel. Each member of the core staff works directly for and is rated by the PM. The remaining personnel within the PMO are termed Matrix personnel. While they work in the same office as the PM, they do not work directly for the PM, and the PM is not responsible for rating their performance. These matrix personnel are secured each fiscal year from the matrix homes or functional organizations. The purchase agreements for these arrangements are documented with the use of a Memorandum of Agreement (MOA). It is in the MOA that the number of personnel, cost and tasks, are detailed.

The MOA is broken down further by detailing those matrix personnel who will reside physically within the PM's office and those who will support the PM at distant locations. Those that reside in the PMO physically are termed *collocated* and those outside the PMO *non-collocated.* Both these groups work together to form a integrated group that supports the PM in terms of weapon system support.

The MOA will detail how each person, whether collocated or non-collocated, will be funded. The tasks that are to be accomplished are broken down into two groups: those that are considered to be within the purview of the PM and those that are outside the purview of the PM. The tasks that are within the purview of the PM will be funded or *reimbursed* with funds provided by the PM. These funds are a portion of those received by the PM from DA. The other tasks that are provided in support of the PM, but are of a corporate or Army infrastructure nature, are termed *non-reimbursable* by the PM and are provided by AMC to the matrix logistics organization directly.

The negotiation of these MOAs each year generates a great deal of consternation between both the PM and the matrix organization. One fault in this system is the push of support from the matrix organization to the PM for manpower, instead of the PM pulling only what is needed. This is particularly true of matrix organizations that are downsizing. The matrix organizations attempt to push excess personnel on to the PMOs, which do not need the added support.

Complicating this issue of overstaffing is the basic question about credibility. The matrix organization pushes personnel on to the PMO, stating that they are all needed to meet the readiness goals. When the final personnel count is reduced and the readiness remains high, one is forced to question the credibility of the organization to which the matrix personnel belong.

Finally, the MOA details the specific tasks to be accomplished throughout the fiscal year. The task assignments within the pertinent MOAs between the various sustainment organizations form the baseline of task descriptions analyzed in this research. These tasks or processes claim huge sums of sustainment funding each year.

2.3.3. Matrix Management

Matrix management within the Army started in the late 1980's. The PMO was an autonomous organization. Every employee working at a PMO was permanently assigned to it. Their careers, appraisals, promotions and training were all controlled by the PM. When it became obvious the Civilian Personnel Office (CPO) was no longer effective in managing the workforce, a means of accumulating and assigning surge personnel was needed. Functional organizations were established around core competencies or disciplines outside the CPO, to handle all assignments, reassignments, promotions and training for the surge employees. The employees who were in the PMOs and who met the core competency requirements were physically left in the PMO to continue to work. They were, however, reorganized on paper and they now belong to one of the functional organizations. With this reassignment came another, functional, supervisor. Logistics or sustainment was identified as a core competency and, therefore, those in the PMOs who were doing sustainment work were reassigned in-place. Those in the existing logistics agency were split between the core or corporate staff and those that had been supporting the PMOs. The split was the obvious outcome of the different funding streams. Those continuing to perform the corporate functions were to be funded from DA and those still left supporting the PMO work would be funded by the PMOs through the MOA method. These funding flows are discussed in more detail later.

2.3.4 Line and Staff Personnel

The typical government agency is comprised of Staff and Line personnel. The staff personnel generally perform those tasks associated with the infrastructure of the agency. These tasks include budgeting, contracting, hiring, task or process identification and function. While the staff personnel typically do not have a detailed understanding of the agency's functioning there is a sufficient degree of understanding at this level to perform such tasks as budgeting, cost estimation and allocating tasks.

The line personnel are those who actually execute the tasks or processes. These personnel would have a thorough, complete and detailed understanding, from the customer's perspective, of what it is the agency actually does on a day-to-day basis.

2.4 Key Sustainment Functional Elements

The following functional elements help define some of the essential characteristics that must be understood in any discussion relating to sustainment processes and costs.

2.4.1 Post Production Sustainment

Once a weapon system is produced or manufactured it is then placed in the hands of the soldier. This process is known as Fielding and is the milestone describing the end of the PM's responsibilities and the beginning of the sustainment agency's responsibilities. This transition of responsibility is a critically important point in time. However, sustainment does not simply appear on that day of transition. There is a great deal of work that must be done before that day to ensure at least some form of interim sustainment activity, so that the weapon, once fielded, can continue for several years with adequate support. Also the quality of the preparation work is very important. If the TDP is not completed or the technical manuals are incomplete or inaccurate, it would be very difficult to sustain the weapon system. The PMOs, because they are not the agencies left to shoulder the responsibility of sustainment, may be inclined to trade valuable sustainment preparations for overrun production or design costs, potentially leaving the sustainment lacking. To fill the gap at this point of transition it is quite likely the PM will contract for CLS for some amount of interim (post fielding) support. This type of support is limited because the Army is required to establish some level of organic or internal support. But once the sustainment activity has been subverted by PMO action, even with the brief CLS support, the sustainment agencies are left with a very difficult task. Putting a sustainment program together, particularly if all the pieces such as the TDP, are not available, is extremely difficult.

2.4.2 Technical Data

Every weapon system is defined to the last component by an engineering drawing. Until recently the government, and specifically the PMO, was responsible for creating, verifying and repositing the related technical data for each weapon system procured. The management discipline associated with generating, verifying and maintaining the technical data or Technical Data Package (TDP), as it is known, involves configuration management (CM). The generation of the TDP has always been a very time consuming and costly venture. For reasons that are not entirely clear, the government has put itself in a position to *purchase* the TDP at the conclusion of weapon development. The reason for this purchasing process is not clear and does not appear to make much sense, inasmuch as the government would already have paid for the development of the weapon system. These weapon systems are exclusively funded by the taxpayer and whatever technical or research data are generated should belong to the taxpayer. This, however is not the case and has presented an opportunity for the PMOs not to *purchase* the TDP in an effort to reduce development costs.

PMOs, forced into budget constraints, would typically leverage the cost of the TDP as a means of continuing to advance the program. This, of course, meant in most cases the accuracy, completeness and validity of the TDP was now in question. The TDP, of course, is an extremely important part of the sustainment function. Without it one would not know what specific spare part to buy, design or modify.

The developing contractor is, of course, aware of the value of the TDP to future business. While the government wanted the TDP to reduce sustainment costs by competing reprocurements and modifications, the contractor wanted it for exactly the opposite reason. That is, the government would not be able to compete the reprocurements or the modifications and, therefore, would be forced to return to the OEM for such work.

An issue associated with the technical data relate to the intellectual property rights. If the government purchases the technical data, along with that purchase the government also acquires the intellectual property rights. That is the free use of the data for sustainment or for any other use. For instance the PMO may wish to bring in a third party for postproduction support. These data can be freely passed to them without restriction. Most recently the policy of the DOD has been to forego the purchase of, or entitlement to, the technical data, as mentioned above. If the government, or specifically the PMO, does not take possession of the data, it cannot in later years have free use of the data.

2.4.3. Integrated Logistics Support

The concept of ILS involves the implementation of several specific logistics elements. These elements include: Maintenance Planning, Manpower and Personnel, Supply Support, Support Equipment, Training and Support, Technical Data, Computer Resources Support, Facilities, and Packaging, Handling, Storage and Transportation. These elements are all integrated within the Army infrastructure to provide postproduction sustainment. Each is a very large piece of the overall sustainment process.

While these elements comprise the structure around which each weapon system is supported or sustained, they are also to be used by the PMO as a sustainment guide as the weapon system begins to evolve from concept to production. Within each of these elements is contained the detailed process loops that, when exercised, accomplish some element of support for the weapon system. An understanding of these process loops is of great importance to the PMO. If these loops are fully acknowledged and their complexities and nuances understood, the design of the weapon system can be optimized around these support requirements. If, for example, the functioning of the spare part procurement loop, within the Supply Support element, is heavily dependent on engineering data, and the PMO neglects the importance of the engineering data, support of the weapon system in this element will be impaired.

2.4.4. Life Cycle Cost

Life Cycle Cost is the totaling of all costs associated with the weapon system life time costs, from cradle to grave. These costs would include, but are not limited to, the designing and developing, testing, documenting, producing, fielding, sustaining, modifying and, finally, disposing of the weapon system. The main focus of the new initiatives within the DOD is to reduce LCC through a number of acquisition reform initiatives.

2.5 Key Sustainment Interface Elements

Within the sustainment arena there are generally two types of interfaces to be considered, those that must be addressed from within the PMO context and those that must be addressed from the Army or global perspective. The first set of interfaces presented below are the Army or global interfaces being imposed on both Weapon System A and B sustainment processes. The second set are those interfaces that must be dealt with from within the Weapon System B PMO.

These interfaces are being discussed here in order to describe how the organizational and institutional environment can restrict the actions of any agency performing sustainment activities for Army weapon systems.

2.5.1 Army or Global Interfacing Procedures, Databases and Agencies

2.5.1.1 MILSTRIP (Military Standard Requisitioning and Issue Procedure)

This is the standard method of submitting requisitions or needs to the Inventory Control Point where the spare parts are managed.

2.5.1.2 MILSTRAP (Military Standard Transaction Reporting and Accounting Procedures)

These are the procedures used to monitor and track all logistics functions.

2.5.1.3 MILSTAMP (Military Standard Transportation and Movements Procedures)

This is the system of procedures used to order, move and track all Army hardware worldwide.

2.5.1.4 CCSS (Commodity Command Standard System)

The CCSS is the main computer database used at most major commodity commands to track the movement of all requisitions and the release of hardware from the depots where the spare parts are warehoused.

2.5.1.5 USASAC (U.S. Army Security Assistance Command)

This is the major Army command that processes all foreign military sales to agencies other than the U.S. government. Its role here is that of a necessary interface when the Army orders spare parts for weapon systems in the foreign military sales inventory.

2.5.1.6 NSNMDR (National Stock Number Master Data Record)

This record forms the master record of all part numbers used by the Army logistics agency.

2.5.1.7 DLA (Defense Logistics Agency)

This agency is responsible for the centralized procurement, storage and support of all standardized parts used in the Army and in the other services. If, for example, several weapon systems require the use of a particular switch, the switch would not be procured separately by each of those weapon system commodity commands but rather would be assigned to the DLA for procurement and distribution to points of need to gain the benefits of economies of scale.

2.5.1.8 ULLS-A (Unit Level Logistics Support-Aviation)

This element describes those activities performed at the unit level related to logistics support. To differentiate this from other levels, it should be noted that at the level of a given unit the personnel engaged in support activities may be authorized only to remove and replace a particular component, where as at other levels (e.g. wholesale support) the personnel would be authorized to disassemble and repair the item.

2.5.1.9 SARSS (Standard Army Retail Supply System)

This is the element of the supply or logistics system that interfaces directly with the soldier in the unit as maintenance is performed.

2.5.1.10 SAMS (Standard Army Maintenance System)

The standard maintenance system is the three-tiered system used to maintain complex weapon systems: unit level maintenance, intermediate repair, or and depot repair.

2.5.1.11 TAV (Total Asset Visibility)

This capability is the ability to see or locate any asset at any time. This is of great value if the need arose for the Army to redistribute or relocate assets based on changing national defense conditions.

2.5.1.12 ITV (In-Transit Visibility)

This capability is the ability to see or locate a particular spare part or component within the logistics distribution system. This capability is of great value if the shipment of a part would need to be redirected to another destination, for whatever reason.

2.5.2 Weapon-System Unique Interfaces

The following interfaces are uniquely associated with Weapon System B support. They are also being imposed on the PVS contractor.

2.5.2.1 Weapon System B Readiness Improvement Program

This program was designed to provide a means of communicating to the field operator and maintainer, as well as other agencies, actions that are being taken to resolve specific readiness issues. This entire readiness improvement program should be discontinued with the introduction of PVS. But for reasons that are unknown it is being imposed on the PVS contractor. The PVS contractor is now responsible for the system's readiness, by contract. If there are to be readiness issues, and there will certainly always be readiness issues, it will be the contractor's responsibility to identify and correct them. Another program in addition to the one in the PVS contract, which already addresses readiness, does not need to be continued

2.5.2.2 Operating & Support Cost Reduction Process Action Team

This team provides no benefit after the award of the PVS contract. The contractor is now responsible for cost reductions in the support and operating areas and is properly motivated to that end. Continuing another team for the same function is wasteful and unnecessary. The contractor should be permitted to perform, without the burden of responding to the redundancy of this team.

2.5.2.3 Integrated Logistics Support Integrated Product Team

The PVS contractor is to be responsible for the ILS function of the support system. It is stated in the transition plan, that the contractor will be given responsibilities by this team. This tasking is both wasteful and redundant. The PVS contract clearly states that the contractor is to be the ILS manager. In that role, the ILS manager assigned within the PVS contract, should be conducting the Integrated Product Team in this regard. The government has clearly given up the ILS responsibility with the awarding of the PVS contract.

2.5.2.4 Provisioning and Logistics Support Analysis and Record (LSA/R)

The provisioning and the logistics support analysis processes are reflective of the current support system, and both are acknowledged to be unaffordable and inefficient. There is no reason to force the PVS contractor into using these outdated interface processes. The PVS contractor should not be required to use these interfaces if they are not compatible with the intended PVS system of support. By mandating this interface requirement it will certainly limit the amount of savings generated from the PVS initiative.

2.5.2.5 Airframe Condition Evaluation/Airframe Analytical Corrosion Evaluation (ACE/AACE)

The airframe condition and evaluations being required are both redundant and unnecessary analyses under the PVS concept. These evaluations were recorded in a reliability database that, in the past, was being maintained by the government. The reason they are now unnecessary is that reliability will not be a performance metric in this contract. Both the PMO and the PVS contractor have agreed that reliability will equate with reduced cost per flight hour and continued readiness. If readiness continues to remain high and the cost of flying is reduced, by definition reliability improves. These evaluations are added work, the contractor need not be specifically responsible for, provided readiness continues at current acceptable levels and operating costs decrease.

2.5.2.6 Reports of Deficiency (ROD) Automated RODs Tracking System (ARTS) and Army ROD Mgt. System (ARMS)

The ROD, ARTS or ARMSs are more examples of government bureaucracy. These interface systems focus on repair parts or components that were received by the user and that were either the wrong part or had some other defect that rendered them useless. Instead of solving these deficiency issues at the root cause, the government created an entire database and tracking system simply to track these mistakes. There is more time being spent on updating these databases, than would be needed to fix the source defect. If the PVS contractor's efforts generate similar deficiencies, their ability to create profit will be diminished. It is the intent of the PVS contractor to first identify these type of deficiencies, determine their origin and correct the deficiency at the source. Burdening the PVS contractor with a defect tracking system appears wasteful.

2.6 Framework for Analysis

The Lean Enterprise Model (LEM) is the framework that will be used for the basic analysis in this thesis. Its practices, while adapted from a high volume production environment, can find general use in the analysis of any process-related activity. There is, however, no such framework developed for the aerospace industry at this time. It is the goal of this thesis to compare the effectiveness of the support processes being studied, with those principles and practices outlined in the LEM.

2.6.1 Summary of the Lean Enterprise Model (LEM)

The LEM is comprised of twelve overarching practices. They encompass: Identify and Optimize Enterprise Flow, Assure Seamless Information Flow, Optimize Capability and Utilization of People, Make Decisions at the Lowest Possible Level, Implement Integrated Product and Process Development, Develop Relationships based on Mutual Trust and Commitment, Continuously Focus on the Customer, Promote Lean Leadership at all Levels, Maintain Challenge of Existing Processes, Nurture a Leaning Environment, Ensure Process Capability and Maturation and finally Maximize Stability in a Changing Environment.

2.6.2 Analytical Framework

The LEM practices are generally suited to the stable repetitive environment of the automobile industry, and therefore cannot be applied directly in the Army aerospace environment, within which the two weapon systems being assessed exist. It is of little value to discuss the full range of advantages offered by any given lean practice, if the likelihood of its full application is restricted by the Army environment. The question then arises, how can the LEM, with its grounding in private industry, within which improvements may be continuous and boundless; find utility in assessing inherently bureaucratic governmental processes, such as those found in the Army? To utilize the LEM, which contains both metrics and enabling practices almost exclusively fashioned after the high volume stable auto industry, for assessing the two weapon support systems, in a quantitative fashion, it must be adjusted for the environment within which these two support systems exist.

For the purpose of adapting the LEM to this unique analysis required by this thesis, each overarching practice is considered to be an independent entity. Each will be adjusted or calibrated based on a subjective assessment of the existing Army environment. These calibrations will be represented by number assignments ranging from one to five. Table 2-1 describes the calibration numbers and associated characteristics.

Later in Chapter 4 these calibrating numbers will be multiplied by lean effectiveness ratings assigned to the objective support processes being assessed. The multiplication function is used to generate relative number scores that then reflect the two-dimensional aspect of the studied processes, as described in Chapter 1. It is then the resulting and measurable area, that represents the overall process' scoring. This two dimensional scoring considers both the surrounding environment as well as the process' effectiveness A pictorial representation of this model is shown at Appendix.

CAL	ENVIRONMENTAL CHARACTERISTICS
1	Information flow restricted, unstable work flow, heavily bureaucratic, decisions at the highest levels, little concern for improvement by the leadership, training restricted
2	Embraces some lean principles, still bureaucratic, some teaming supported, some info flow encouraged, some training possible, relatively unstable work flow
3	Moderately lean environment, more teams required, still bureaucratic but decisions are at lower levels, managing the stability of workflow, improvement is possible, training required
4	Lean is a topic of discussion at higher management, job training and qualification required, takes positive action to stabilize workflow, flex. job descriptions, encourages the formation of relationships
5	Represents the potential of the auto (Toyota) model

Table 2-1 LEM Practice Calibration Factors and Their Characteristics

It is also important to note here that these adjustments or calibrations are applicable to PVS processes as well, because these processes must also exist in the same Army environment. So the calibrations applied here, are applicable to both the current Army support processes as well as those being proposed by the PVS contractor.

Each Lean practice will be briefly discussed in the following paragraphs. Their specific application is described within the Army support process context. The assignment of the calibration is the result of conversations with those involved in the Army logistics agency, those working in the PMOs, and the author's experience.

2.6.2.1 Identification and Optimization of Enterprise Flow

Enterprise flow throughout the value stream is an important characteristic of the Lean enterprise. It is extremely important that the value stream be fully understood for both the agency and the contractor's PVS process. This can be accomplished by following each process from the point of beginning to the point of delivery or completion. In this value stream analysis, the length of time it takes for each step should be recorded for both the valued-added tasks as well as the non-value-added tasks. Those tasks or processes that do not add value for the customer should be candidates for elimination. Also within this practice is elimination of inventories, reduced flow paths, process-owner-inspection and synchronized production and delivery.

- **Adjustment:** The calibration number of Five (5) is assigned to this practice. The flow of both data and materiel in this logistics process is extremely important to the readiness of the weapon system and even in the Army environment can be achieved.

2.6.2.2 Assurance of Seamless Information Flow

Key characteristics of this practice include making the process visible to all stakeholders, establishing open communications, linking databases and minimizing documentation while insuring traceability and availability of needed data. PVS in some sense is more information flow than any other activity. The flow and sharing of technical data among all support personnel is crucial.

- **Adjustment:** The calibration number of Four (4) is assigned to this practice. The flow of information is very important to the proper functioning of the logistics system however in the bureaucracy of the Army structure and the varied agencies involved in the sustainment process, seamless flow is restricted but possible to some degree. The Army environment surrounding the two weapon systems being studied have been the beneficiaries of a substantial amount of communication equipment, email, networks, etc.

2.6.2.3 Optimization of the Capability and Utilization of People

A key characteristic of this practice is developing the full use and capability of the involved employees. Certification and continued education coupled with flexible job descriptions are all highlights of this characteristic. The current PVS process involves the use of expeditors at weapon system (field) locations. It is important that these personnel are not restricted in the scope of their duties and are utilized to the maximum extent by assisting the user in troubleshooting and turn in of defective parts, etc. Within the government environment however civil service rules still impeded management's' ability to fully utilize personnel capabilities. Promotions and pay increases have been nonexistent for several years. Training has been curtailed due to budget reductions. Reorganizations continue at a very high rates causing disruptive impacts. Unrestricted retirements and resignations also continue unabated, creating a lopsided workforce. Arguments still rage over what is a governmental core competency.

- **Adjustment:** The calibration number of Two (2) is assigned to this practice. While this is an important practice it is not always possible to train everyone at all times. In addition due to civil service rules and restrictions it is very unlikely that the use of people can be either optimized in either capability or utility.

2.6.2.4 Making decisions at the Lowest Possible Levels

This practice optimized exhibits few approvals or handoffs, increased delegation and the creation of decision-making, multiple discipline teams. Currently in the Army's environment, decision levels are moving upward instead of downward. More directions originate from the bureaucratic center. Managers are not clear on the specifics of acquisition reform and other initiatives and therefore are reluctant to make the decisions themselves, electing instead to raise the level of the decision. Some support processes are being reinvented, but by the higher levels within the bureaucracy instead of at the customer's or working level where the requirement exists. Manpower levels are being dictated from the bureaucratic center, forcing all personnel decisions to higher than necessary decision levels.

Adjustment: The calibration number of One (1) is assigned to this practice. While it is always best to force the decisions to the lowest level, it is not possible in the bureaucratic Army organization within which these employees must work. In fact even under the empowerment reforms of acquisition reform the decision levels are actually increasing.

2.6.2.5 Implement Integrated Product and Process Development

The practice of integrated product and process development s essential to success of PVS. A systems engineering process, platform reuse approaches, risk management, and designed-in producability are all traits of this practice. A platform reuse strategy similar to that used at Black and Decker and detailed by Lehnerd[8] is to be used by the PVS contractor to lower spare part costs. They intend to the maximum extent possible redesign major components using the modularity or platform approach. Both the process innovation like that of design innovation must move both the processes and designs forward while not rendering existing processes or designs obsolete.

The environmental issue within the Army limiting this type of development is cost. The redesigns suggested by the PVS technical manager are both innovative and exciting, but will require up-front funding. This type of investment in future designs, is simply not

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[8] Lehnerd, Alvin, (1987), Revitalizing the Manufacture and Design of Mature Products", Technology and Global Industry: Companies and Nations in the World Economy, 49-64, National Academy Press

possible in the Army. Typically the motivating force in the Army that forces such investment, is weapon system obsolescence. In other words, unless the weapon's usefulness is in the balance there is very little thought put into product or process development methodologies.

Adjustment: The calibration number of Four (4) is assigned to the practice. Teams do, when formed to develop new products operate relatively autonomously in the Army environment. However the Army teams are still very dependent on decisions made outside the team. Army team decisions rarely are the last word in product development.

2.6.2.6 Development of Relationships Based on Mutual Trust and Commitment

Again this practice of developing both relationships and trust with the customer and suppliers is essential. The cost-effective approach to PVS will be parts on demand or pulled from the suppliers. Inventories will need to be at or near zero. This can only work with continued trust to insure a long healthy relationship.

These relationships are recently being supported by the Army leadership. Many offices however are still reluctant to form these type of relationships fearing conflicts of interest problems, should a difficult decision regarding the contract be needed. However the Army environment is fostering such relationships.

Adjustment: The calibration number of Five (5) is assigned to this practice. The issue of trust and commitment in the logistics relationship is of great importance. There is a high degree of relationship building in the Army environment.

2.6.2.7 Continuous Focus on the Customer

Obviously a critical practice, but one that is typically overlooked when non-value added tasks are found in the flow. If the task is non-value added, by definition it is not focused on the customer and must be considered for elimination. PVS must focus on the DOD customer and understand that reduced costs are a must for acceptance.

The Army leadership and environment encourage a focus on the customer. Several personnel interviewed during this research complained that the Army ahs embraced this concept so dramatically that its effectiveness is being reduced. It seems that if this practice is not implemented in an orderly fashion, everyone becomes a customer and therefore no one considers themselves suppliers.

- **Adjustment:** The calibration number of Five (5) is assigned to this practice. Arguably this is the most important practice that one encounters in the logistics process. It is entirely possible to have this focus in the Army environment.

2.6.2.8 Promote Lean Leadership at all Levels

Throughout the aerospace industry teams are meeting and lean principles appear at work, but yet on closer inspection the organization is not yet lean. As Womack has stated "Everyone Loves 'Lean' Hardly Anyone Can Do It." He continues: "The general direction is right, but there's vastly more to do than we've done and the rate of improvement is barely detectable."[9] This is attributable to the lack of leadership. This is particularly true in the Army environment. The Army is a military hierarchical organization and the leadership occurs at the highest levels. This is a major problem in the Army.

- **Adjustment:** The calibration number of Two (2) is assigned to this practice. Leadership is simply not permitted at all levels. The conception of the current Army support processes is created at such high levels that the functionals doing the work are powerless to effect any change in the processes.

2.6.2.9 Maintaining Challenges to Existing Processes

Establishing activity-based cost accounting, structured methods for dealing with process innovation, and fixing problems when they first surface are all key characteristics of this practice and of PVS as well. Conversely, these traits do not seem to be part of the current Army logistics structure. Continuous Improvement must be distinguished specifically from other improvements or Lean activities, pretty much along the line that Liker explains in his book *Becoming Lean* "...Continuous Improvement activities should entail a concerted and systematic approach."[10] The defense industry for years had many ample opportunities to submit Value Engineering (VE) Proposals, but did not do so. The Army environment does not foster the necessary attitudes where legacy processes can be challenged.

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[9] Womack James, (1998), Lecture given at MIT (15.353- Management of Technological Innovation, Professor Utterback)

[10] Liker, Jeffrey, (1998), Becoming Lean, P. 450, Productivity Press

Adjustment: The calibration number of Three (3) is assigned to this practice. This practice is the essence of why PVS is being considered. The inability to challenge existing, unaffordable, inflexible processes is the reason why the PMO's are considering PVS. The LEM indicates enabling practices such as cost accounting changes and root cause analysis, which would be very difficult to do within the context of the Army environment.

2.6.2.10 Nurturing a Learning Environment

The practice of learning must occur if continuous improvement is to be expected. Employees must be free to learn and apply that learning in the Lean enterprise. It is in this environment where innovations occur and processes/products are optimized that PVS success can be realized. Much like that found by Von Hippel "...micro-level understanding of learning by doing...can contribute to a better understanding of learning curves for the entire production processes..."[11] However the Army environment is simply not a learning environment. Job descriptions are inflexible as are civil service regulations.

- **Adjustment:** The calibration number of Three (3) is assigned to this practice. This is an important and essential practice. Within the Army environment the training is a difficult issue to address. Training is costly and takes the employee away from the work place, two conditions that are difficult to mitigate with office budgets on the decline and fewer employees in the office.

2.6.2.11 Ensuring Process Capability and Maturation

The practice of ensuring process capability and maturation is again difficult but not impossible in the Army environment. Many of the support processes studied during this research are quite mature but yet incapable of providing the service intended. It appears that the defining issue is process ownership. With the weapon system support processes being dictated from the bureaucratic center and at great distances from the customer, they are difficult to change. Maturation for years in the Army meant adding process steps not streamlining them. Recently though under acquisition reform, the Army environment is

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[11] Von Hippel, and Tyre, (1995), "How Learning by Design Is Done: Problem Identification", Research Policy, 24 (Ed. 1), 1-12, Elsevier Science Publishers

changing. The change is introducing performance standards and other outcome-based testing to ensure the processes are capable of meeting the customer's performance needs.

- **Adjustment:** The calibration number of Four (4) has been assigned to this practice. Within the recent Army environment there is the ability to ensure process capability and maturation using new techniques like performance-based contracting. This contracting method is similar to that employed in the PVS contract.

2.6.2.12 Maximizing Stability in a Changing Environment

There is little question that the Army environment will induce many destabilizing demands on the contractor's PVS process, much as it does in the current support systems. War contingencies and tactical exercises are just examples of destabilizing factors that can adversely affect either the PVS support system or the current system. Lean practices do build margin into the system by keeping inventories level. Wasteful large inventories of dated practices' cause the destabilizing business cycles of the past, according to economists as well as the Lean thinkers alike.[12] The Army environment simply cannot accommodate such leveling. The military generate widely varying needs and there is very little that can be done to stabilize, although the Weapon System B managers have leveled the hours of weapon system operation in the PVS contract. If the Army operates the weapon system either below or above the established thresholds a penalty must be paid. This approach is helpful but the support processes remain very unstable.

- **Adjustment:** The calibration number of One (1) has been assigned to the practice. The reason for such a low numerical assignment is that the issue of instability or variability in demand is at the very heart of supporting a military weapon system. The sustainment system, must be designed to cope with it. While in general the concept of leveling the flow is of great value and could improve the performance of the sustainment system, it simply is not possible or even realistic given the varying demands placed on the typical weapon system support processes.

2.7 Data Collection

The data collected during this research involved phone interviews, personal interviews, group meetings, and email exchanges. All the processes described in this thesis were

[12] Womack, and Jones, Lean Thinking, P. 88, Simon & Schuster

extracted from live documents currently in use by the respective weapon system PMOs. Copies of the related Contracts, Performance Work Statements, Contractor Data Requirements Lists, Transition Plans, Memoranda of Agreement, and several volumes of Process Information from the functional offices were all reviewed during the preparation of this thesis.

2.8 Data Qualification

The data collected during this research is thought to be relatively reliable. Many of the processes however were dated on or near the date of the request. The impression is that many of the Army organizations spoken to do not have a record or formal recording of their processes. This research may have been the first time a request was made for such data. To some personnel it appeared difficult to verbalize what it is they do in terms of a support process.

When requesting this information the respondents were asked not to spend more than 15-30 minutes preparing their data submissions. Coincidentally those responses that were too short or incomplete were the same processes most complained about.

2.9 Chapter Summary

In this chapter the following information has been provided:

- Brief overview and background of PVS
- Definitions of key elements related to sustainment support. Also included were organizational, functional, and interfaces associations.
- The LEM was introduced and defined. The Army environmental adjustments or calibration numbers were both defined and assigned
- Data collection methods and data collected were identified
- Qualifications of the data were also identified.

3 DESCRIPTION AND RATING OF MAJOR SUSTAINMENT PROCESSES

3.1 Introduction and Overview

In this chapter the support processes of both Weapon System A and B will be presented. First to be presented are processes used by Weapon System A, which are in use today. Next, the PVS processes used by Weapon System B will be presented.

Weapon System A processes number 36. Weapon System B or PVS processes number only 4. The reason for this is simply the construct of the PVS contract. When preparing the contract, instead of listing each and every process to be accomplished, the contract authors grouped the processes under major topics. During an interview with the PVS contract and technical managers, they stated that they intended to use essentially the same processes currently in use. Therefore it is both possible and rational to map the 36 Weapon System A processes, into the 4 major process topics describing Weapon System B support.

The 36 processes of Weapon System A are detailed here first to give the reader a sense of what type of processes are required to support these similar weapon systems. Later in the chapter they are collapsed or consolidated under the same 4 major topics listed as the Weapon System B (PVS) processes. This consolidation is done simply to facilitate assessment and analysis.

Also included in this chapter are key similarities and differences associated with each of the support approaches discussed.

Finally, PVS candidate selection and Performance Work Statement criteria are presented.

3.1.1 Process Ownership

Today in the current Army support structure there are many tasks that are performed each day in both the support agency and the PMO that are not related to PVS. In performing the research here however, a single source had to be agreed upon which would identify only those processes that would be considered for replacement by PVS. After extensive interviews with those involved it was decided to use the MOA as the source document. The MOA, as described earlier, outlines each process that is accomplished by the support agency.

But the processes in the MOA do not represent the "sustainment process" in its entirety. Most PMOs maintain matrix support personnel collocated with the PMO. These personnel in the PMO typically have a role within the sustainment process. In some cases a process in the MOA may not begin unless a request is received from the PMO. In others, the support agency initiates the process unilaterally, without the PMO involvement. This collaborative integrated process though, form the "entire" infrastructure of support for postproduction sustainment which is to be replaced by PVS. It is this infrastructure-type support that will be assessed and compared with those processes of PVS. The following Weapon System A data then, represent those processes that make up this integrated infrastructure of support. First the MOA processes are presented followed by the PMO processes.

The reason for going through such an elaborate explanation of the process ownership is because this current fractured Army support structure, is eliminated in PVS. While the same processes are to be performed in the PVS approach, the typical MOA and Army PMO arrangement no longer exist with the introduction of PVS. Therefore the presentation of Weapon System B (PVS) processes are not identified separately by MOA or PMO. Perhaps the best method to describe Weapon System A process ownership is to detail the process funding flow. A representation of the funding flow and therefore process ownership, is shown below in Figure 3-1. Note those blocks identified by MOA or PMO

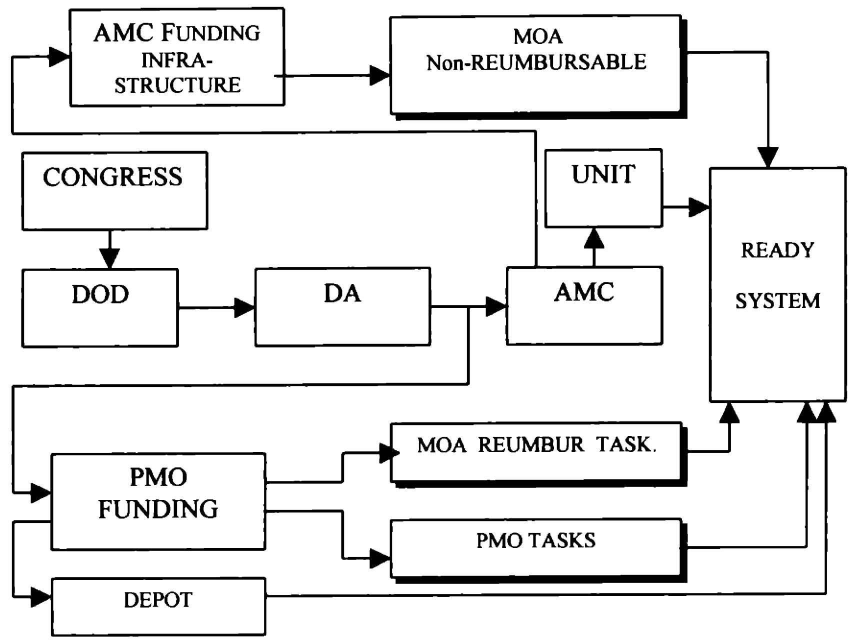

FIGURE 3-1 Funding Flow (Weapon System A) MOA and PMO

3.2 Weapon System A Processes (MOA)

The following are those processes identified by the Army personnel, as those being performed in support of Weapon System A. Also included are research comments and interfaces identified that impact the particular process. The information provided by the comments and interfaces will be used in Chapter 4 to assign lean effectiveness ratings.

3.2.1 Automatic Test Equipment/Test Program Sets

The tasks associated with this process involve both the design and management of automatic test sets used to maintain the weapon's systems. Typically these can be suitcase size test boxes that run on a microprocessor to quickly test, troubleshoot and identify defects in weapon's systems or Line replaceable units or boxes. This equipment is normally employed either at the users site or intermediate repair shops.

Test program sets are the hardware that interface much larger (typically commercial) mainframe computers with a particular weapon's Line Replaceable Unit or black box. These sets normally are employed in the Depot. The process provided by the Army agency for this task was very brief. Essentially this process is invoked when a modification or engineering change is proposed for the existing hardware. The change process encompasses a series of steps, which include assessing the hardware change, drafting the change to the Automatic Test Equipment, testing the change in the test equipment, circulating the final change to the community, gathering all comments, adjusting the change if necessary, formalizing the change package, approving the change package, distributing the approved change package, making numerous copies of the code change, and distributing the code change to all automatic test equipment users.

Comments: This process was condemned by many interviewed. One of the most obvious problems with the current system is the failure of the test equipment to adequately identify defective components. Either the test equipment presents an ambiguous response or it incorrectly identifies good components for defective ones. Once this occurs the defective component taxes the logistics supply system unnecessarily as it returns to the intermediate repair shop or the depot, incurring costs along the way. Reasons given were again limited funding to update and improve the test equipment.

Interfaces: RODS, OSCAR, ULLS-A

3.2.2 Configuration Management

Configuration Management is the discipline of managing the design of an item. In the case of the weapon systems under investigation in this thesis this discipline is responsible for documenting and monitoring all design changes that are implemented in the design. Because these modern weapon systems utilize so many different technologies many different agencies must be involved in the CM function. Typically an Engineering Change Proposal can be submitted by any organization or person. But before the ECP can be approved (or disapproved) everyone of these agencies must review it for impact to their particular piece of the overall system. This process outlines the distribution of those engineering changes. This process involves 33 steps of documenting an official modification to the hardware and 18 steps if only doing a routine hardware change. The modification process involves a very long verification that brings in several different agencies and requires many reviews.

Comments: The CM process was heavily condemned by the PMO as being too convoluted and in some cases non-responsive. The PVS contractor stated they had submitted engineering changes and waited for months for resolution. The current CM process is simply too convoluted and decentralized and therefore out of control. Also complained about was the fact that the originator would submit engineering changes without coordinating their preparation with the reviewing agencies. This uncoordinated effort resulted in proposed changes that appeared desirable on the surface but in the end would have adverse impacts to existing logistics programs either by obsoleting existing inventories, maintenance procedures, manuals, repair part listings, etc.

Interfaces: NSNMDR, DLA, APD, Depots

3.2.3 Develop/Maintain Technical Manuals

The technical manual process involves both the creation of new and the revision of old technical manuals used in the operation and repair of the weapon system. Preparations of new manuals typically occur when there are a large number of outstanding, but small changes to the manual's pages, or when there is a major change to the weapon system in some way. Once these manuals are changed they must be both verified and validated by technical personnel to insure the intent of the change was accomplished. Almost always these changes come about as a result of an engineering change to the weapon system. This process involves 33 steps and is tracked by a Publication Tracking System. The development of the change involves 14 steps and the verification process involves another 19 steps.

Comments: This process is perhaps the most deficient process of all. The technical manuals was one of those topics brought up during the interviews with Weapon System B managers. During their visits to the depots one could find technicians using stacks of pencil edited manuals while overhauling major components. When asked why they were using such outdated manuals, the response centered on the lack of funding to update the manual. Much of the blame related to pooling the logistics agency money. When pooled, it might fix one's more immediate problems but others are left with deficient manuals.

It appears there are far too many steps involved in the correction and verification of these manuals. There are 33 steps required. For example if manual changes were coordinated in parallel throughout the community, there would be no reason to repeatedly verify and validate the changes.

Interfaces: NSNMDR, DLA, APD, Depots, LSAR, OSCAR

3.2.4 Field Data Collection and Analysis

This process begins in the field where the aircraft are being operated. Failures that occur to weapon system components that do not appear to be a typical failure are reviewed for possible premature failure. If the cause of the failure is not able to be determined in the field, it is sent back to the PMO for analysis by the applicable research agency. The research agency determines the root cause of the failure and initiates further design action if deemed necessary. Depending on the nature of the data this process can occur with relative ease or can extend into the engineering change process.

Comments: No complaints were reported about this process. It seemed to work well with the exception of adequate responses from the PMO. Typically in the DOD when problems flow rearward, bureaucratic systems are established to manage the defect "report" but not the defect or its source. The Logistics Assistance Representatives do an adequate job of getting the field data reported. Technical experts placed in the field, serve this function. During discussions with the Weapon System B managers and the PVS contractor, both agreed these field positions hold the most promise to turn around the logistics problems with the system. Having these experts in the field improve problem diagnosis, repair procedures, etc.

Interfaces: MILSTRIP, ITV, TAV, RODS, ULLS-A

3.2.5 Integrated Material Support Management

This process are the activities associated with the overall management of the logistics infrastructure as described in Chapter 2 and involve all logistics elements.

Comments: There is general dissatisfaction with the ILS management. Inventories are being turned at inefficient rates. Stock availability generally is below those dictated from the Army leadership. The NMCS stock availability is especially below the Army leadership's requirements as well. Support cost requests continue to escalate each year without improvement in readiness. Technical manuals are not being updated. Desirable engineering changes cannot be implemented because of ILS concerns. Obsolescence is a constant problem that is not being properly addressed by the current logistics agency. Finally the fact that Weapon System B is willing to convert to PVS without wanting to review the contractor's processes speaks for itself, the current system is not desirable.

Interfaces: All

3.2.6 Life Cycle Provisioning

The Provisioning process tends to be a very complex process because it determines what the needs of the system will be in terms of spare parts. The reason, for its complexity, however is not necessarily the simple act of determining spare parts needs but doing so in light of perhaps a 24 month lead time between identifying the need for a spare part and the arrival of the part in the depot. Also complicating the provisioning formulations are the costs associated with holding inventory which may be unnecessary or too large. This situation would drive up the operational costs of the system through both unneeded procurement costs and warehousing costs. This process includes 126 steps. The reimbursable elements of this process include 24 steps, with the remaining 102 steps being on the infrastructure or non-reimbursable side.

Comments: The provisioning process is a very complicated process at least from the Army's perspective. It involves many steps. The supply support alone requires 24 steps and involves other agencies as well just to identify a need for stockage. And in the end, stock supply availability does not meet the requirements, which is the specific purpose of this process. The 126 steps are excessive. If one were to incorporate a "manual" item or an item which is not loaded in the system there are 63 steps involved. Processes of these types must be brought back to reality and streamlined for speed and necessity.

Interfaces: CCSS, NSNMDR, DLA, SARASS, APD, LSAR,

3.2.7 Logistics Support Analysis and Logistics Support Analysis Record

The LSA process is the recording of all the pertinent logistics data that drive the many functions of the logistics system. Each failure and failure effect is played out in great detail so as to determine the correct repair part at the correct indenture level. Also each technical manual is conceived in this record in great detail, so that each repair scenario is planned step by step. Changes to this record are typically driven by engineering changes after production. This process includes completing of what is called Sheets or Records that are labeled B through H1. That specific process involves 13 steps to generate a repair parts list, with two major reviews. Other review processes within the 13 includes a 35 step review of the technical data, 13 steps for substitutability review and finally 27 steps to assign a part number. This process in total includes over 75 steps.

Comments: This process is very expensive. It reflects the records of all logistics data that forms the infrastructure that will eventually support the weapon system. This system is so expensive that many PMOs either shorten, delay or cancel this process. Once delayed the opportunity for increased support costs are created. It is important that this record accrue as the weapon is developed so all the related logistics decisions can be made as the design is coming together. If there is an issue that does not fit the ILSP, and it is missed because of a delayed LSAR, the impacts can multiply dramatically. But here again the huge amount of preparation and the number of steps involved are daunting.

Interfaces: CCSS, NSNMDR, DLA, SARSS, LSAR

3.2.8 Maintenance Engineering

The maintenance engineering process involves many facets of the logistics function. It involves the review of ECPs for maintenance impact as a result of the engineering change. It may include the installation of a modification. Or it may include the preparation of the modification process. Typically it involves a 10 step process beginning with the identification of an issue and as stated above ends with an engineering change.

Comments: Maintenance engineering generally gets high marks. These personnel are closely associated with the soldier in the field. They spend many days with the hardware modifying, troubleshooting and repairing the fielded systems. They also have relatively short processes to accomplish what it is they do. If however they encounter a design problem, once again the steps associated with getting the design corrected are excessive. First however they must get the attention of the PMO. It is the PMO who is the design agency and it is the PMO who must begin the process of getting the design corrected. Unless the issue identified is critical it may be given a low priority.

Interfaces: NSNMDR, ALOG, ULLS-A, OSCAR, RODS

3.2.9 Material Acquisition Decision Process Review

This process involves the review of every spare part procurement. When the government procures a spare part it does so with the applicable technical data package. But before the technical data package can be used for procurement it must be reviewed for accuracy and obsolescence. If mistakes are found it is then turned over to the systems engineering group to correct whatever mistakes that may have been found. This process is simply a single review step process, to make sure the acquisition decision was completed.

Comments: The material acquisition process was found to be deficient. Even after Acquisition Reform this process is still being slowed with the use of impeding military specifications. On several occasions it was mentioned that this deficient process was a major reason for looking at PVS. Of course this is just the review of that decision process. But the process is so encumbered with bureaucracy, reviews and justifications that it appears as a task in the MOA. If the acquisition process was optimized this review process should be eliminated.

Interfaces: MILSTAMP, CCSS, USASAC, DLA, Depots

3.2.10 Material Release Review

Before any piece of Army hardware can be released to the soldier it must be in such condition that if something were to fail or if an operation was unclear the material review process would have caught it. This is the review of the review which is intended to find all the defects in the system so the soldier does not have to find it once in the field. This is a one step review process, to make sure the review was completed.

Comments: Here again the materiel release depends on the completeness and accuracy of the logistics support structure before moving ahead to fielding. If the logistics process has been delayed due to budget cuts or the like, those cuts will come back in the form of fielding delays. If there are insufficient spare parts available materiel release will not be possible. But repeating what has already been stated, because the acquisition or procurement process is so encumbered with convoluted processes the "review" of the process is deemed to be a legitimate process.

Interfaces: CCSS, SARSS, ITV, TAV

3.2.11 New Equipment Training Development

The new equipment training and development is the training that must be done before any piece of Army hardware is put in the hands of the soldier. In the case of new equipment it might involve training the trainers. In the case of a major modification it might involving forming a small team and going to each outfit and train all the soldiers who will be involved in the modification. The steps involved can vary but at the least the need for training must be identified, a review of the hardware change creating the need must be reviewed, a Program of Instruction (POI) must be created for each job specialty, the POI is circulated for review, the POI must be approved, the POI must be printed formally. Once the POI is completed the locations and numbers of students must be derived and the training commences.

Comments: There was very little discussion concerning new equipment training. Perhaps the reason was the fact that once in the sustainment phase of postproduction there is typically little to be done in the way of new training. Established training continues but the introduction of new training would generally fall into the realm of new performance or new work. Although when the Army "fields" modified hardware new equipment training does get involved. However it was my understanding that much of the new training is initially done by the pertinent contractor. So if for example a major modification were to be accomplished part of the engineering change process would necessarily include a response to the question; "will additional training be necessary to implement the design change?" If training is required, typically the training will be prepared by the contractor who is preparing the design change. So the new equipment training has built into it the efficiency of the same agency who is preparing the engineering design change (modification) is the same agency preparing the training. This is an example of how well the lean practices of the lean enterprise and integrated process team approaches work.

Interfaces: ULLS-A, ILS Team,

3.2.12 Planning, Programming, Budgeting and Execution

The PPBS is the process of first identifying, analyzing, and finally costing a particular desired objective. This is the funding process used within the DOD. However with the current state of flux of the budget this process must occur frequently. One might like to think that a yearly budget can simply be submitted to the Army leadership and one needs only wait on the funding. This, however, is not the case. Almost daily the Army is constantly addressing funding issues of the hundreds of systems. Each time a funding level changes other systems are affected. This process is that near constant response to the budgeting questions both during budget preparation and execution. The number of steps involved are 61 but must be done repeatedly with every change to the budget numbers.

Comments: Without question this was the most complained about process. There simply is no connection that can be drawn between logistics budgets and logistics activity. This perhaps is the most compelling reason to investigate the PVS alternative. As many know PPBS was first introduced in the DOD in the 60's and by the end of the decade had spread throughout the entire government by presidential direction. Subsequent to this directive however its many flaws were found and was eventually replaced by Zero Based Budgeting and them CAMS. PPBS had the fatal flaw of first determining the desired outcome then backing into the appropriate budget numbers. But as one might guess with such a process the budget can, when finally completed, be unrealistic if the processes used to achieve the outcome are not challenged. The CAMS system does require discussion early and at least presents the opportunity for dialogue. But it is my opinion that as long as the PPBS budgeting process is used, the budgets will continue to be unrealistic and will have no correlation with the eventual outcome.

Interfaces: SARSS, Depots, CCSS, DLA

3.2.13 Provide Logistics Assistance

Logistics assistance is an extremely important part of the sustainment phase. This assistance takes the form of experts located at a given unit or very close to it when there are multiple units in the same geographical area. These experts visit each unit daily if possible and check the availability of the aircraft, to determine which ones are operational and which ones are non-operational. Those that are non-operational because the focus of these experts. Has the problem been identified? Is the problem a maintenance issue or is it a supply or repair part action? While these experts are technically capable, their main focus is to reduce non-operational time by assisting with the resolution of the problem or by ensuring that the supply requisition is correctly prepared and submitted. Each day the aircraft remains non-operational is recorded and is subsequently reported to the Commanding General at the responsible MACOM as part of the standard readiness reporting procedure.

Further, these experts report monthly on all problems found and on all corrective actions taken. Problems which are unique or pose a particular danger to safe operation are then filed in a Logistics Assistance Special Report notifying the MACOM of these particular problems. The steps involved in this process can be a few or numerous.

Comments: While this process was not specifically singled out as being particularly deficient it is duplicative with the Field support process above. The PVS contractor intends to put in the field 60 logistics experts to provide logistics support. This single action is expected to generate significant savings. The misdiagnosis and no-failure-evident problem is expected to be dramatically reduced, if not eliminated. If this is expected to work so well using PVS, one must conclude that the current support is lacking. Although, as mentioned above, the current support in the field is focused more on getting the repair part to the user than diagnosing the correct defective part. The type of support offered by the PVS contractor is focused on reducing the number of parts ordered.

Interfaces: MILSTRIP, MILSTAMP, ULLS-A, ITV, TAV, RODS, OSCAR

3.2.14 Systems Engineering

The systems engineering identified here is not entirely the same as systems engineering employed in product design. The product design systems engineering function is more of an iterative design refining process to address system requirements. By contrast this logistics-based systems engineering activity is one that involves the review and evaluation of the technical data for the system. There is an engineering component that is essential to the procurement of spare parts using existing technical data as well as to any modification of the system. Typically, and particularly during reprocurement, the need for an engineering analysis of a technical data issue can be the difference of getting an item that works in the weapon system or one that does not work. This process typically has approximately 35 steps beginning with the compiling of the technical data through the production engineering review, quality review, PMO review and finally an acquisition method code assignment.

Comments: This process is also plagued with inefficiencies. Again the PVS contractor is proposing the capability to modernize and avoid obsolescence, and at the same time save large sums of money. To do this they claim they will use the best commercial practices to move the designs to production and into the system rapidly. The Army Systems Engineering consumes nearly three to four years to move these designs along. Also this is an engineering task and is duplicative with that of the sustainment engineering function. This process typically is responsible for the extended Administrative Lead-time that compiles as the logistics agency attempts to procure an item that has a technical data problem. Before the procurement can go forward the engineering issue must be resolved. This process should not reside in the logistics agency.

Interfaces: OSCAR, RODS

3.2.15 Total Package Fielding

Total packing fielding is the process of fielding a weapons system with many, if not all, of the required spare parts. This is a very difficult task. Typically when a weapon system is fielded, for one reason or another many items are either not available or not on requisition. This process is the recognition of a needed spare part and the activity needed to get the part to the field unit. If this process is not properly executed it is entirely possible the unit may experience immediate down-time due to a lack of spare parts. The steps involved in this process are perhaps few, but comprise a formal review of the total package fielding process. It is not unusual that the fielding package is short several critical items. The production line is in competition for these same parts. If there is a shortage due to premature failure the production line is filled first leaving the total package less than total. However, the steps involved in actually putting the package together must marshal all the steps involved in spares procurement, decision reviews, system engineering, etc.

Comments: The respondents had very little comment on this process.

Interfaces: CCSS, DLA, Depots, ULSS-A

3.2.16 Business Planning

This process represents the activities associated with the efforts needed to put in place the MOA discussed above. Typically this is a very time consuming process. Budget uncertainty is the single greatest factor contributing to the length of the time involved. As noted above, these MOAs represent a contract between the matrix functional organization and the PMO. The PMO, however, will not know what the system budget will look like until late in the preceding fiscal year and sometimes in the executing fiscal year. Because these MOAs are dependent upon available dollars, available manpower, and unilaterally (PMO) desired objectives, the process can take a very long time. It is not unusual that the process consumes perhaps as long as 3-4 months of back-and-forth communication before an agreement is reached. The steps involved number in excess 122. The number of steps is arrived at by the individual negotiation of every subtask in the MOA. This number can grow quite quickly when disagreement occurs with any or all of the subtask negotiations.

Comments: This process is lacking credibility and effectiveness. There seems to be very little credible business planning done within the logistics agency. This was evidenced by the report that Weapon System B has not had an agreed-to MOA in the last two years. Further Weapon System A had a very difficult time negotiating their last MOA. Eventually it was signed but not before negotiations had broken down several times. This process simply fails any type of test of the lean practices involving focus on the customer or building trusting relationships. Business planning must be a bipartisan negotiation with the customer.

Interfaces: ILS Team, Depots,

3.2.17 Competition Advocacy

In 1981 the Competition in Contracting Act (CICA) was passed by Congress. At the time there was a great deal of discussion that if the DOD could compete all spare part procurements, a huge savings could be generated. Many major commands (MACOM) established offices that do nothing but review all procurements to ensure competition has at least been addressed. For many reasons CICA did not result in the savings that one might have hoped. But the requirement still exists for a competitive review of all procurements, and spare parts are a major part of that review process. This particular process is the assessment of all spare part technical data with the intent of determining whether the item can be acquired through competition. Unique design characteristics, component availability, special test requirements are all reviewed. The objective is to conduct an economic analysis of the total life cycle cost of the system for two reasons: first, to determine whether the procurement can be competed from a technical standpoint *and* second whether the competitive procurement will result in a cost saving of at least 25% over the life-time of the weapon system. The steps involved in this entire process number in excess of 100.

Comments: According to the MOA this process is comprised simply of reviewing basic contract documents. Further these documents must be signed several levels above that which prepares them. Also the signature is academic inasmuch as the binding facts on these documents are prepared by other agencies. The CICA required competition. Generally speaking the only impediment to competition in the procurement of spares is based on technical arguments. Either only one firm has the intellectual property rights and others must be excluded; or the design is so complex that the only firm that can be trusted with the reprocurement, is the one who successfully built it the last time. It is true competition can be considered on the very small parts, but generally it is not realistic. Often the technical data is incomplete or inaccurate for the reasons mentioned above. So even if the intellectual property and complexity issues do not apply, holes in the design disclosure do. When any of these issues apply the procurement must be given to those who have built the item in the past. The problem comes with conforming to the CICA act. There is a need to review and justify that in fact a review process was gone through. This process is very wasteful and is responsible for adding administrative lead time as well.

Interfaces: OSCAR, ILS Team

3.2.18 Depot Transition Planning

This process involves the efforts in setting up the depot as the system migrates to the organic maintenance capability. In most cases when a weapon system is in production the PMO purchases contractor logistics support for the first several years. However, once production begins to slow down and the contractor logistics support ends the Army must be in a position to support the weapon fully and organically. This process involves the preparation of all the facility, equipment, procedures, processes, and functions that would be required to shoulder the full responsibility for the weapon system. This process includes 52 steps across five different major Army agencies.

Comments: There was a great deal of discussion regarding the depots and their equipment. Most thought their processes were not very well optimized. The technicians did not seem to have appropriate procedures or equipment. The PVS contractor for Weapon System B intends to optimize the depot once under contract by drafting a new agreements establishing repair cycle times, processes and procedures. The public law dictating the 60-40 split will remain intact. A fixed amount of hours (85K) will be funded into the depot and the PVS contractor will essentially manage or dictate management of the depot. The reason this becomes very important to the contractor is that if the depot does not meet overhaul times on components, (for example) then the PVS contractor will not meet contracted times on delivery of the items to the user. With the PVS contractor having liability in the depot, it is believed that the depot will become naturally better and more efficient.

Interfaces: ITV, TAV, ILE Team, RODS

3.2.19 Force Modernization Planning

It is the rare weapon system that is not in some form of modernization at all times. Whether by design or through circumstance, most DOD systems are in a continual state of evolution, involving the commitment of hundreds of millions of dollars. Force modernization requires a great deal of planning, in performance enhancements, budgeting and, of course scheduling. While the steps involved in the planning process may vary, execution of the modernization effort would normally encompass many tasks or steps numbering in the hundreds, including nearly all of those described above.

Comments: Any process that has anything to do with modernization simply is believed to be deficient. The Army logistics agency is incapable of planning the affordable modernization of the Army's equipment. This is one item that the Weapon System B PMO talked about at length. Apparently there is a costly sensor on the system that is plagued with numerous problems. It is generally believed the fix for this sensor is unaffordable. The PVS contractor has promised and scheduled the upgrade of the sensor over the next few years funded with the savings from the PVS contract. The PMO staff is extremely pleased about this offer. Other government wide programs similar to the Modernization through Spares are fraught with the trappings of government procurement and rarely are desirable. Making the modernization part of an incentivised package within the larger PVS contract seems to have worked.

Interfaces: DLA, Depots, OSCAR, ULLS-A, ILS Team

3.2.20 Manage the Army Maintenance Management

The Army has established for its aircraft systems a systematic maintenance process. It involves scheduled maintenance, removal and replacement of major components at specific time intervals, documenting of flight time, component repair, and associated functions. This task represents the management of those activities, and involves the publishing of a technical manual, altogether encompassing a 33-step process.

Comments: Most comments provided on this process were associated with the wholesale management issues. The general consensus is that the wholesale logistics process is very inefficient. The wholesale part of the supply and maintenance functions is that which the intermediate maintainer must interface with rearward to the depot, etc. The entire wholesale system is to be replaced by the PVS contractor.

Interfaces: NSNMDR, SARSS, OSCAR, ILS Team, RODS

3.2.21 Managerial Accounting

This process involves managing reviewing and reporting of the financial data. The managing, reviewing and reporting are all on-going overhead activities.

Comments: Any discussion involving the cost accounting or reporting met with significant criticism by the respondents. The cost accounting of the current Army logistics agency is neither transparent nor effective. The continued use of the old processes are outdated and tax the Army logistics agency with a 25% premium. This added cost is unacceptable to the PMO. By going to PVS the Weapon System B managers realize an immediate 25% savings. This is nothing more than an added tax for doing business with the Army logistics agency.

Interfaces: ILS Team, DLA

3.2.22 Materiel Accountability, Distribution and Transportation

This is a very complex and decentralized process, representing those activities associated with moving both aircraft and aircraft parts around the world. Also involved is the exchange of hardware and major high dollar items as they make their way back to the depot or other repair facilities. These items must be in control at all times to ensure that they do not find their way back into the inventory prematurely. This process, depending upon how much of the task is exercised, can take s many as 87 steps.

Comments: These processes represent very old processes used throughout the Army. It is also reported to be a very inefficient system as well. Perhaps some of the best opportunities for improvement in the future for Army logistics is in the distribution channel. There is still too much bureaucracy reported in this process.

The one issue that raises concerns with the PVS concept is the distribution and transportation channels. Under the current PVS contract the contractor is required to move all parts to all parts of the world as required. They may, at their expense, use the Army distribution or transportation channels depending on prevailing conditions. The problem comes when there are hostilities. The contract currently states that the PVS contractor may only be required to ship parts to a predetermined location in the U.S. from which they will be forwarded by the Army into the theatre of hostile operations.

Interfaces: MILSTAMP, DLA, Depots,

3.2.23 Packaging, Storage and Transportability Management

These processes, while self explanatory, need a brief description. Aircraft components are very costly but yet fragile items. Further, they may be required to sit in warehouses or outside for extended periods of time. The detailed procedures used to pack these items are under the jurisdiction of the logistics community. These procedures are very detailed and are controlled in much the same way that the engineering technical data are maintained. There are essentially no changes to these packaging procedures unless the entire community reviews and approves. The containers used for packing are themselves very costly and reusable. They also must be inspected to ensure that they are still serviceable and ready for reuse. More time spent at the packaging process translates into reduced impacts of storage on the item. But, here again, the logistics community is responsible for the warehouse or storing facilities. Finally the logistics community is responsible for getting the item where it needs to go. Transportability and the monitoring of the transportation is extremely critical. The Army desires today to be able to monitor each item from its departure point through every stop until it reaches its destination. With limited dollars in the support budgets the capability must exist such that the Army, as needed may redirect the shipment of any item to another destination. There are 156 steps involved in this process.

Comments: It is in this area that there are expected to be savings. First the management of the packing data is a very costly process. This data is treated much like engineering drawings. While the Army intends to digitize many of these data sheets many to date have not. Changes to these documents are represented by long approval processes. Further in the past the government tended towards better than best commercial packaging. Today with the advances in the technology of packaging, the PVS contract intends to use best commercial and at the same time generate significant savings. Also to the extent the Army must maintain the facility for warehousing inventory, by going to PVS the warehouse costs can be saved through the cost reduction of operational rates. By leveling the operational hourly rates which is to be done through strict penalties, the PVS provider can now lean out the support process by clocking to; the use data generated by the operational program. The Army must maintain the operational program however, otherwise the contractor rates in the contract can be increased. So it is in the best interest of the Army to stabilize the operational flight hour program around those dictated in the contract. The only problem with this is that historically the Army has not maintained the number of operational hours currently in the contract. Today they rarely exceed 100000 hours the contract mandates 125000 hours. At any rate, this process' costs can be reduced by the Army planning to stabilize the operational program.

Interfaces: MILSTAMP, CCSS, DLA, Depots, ITV, TAV

3.2.24 Performance Management and Improvement

This process is based on the Army's internal control program. It is a requirement that each and every agency establish the necessary controls to make sure that each tax dollar is spent not only wisely but also that its expenditure can be audited. These controls can involve something as small as travel expenditures and the movement of expensive aircraft parts. The process that is followed to actually execute these activities is normally not sufficient to satisfy this internal control requirement. There must be a parallel method that can, if interrogated, reveal how the process occurred. The steps involved typically include the preparation of draft internal controls, distributing the drafts for comment, negotiation of the comments, approval of the controls and finally the formalizing of the controls in publications

Comments: This process is based on an internal control program. Internal control programs generally are not considered to be performance improvement programs. But without question the respondents did not correlate performance improvement with the Army logistics agency. There is little proof of performance improvement in the most recent years hence PVS became a viable alternative. Even in their response to the current PVS proposal, the Army logistics agency has shown very little potential for improvement.

Interfaces: ILS Team, Depots

3.2.25 Replenishment Spares Requirement Determination

This process is one of the most perplexing of all the logistics processes. It is the predetermination of what will fail, when, how many and how long will it take to get a new one. The LSA and LSAR add some degree of visibility to this process. The FEMCA also provides some insight in to what will fail and when. But the only sure method is watching the real time data. The real time data will indicate when the item is failing and how often given a fixed set of circumstances. But assuming that one is able to accurately estimate the timing and frequency of failure rates, the remaining issue concerns how accurate the estimate was, whether the required item is on the shelf or whether it must be procured from the manufacturer. If it is on the shelf, having access to it and transport time involved is all that must be considered. However, if it is not on shelf, typically 18 months is needed to get it on the shelf. Of concern recently are those parts on the shelf that were mistakenly projected as having high failure rates. Now the issue becomes warehouse space and associated costs. This process, which is very critical in getting the support life cycle costs down, involves 115 steps up to the point of procurement. Procurement itself involves another 116 steps.

Comments: This is a very difficult process. The best approach is watching the real time failures of the hardware in use. Complicating this is the funding pooling that is going on in the logistics agency. For example, there are two weapon systems, one is funded one is not. If the item manager for the funded systems has the authorized stock very close, lets say ten are authorized and eight are on the shelf. One may be tempted to use the funded system's money to support a program who has had poor funding. Assume its stock availability is say 10 authorized with two remaining on the shelf. The problem is that if the authorized stock level has been generated by real time data and the decision is made not to procure that year 9for the funded system), there will almost certainly be a shortfall. Once the shortfall occurs the Army logistics agency, because of their lengthy procurement cycle of 4-6 months administrative lead time and 18 months procurement lead-time, the original example above will go negative in the following year before new parts arrive.

Interfaces: MISTRIP, NSNMDR, CCSS, OSCAR, APD

3.2.26 Spares Budgeting and Execution

Spares budgeting must be exercised or accomplished all in one fiscal year. The funding is to be provided on 1 October of each year and the Army must be in a position to place this funding on awaiting contracts. To make all this happen in real time, which is something of a rare occurrence, one must have a keen sense of what is to be ordered or procured, the competitive status and approximate contract award lead-times. Obviously contracts, thought to be ready for award, rarely are. The contract review process is another convoluted study in itself consuming untold steps. If these dollars are not awarded in the fiscal year they will be lost as executable dollars and must be returned to the treasury. Often-times if the intended contract award is not realizable, the funding can be placed on another contract for other parts to ensure the funding is not lost. This entire process, including the reallocation of funding to other items, involves a detailed set of activities requiring significant amount of analysis and encompassing 72 steps.

Comments: This process generated more discussion than most. It is very obvious that the PMOs are not satisfied with the budgeting or the execution of the Army logistics agency. The costs are simply too high with marginal performance. In addition there is very little correlation with the logistics budget and that of the performance.

CCSS, DLA, APD, OSCAR, RODS, Depots

3.2.27 System Assessment

This overarching process, an aggregate of many processes described above, is essentially a health check of the weapons system. It involves the use of the readiness reports, the logistics assistance reports, field visits, and other activities. While all of these metrics can be in the green, the weapon system may not be in a good state of health for a variety of reasons. Sometimes local commanders have different priorities than the MACOM. So while readiness is being reported high it may in fact be something less than high. Likewise, with the logistics representatives, maintenance time may be taking too long because of a unique unit problems in the field or may become a local priority issue. The logistics representative may be hesitant to disclose these issues because of embarrassment to the unit. Local visits and independent assessments can be of great value in this context.

Comments: This task while being redundant, apparently is well received. This is further substantiated by the contractor relying on the 60 field experts to generate significant savings. It appears that by being in the field with the user a great deal of efficiency can be built into the support system. As stated above there are huge impacts every time a part is either put in the return path or if a part is ordered. If the numbers of both can be reduced, if only by a small amount, support costs can be dramatically reduced.

Interfaces: All

3.3 Weapon System A (PMO)

3.3.1 Material Fielding

Review, evaluate SLAC and develop the authorized stockage list (ASL) and prescribed load list (PLL). Develop and forecast materiel fielding budget requirements. Coordinate ASL/PLL's with gaining command and adjust the lists accordingly. Monitor Total Package Fielding problems and assist in filling shortages. Provide the gaining commands 90, 60, and 30 day total package assessments. Coordinate fielding dates and milestones for release of fielding packages. Conduct joint inventory and assess fielding support Participate in unit inventory and hand-off and provide overall fielding assessment.

Comments: No comments were provided by respondents.

3.3.2 Unit Sustainment / Readiness

This task involves the monitoring of the system status. Each day the unit commanders must report how many systems are operational and how many are non-operational. For those that are non-operational they can be either non-operational supply (NMCS) or Non-operational maintenance (NMCM). For those that are non-operational due to supply this process attempts to identify that requisition(s) and determine how long it will take to fill it. Perhaps there are zero balance at the depot and a procurement will be required. If caught off guard this can take anywhere from one year to eighteen months to get this part as mentioned above. If however the part is in the depot this task will attempt to get it moving fast to the user. Based on the number of supply demands for non-operational systems this task will determine if the user has the right number of each of the spares. If a particular part continues to fail and the unit is only authorized a fixed (too low) number in inventory this task will attempt to get the unit a higher number authorized for stockage. For those systems that are non-operational due to maintenance, this task attempts to determine why the maintenance has not been done, remember NMCM means there are no requirements for parts only maintenance. Based on the what is found there may be a change needed to maintenance policies or procedures. Perhaps there are technical issues needing addressed, where the system is non-operational but passes all known troubleshooting techniques. The user is then confused as to what if any parts are to be ordered or what if any maintenance actions to perform. This task also involves traveling to the locations where the systems are to get a first had view of the situation.

Comments: One can hardly argue with the readiness numbers; both Weapon System A and Weapon System B have enjoyed high readiness ratings. As is stated in chapter three this process is basically the outgrowth of a broken or defective system. If the logistics system was functioning normally the tasks and processes described by this process would be redundant, i.e. the system would be ready. It is because the system is not functioning that one finds the need to have a "readiness" process. The goal of the PVS contractor should be to achieve the logistics system such that readiness is only a reported number not a costly process. Having said that, as one assesses this process it is apparently working well.

Interfaces: All

3.3.3 Implement Integrated Logistics Support (ILS) Policies

This is a very broad task associated with the logistics function. Perhaps the most important function of this task is the planning. The planning resides in a document called the ILSP or ILS Plan. It is within this plan that all the groundwork is laid so that as the system evolves everyone is aware of how the logistics is to evolve with it. To a large degree the user or warfighter has a large input into this plan to insure the system once fielded, will fit the battle planning and intended tactics. If for example it was the desire to do CLS for a particular component that desire would be detailed in this ILSP. This plan is also used during any new development activities to insure the new development will fit in the existing ILS structure. As one evolves the design one must insure new technicians or technician abilities are not added or if added that the entire logistics process is reviewed. If new abilities are added it may be necessary to add a particular technician to each user unit. These requirements must be staffed in Washington to allocate the personnel and are considered serious implications. This task also involves attending meetings to discuss and resolve ILS issues the user may be concerned with. It is within this task that the maintenance concepts and spare part stockage for the system are planned (ILSP) but also periodically reviewed. If any of the ILS elements are being performed by contractors this task will perform the necessary oversight of that tasking. It is also within this task that the MOAs described above are formulated and negotiated. Budget requirements and development are also part of this task. Logistics facilities are also a big part of the logistics area. Maintenance equipment and shops must have either permanent and or mobile facilities to house the logistics capital equipment. Demonstration and Supportability tests are also part of this task. Before any logistics function maintenance or operational they are required to be demonstrated to insure they are correct and do not bring harm to the soldier or equipment. Finally this task involves the creation and execution of all training for both new and existing equipment. In addition this task will include the identification of added training equipment that might be needed to more efficiently train the soldiers.

Comments: See the earlier analysis of ILS implementation. But also recall from chapter three that this process is thought to be duplicative with that of the MOA ILS process. It's the budgeting, planning, monitoring of the ILS activities. There was little discussion that this process was working. This is a prime target of PVS. The contractor believes they can do it better and more efficiently. There seems to be fragmentation of the process between the PMO and the logistics agency.

Interfaces: ILS Team, Depots, DLA

3.3.4 Identify and Coordinate Critical Spare Part Requirements

This task involves the identification of and the coordination of all critical spare part requirements. Note that this is nearly identical to the earlier task. This data was gathered by the individuals doing the task independently. This duplication will be analyzed later in chapter four but does nonetheless exist. Also listed as this task's requirements were the identification of all critical parts based on demand data. Also the monitoring of how effective the spare parts move out of the depots to the user are listed as this task's requirement. Attending supply support meetings are also part of this task.

Comments: This of course is a duplicative process and is indicative of a system which is broken. All parts in the operating system both critical and non-critical should flow seamlessly without the benefit of additional coordinating processes. If the logistics support system were working this task would be unnecessary

Interfaces: OSCAR, RODS, CCSS, ULLS-A, Depots

3.3.5 Safety-of-Flight Messages

This task obviously is a necessity for only aircraft weapon systems. As the OEMs or the user finds peculiar safety issues they are quickly evaluated and a determination is made as to whether to ground the entire fleet or simply make all users aware of the condition. Non-operational characteristics that cannot be resolved with known troubleshooting techniques is an example of such an alert. Any time any part of the aircraft system does not respond to accepted test or troubleshooting techniques there is reason for concern. These messages must not only go out but their delivery is very important as well. The PMO must assure itself that the message went out and all users are in possession of the message.

Comments: This process apparently works well in both weapon systems and there was little talk of defects or improvements. In addition there was very little discussion that this system would be given over to the PVS contractor.

Interfaces: ULLS-A, Depots

3.3.6 Procure, Evaluate and Maintain the Technical Data Package (TDP)

The weapons system technical data is typically purchased as a package hence the term technical data package or TDP. This task is responsible for generating all the contract work to purchase the TDP. The Data Calls to gather all pertinent requirements for the

TDP and the Performance Work Statements are all prepared under this task. I was surprised this function is in the logistics area because most PMOs have either a dedicated engineering office doing this task or a configuration management office doing it. Both these latter offices are staffed with engineers. Also because the purchase of a TDP is typically from a sole source or OEM the government must prepare the justification to do so. This task performs this function as well. Once the contractor proposal is received it must of course be reviewed, negotiated and awarded. The purchase to the TDP is a long process. The TDP is generated as the hardware is generated and typically takes many years. During the interim there are many in process reviews that take place to monitor the progress. This task conducts those reviews. As the engineering data arrives it is to be evaluated for accuracy and adequacy. Also the beginning of the provisioning, repair parts and special tools listings and technical manuals are prepared.

Comments: This process is a very complex process which is thought to be anything but lean. There are endless reviews of the data calls with meetings trying to get the contract written in great detail. Once written the negotiation takes an exceedingly long time. When there is a TDP under contract there are endless reviews of the drawings for both technical and indenture level errors that could wreak havoc with the logistics system if loaded into the system with the error. Further in the past as long as the technical data package was to go to the government there was little or no incentive for the contractor to do a good job in preparing it. That is not to say it would be inaccurately prepared on purpose but there was not sufficient enough focus to get the errors corrected. One thought is that if the error were left in, the government as mentioned above would be required to go back to the last successful manufacturer. That is of course the contractor who prepared the technical data. Taking this example to the extreme but not at all impossible (it happens all the time) the technical data is given to either the original manufacturer or another and a contract is awarded for the item. At some point during the production the error is found. The technical data at this point is government owned and represents the government requirement. But now it is in error, slowing production. The government must now pay for the technical data correction and the production slowdown costs. Again the contractor wins. In PVS, giving the technical data to the contractor, if these errors are passed on to their suppliers, they will be one to pay, it is now their requirement.

Interfaces: NSNMDR, APD, ILS Team, Depots,

3.3.7 Procurement of Spares

This task involves the forecasting of spare requirements, and budgeting. Note again that this independently gathered data is found to be duplicative with that reported earlier. This task ties together the long range requirements for both fielding as well as normal budget guidance. Support of the critical items is mentioned once again.

Comments: This process is another that is very inefficient. The identification of spares. These evaluations go on forever and rarely are accurate. They are crippled by funding shortfalls and errors in the system, sometimes buying too much of one item and not enough of another. The budgeting piece is also subject to the same errors. And of course as mentioned above it is duplicative with that of the logistics agency.

Interfaces: ILS Team, OSCAR, Depots,

3.3.8 Logistics Assessment

Logistics assessment is associated with the measurement of that which is in the ILSP and that which is actually accomplished. The first stage of this tasking is the review and evaluation of the Logistics Support Analysis (LSA) and Logistics Support Analysis Records (LSAR). It is in these records that the detailed logistics activities are described. This data also feeds into the technical manuals and the maintenance levels and concepts as well. From this data is gleaned manpower requirements, maintenance actions, operational skills as well. Unrelated to the LSA and LSAR data are the rapid deployment and transportability aspects of the logistics process.

Comments: This process is again the outgrowth of a broken system. It represents another layer of oversight on top of oversight. If the current Army logistics agency processes were working there would be no need for this process.

Interfaces: All

3.3.9 Sustainment of Technical Support

This task it will be noted is also duplicative with that which has gone before. It involves the monitoring of the readiness levels of each system and the NMCS actions referred to earlier. Expediting those critically needed parts are also part of this task. In the field there are several logistics assistance representatives, from both government and industry. This task coordinates with those representatives to insure their efforts are properly directed.

Comments: Again anther redundant process that if the Army logistics system were working would be unnecessary. This entire process is nothing more than oversight of the overseers. This process along with many others should be so constructed to not only determine the problems but fix them at their root. What has happened here they are perpetuated into bureaucratic processes whose recording of defects activities eclipse the original intent of getting the solutions at the root cause of the problem. Tasks of this type should be almost like tiger team approaches but once the problem is solved the task goes away and doe not live wastefully on

Interfaces: Depots, OSCAR, RODS,

3.4 Weapon System B Processes (PVS)

The following is the list of PVS processes to be implemented by the PVS contractor. Due to the construct of the PVS contract, there are only four major process groupings. Because the type of sustainment processes needed by each weapon system is identical, Weapon System B processes will be presented here and a consolidated version of Weapon System A processes will be presented in the next section of this chapter. Comments are included in these following discussions.

3.4.1 Program Management

The program management process includes two major sub-processes outlined in the PVS contract.

3.4.1.1 Formation of the Joint Project Office (JPO)

The government and the PVS contractor are to form a Joint Project Office (JPO) to support Weapon System B. It will contain near equal staffing of both contractor and government personnel. The JPO will be the single point of accountability upon which all sustainment activities will fall.

3.4.1.2 Guarantee Support Cost Reductions

The issue of cost is the one issue that kept coming up during all discussions with the Weapon System B managers. They could not afford the current level of support as it was provided by the Army logistics agency. The cost of operation was not only too high, it was increasing each year. The PVS contractor was guaranteeing that these support costs would come down throughout the life of the contract by 16% in operating costs and 32% in materiel costs.

3.4.2 Technical Support and Documentation

Included in these processes are the following sub-processes

3.4.2.1 Distribution of Technical Experts

The contractor is to place in the field 60 technical experts. This group will include experts from each of the three contractors. The function of these experts will be to insure that only defective parts are in the supply chain. Today, based on several interviews, almost 40% of all parts returned for repair, do not need repair. But once in the supply chain, there is little that can be done to retrieve this sunk cost. These experts will work closely with the user during troubleshooting the defective weapon system to insure only defective parts are returned.

3.4.2.2 Single Point Configuration Manager

Today the configuration management of Weapon System B is managed by five Army agencies. Engineering changes prepared in the past almost never were incorporated because at least one of these CM managers did not find any value in the change. With the PVS approach the PVS contractor is now the single entity, that both prepares and approves engineering changes.

3.4.2.3 Obsolescence Avoidance by Modernization Through Spares

In the aerospace industry obsolescence is a fact of life. Particularly with the DOD policy moving in the direction of commercial technologies. If there is one issue that characterizes the commercial industry it is the creation of obsolescence through, innovation, cost reductions, better, faster, etc. One cannot do all these things without changing the product that was originally designed. The question arises, If the product continues to change, will it still function in all old applications? This is the avoidance question. If an item is to change but still function in the old application, obsolescence has been avoided.

The DOD has had a policy (Modernization Through Spares (MTS)) that states obsolescence is to be avoided by; when procuring spares that every opportunity be given to the vendor to "modernize" the design to avoid obsolescence. This is an admirable policy with the only sticking point being this does not happen without additional cost. That is why this policy has not worked as well as it should under current conditions. The PVS contractor, by guaranteeing both readiness and cost reductions has stated it is possible, with the flexibility in the PVS contract. By having the PVS contractor responsible for all configurations, it offers the modular opportunity to the designer. Therefore while obsolescence changes will not be avoided, their effect can be mitigated by instead changing the one offending part, instead of the entire assembly. This action coupled with dramatically reduced inventories (of the old configuration) can maintain readiness and reduce overall costs. This is the argument used by the PVS contractor. According to those interviewed, obsolescence engineering changes in the past were repeatedly rejected due to overstepping one another's footprint in the design and the desire to maintain dated inventories.

3.4.3. Integrated Materiel Management

Included in this major process are the following sub-processes

3.4.3.1 Creation of a Management Information System (MIS)

The contractor is to establish a Management Information System (MIS) to manage the PVS Weapon System B activities. In this particular case the PVS contractor is actually one single limited liability company (LLC) that is comprised of three OEMs. Each partner is the OEM for one of the three most complex systems within the weapon. One of these firms already is using their MIS to manage one of the major components within the Army logistics context. During the first year this existing system is to be expanded to include all weapon system items managed by the PVS LLC. The MIS system is proprietary to that one contractor. Once the PVS contract has been in place for several years, not more than two, a completely new MIS system will be introduced. The new system will be Weapon System B-unique reflecting all its important characteristics.

3.4.3.2 Improved Stock Availability and Reduced Inventory Levels

The current Army logistics agency focuses on all assigned Army systems. If any particular system is well funded or has "adequate" stock availability a large share of the spare part funding may be directed to another weapon system that is not as well funded. This was stated by those involved in the Army logistics agency. But the problem with this approach is that even with the knowledge of the well funded system, it only takes one spare part to make the weapon non-operational. According to those involved, this has been the case for Weapon System B. As the PMO, with ultimate responsibility, this is undesirable. Under the PVS contract the contractor is responsible for and measured by the ability to both reduce the number of non-mission capable requisitions. Non mission capable requisitions represent the need for a spare part that is currently keeping the weapon system in a non-operational status. In other words, if this part were available the system would be fully operational. I have already discussed how the number of these requisitions can be reduced: technical experts on the scene, proactive reliability and obsolescence activities, etc. Reducing the fill time can be more difficult. This parameter can be controlled by maintaining a high inventory or by maintaining a leveled production of the item so it can quickly be shipped from the factory to the user. Inventories under PVS, while still physically belonging to the government, will be paid for out of available contract funding. Therefore the more the contractor spends building inventory the less funding is available for sharing at the end of the contract period. The contractor is therefore disincentivised to maintain large inventories and incentivised to create conditions such that accurate forecasts of the eventual inventory are available. Further if one can accurately forecast from flight hour usage, then production levels can be leveled to match the operational requirement of the weapon system.

3.4.3.3 Implementation of Best Commercial Practices

The use of best commercial practices cannot be underestimated as an exceptional process. During conversations with the PVS contractor, repair/replace processes surfaced as a savings generator. The Army logistics agency uses the 65% threshold when considering to either buy new or repair defective parts. If the item can be repaired at a cost which is less than 65% of the new part, the part is repaired. If however the repair costs are greater than 65% of replacement costs, the item is instead replaced. In some cases this makes sense but only in a few cases. The best approach is to review each case on its merits, which is what the contractor intends to do.

Further the use of military specifications and the Federal Acquisition Regulations (FAR) are thought to be very burdensome. The contractor intends to use neither. During conversations with both PMO and contractor personnel the administrative and procurement lead times for spare parts is simply unacceptable and creating huge costs. The PVS contractor believes that their procurement times will be substantially reduced.

3.4.3 Reliability Improvement

Included in this major topic is only one sub-task but it is critically important to the PVS cost savings function.

3.4.3.1 System Reliability Improvements

Reliability in a general sense is the probability that an item will perform its intended function for a specified interval under stated conditions. Mission reliability is the probability that a system will perform mission-essential functions for a period of time under the conditions stated in the mission profile. Finally Logistics reliability is the probability that no corrective maintenance or unscheduled supply will occur following the completion of a specific mission.[13] These definitions all include a probability of performance. Note that each definition above includes the ability to either perform or the avoidance of activity that would prevent performance. In the PVS contract, reliability is to be defined and measured by readiness and the reduction in support costs. As is stated above the support costs are guaranteed to decrease. The contractor has stated and the PMO has agreed that without significant action by the contractor, support costs simply cannot be reduced over time. Cost reductions have never been a characteristic of an Army weapon system model. This contractor is stating that with the added flexibility provided by the PVS contract, support costs can be reduced by 16% over five years.

Readiness of older systems will degrade over time without action. The contractor intends to maintain readiness by maintaining availability of spare parts.

[13] The DOD Logistics Guide, page 10-3

3.5 Weapon System A Process Consolidation

In Table 3.1 below, the 36 Weapon System A processes, that were detailed earlier in this chapter, are grouped or mapped into one of the four major PVS process topics. This is most efficiently done by using the above assigned chapter paragraph number.

Program Management	Technical Support And Documentation	Integrated Materiel Management	Reliability Improvement
3.2.12,3.2.16,3.2.17 3.2.20,3.2.21,3.2.24 3.2.27 and 3.3.1	3.2.1,3.2.2,3.2.3,3.2.4 3.2.11,3.2.13,3.2.19 3.3.5,3.3.6,3.3. 9	3.2.5,3.2.6,3.2.7,3.2.9 3.2.10,3.2.15,3.2.18 3.2.22,3.2.23,3.2.25 3.2.26,&3.3.2,3.3.3 3.3.4,3.3.7,3.3.8	3.2.8,3.2.14

Table 3.1 Weapon System A and B Process Mapping or Consolidation

3.6 Some Key Similarities and Differences Between Weapon System A and Weapon System B (PVS) Processes

Some of the key differences between these processes include the organizational structure. Note in the current Army support processes the matrix functional home room method. Some processes are being done by the Army support agency through the MOA. Others are being done in the PMO. Both by matrix personnel, non-collocated in the MOA, and collocated in the PMO. This decentralized or fractured support structure is inefficient. The PVS contractor intends to use the Joint Project Office approach. The JPO will be comprised of both contractor and government personnel. It will not make use of the matrix and therefore all employees and their supervisors will be in the one centralized office. In the following figures the two different office organizations are depicted.

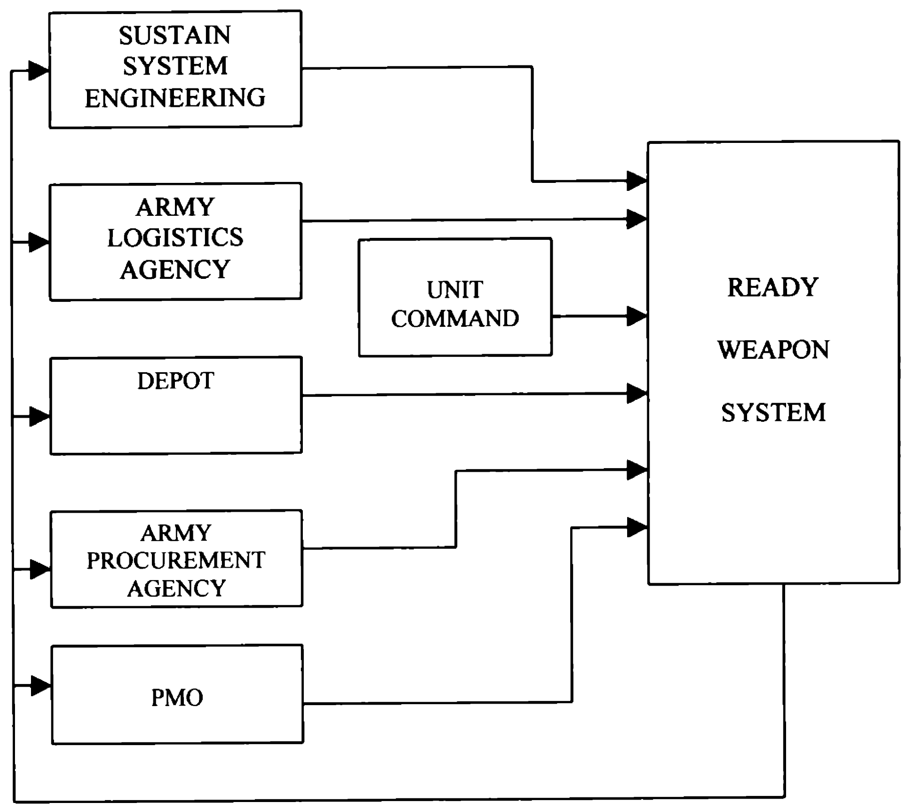

Figure 3-2 Current Decentralized Weapon System Functional Support Structure

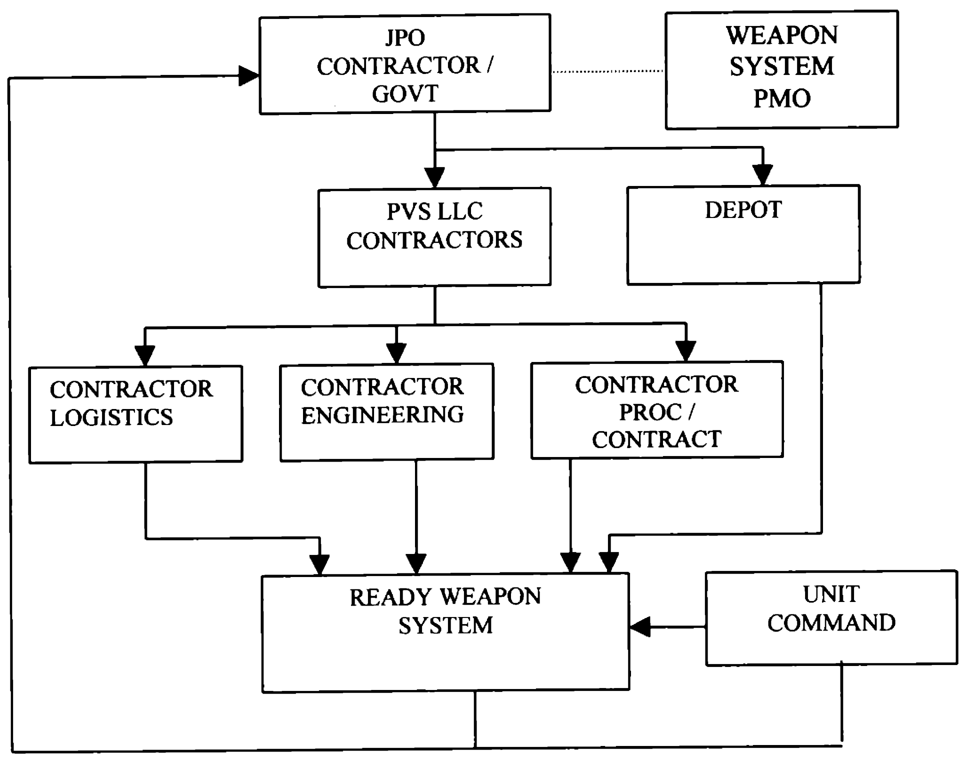

FIGURE 3-3 Central PVS Organization

The configuration manager in the current Army support process must interface with three government agencies in addition to the three prime contractors. Engineering changes take months to work their way through these loops and even then may be returned for any number of reasons. Under the PVS concept all engineering changes will be coordinated within the JPO. The PVS contractor is a Limited Liability Company that is formed by all pertinent prime contractors. All the government agencies involved have been collapsed into the PVS contract (JPO) so the lengthy coordination is no longer needed.

Another major difference is the guarantee to lower operating costs. The PVS contract is a firm fixed price contract with built in thresholds for operating costs. The contractor has committed to reducing support costs in each year of the multi-year contract. The current Army system has been faced with escalating costs every year. In addition there is a lack of transparency of Army support costs. The increasing support costs have not resulted in increased readiness.

The PVS focus on reliability is a major difference. This focus will target those areas where savings can be identified and captured. Weapon System B, has for the purpose of PVS, equated reliability with cost and readiness. In other words if the PVS contractor meets all readiness and cost goals, by definition, reliability has been increased. The current Army processes do not have a reliability focus, per se. They obviously desire a highly reliable weapon but it is difficult to focus solely on reliability when the current support structure is decentralized. Any such specific focus may demand flexibility in processes, which are not easily changed because of ownership issues.

The focus on the issue of obsolescence is of critical importance. The current processes are unable to focus on this subject in any meaningful way because of the associated cost. The PVS contractor intends to use the savings generated through process efficiencies to solve the obsolescence problems. It should also be remembered here that to a large degree, obsolescence, from the Army perspective, can be defined simply as the reluctance of industry to support current Army designs. With PVS, the same industry is now responsible for solving obsolescence issues. It is to be expected that obsolescence under PVS will not be as prevalent.

A similarity exists in the deployment of field experts. These experts are used in both the PVS and current army support processes. There is great value in having someone on the ground at the user's site to ensure that the support system will be exercised only when needed. However under the current Army support structure their experts do not have a strong motivation to build-in support integrity and will too easily accommodate local commanders. Under the PVS concept these experts are motivated by company profit to reduce support demands to the very minimum.

A final difference is the use of best commercial processes and a centrally monitored Management Information System (MIS). Even with all the current Army discussion surrounding acquisition reform, and the willingness to introduce best practices it is still not being done. During interviews with Weapon System B managers, they complained about being burdened by wasteful practices. The PVS contractor intends to make best use of all existing best practices and expects to generate significant savings. The centrally monitored MIS will also be a great improvement over the many databases used in the Army structure today. Even though the PVS contractor is being forced to stay within some of these Army interface information systems, the PVS contractor will be rated, in the contract, against performance based on accomplishments accumulated in this central JPO monitored MIS.

3.6.1 PVS Candidate and Performance Work Statement Processes

Related to the key similarities and differences is the issue of what makes a good PVS selection. What does one look at in selecting a weapon system or component for PVS support? Once selected, what might an adequate PWS need to contain? Both these subjects in keeping with the goals of this thesis were discussed during the process of gathering Weapon System A and Weapon System B process data. The following processes are provided as a means of selecting good PVS candidates and creating appropriate PVS tasks

PVS Candidate Selection Process

1. This first step is to identify that there is a problem. Problems identified with Weapon System B in this case were: escalating support costs, non-transparent support processes, low inventory turns.
2. Next identify the specific item or system that is to be considered as a PVS candidate. In the case of Weapon System B the entire weapon system was selected. One might consider an aircraft engine, weapon system, unique sensor, etc.
3. The question now must be asked, does a prime vendor or OEM or after market firm exist, that can totally support the item that has been selected? If a vendor does not exist that could be considered prime, you should reconsider implementing PVS. A well established vendor, preferably the OEM, are the only prime vendor suppliers that should be considered.
4. Does this vendor own and or have total rights in data to all intellectual property? The vendor you have selected must be in possession of all rights in data associated with this item or its design. If all current intellectual property is not owned by the prospective vendor, recommend support other than PVS be considered.

5. Is this vendor, who has been selected, the design agent now or has ever been the design agent for the item selected? If the vendor selected is not the original design agent the concern becomes one of technical capability and knowledge. The design agent will be familiar with all aspects of the design and production. Special calibration, testing, tailoring, production processes, etc. become very important, particularly if your agency is expecting the PVS vendor to be able to solve obsolescence issues. If the intended vendor is not the design agent, one can continue through the selection process but with greater risk.
6. Does a viable commercial market exist for a like item or identical item? Many military items are militarized versions of commercial items. There must be a significant amount of duplication for a PVS selection to be made. If a viable commercial market does not exist, it is unlikely, although not impossible, that the PVS vendor will be able to reduce costs in any dramatic way. Your agency should investigate weather this item is in the vendor's business plan going forward into the future. Although if a commercial market does not exist, but the current support structure is of such poor quality it may be possible for the potential vendor to still save support dollars. This is the case with Weapon System B.
7. Does an adequate funding flow now exist or can one be established? If the item is currently being supported by the Army, arrangements must be made to move a substantial amount of those support dollars away from the Army support agency to your agency. If your agency is currently funded to support only the PMO piece of the candidate item or system, this funding will not be sufficient to move to the expanded level of support, considered to be PVS. That is not to say that your agency could not work an arrangement where full funding may not be necessary. Weapon System B in this thesis created arrangements where savings would flow back into the contract to be used on cost reducing initiatives.
8. Are all known Interfaces understood, and if understood can your agency influence them? If your agency is not aware of all interfaces that may impact the item if PVS is implemented, this needs to be completed. Failure to recognize a critical interface may result in the inability to ship the item once back in the Army infrastructure or get it back to the PVS vendor, etc.

8A. Collect and document all of the item's system-related interfaces. This would be unique interfaces created or that exist within the support system, such as: special inspections, special reporting, modification records, etc.

8B. Collect and document all global interface information. These interfaces are those associated with the MILSTRIP, MILSTAMP systems if they are continued to be used.

8C. Collect and document all technical interface formation. If this item is a subsystem within a larger system all technical interfaces must be fully documented at this time.

9. Is this vendor now or has it been familiar with the Army support system? In other words is the item currently being supported by the vendor within the Army infrastructure? Does this vendor have a thorough understanding of the Army support system? A careful assessment must be done if this vendor is not familiar with the Army infrastructure. Regardless of PVS implementation, the selected item or system will likely exit and reenter the Army infrastructure as it is being repaired, modified, etc. Knowledge of this Army infrastructure while not mandatory, reduces uncertainty. Further if the vendor is not sufficiently familiar with the Army infrastructure system it will be very difficult to generate Army-based records if this becomes a requirement. All members of the Weapon System B PVS Limited Liability Company are completely familiar with the Army support system.

9A Identify to what extent is the item being supported by the Army organic support system. Who owns the Depot equipment, repair procedures, provisioning records, etc.

9B Identify to what extent the item is currently being supported by a Contractor Logistics Support structure. Will this PVS move simply be an extension of what is currently being done.

10 SELECT, if your agency has arrived at this point, the item that you have selected may be a good candidate for PVS support.

Performance Work Statement Development Process

1. Identify the PVS candidate using the above listed criteria. The result must be a recognizable item or system.

2. Identify all issues and scope the PVS program. What, as an agency, do you expect PVS to solve for you. Examples might include controlling support costs, increasing reliability, increasing readiness, resolving potential obsolescence issues.
3. All interfaces must form a part of the PWS. The PVS vendor must have a sense as to what interactions they might have, as they embark on the PVS concept. This should have been part of any candidate selection process.
4. All processes that the government intends to retain must be clearly identified. All PVS systems necessarily will intersect with Army management. At this point a detailed list should be comprised of how the government defines their role.
5. All processes that the vendor is responsible for, must be clearly defined. These should be defined with sufficient detail to insure the contractor knows what it is he is to do. In the case being discussed in this thesis, the current Army support system (Weapon System A) was detailed to the 36 processes found in the MOA. However when preparing the PVS contract for Weapon System B, the 4 major topics were sufficient to ensure an agreement.
6. Also of importance, while defining what is to be done by the vendor and the government managing agency, are those processes assigned to neither. A thorough analysis of all related support processes should be accomplished by the contracting agency to ensure that if the PVS vendor is not to do a particular process, that some agency is assigned to the process.
7. Within the PWS should be a discussion of both cost and performance measurement. While the contract will describe in great detail how the costs and performance are to be measured, it should be made clear in the PWS what type of cost containment is being expected. It is at this point that the Lean practices should be introduced in terms of performance. Then when the vendor prepares their proposal and the contracting agency reviews their proposal, the issue of Lean will and should be discussed.
8. Before transition to PVS a thorough baseline review of the pertinent engineering data should occur. This is essential to understand the differences existing between the engineering and hardware configurations. Obviously they should be identical but often times they are not.

9. If readiness is to be a measure of performance and everyone interviewed thought it must be, how is it to be measured and who is to measure it. In the case of Weapon System B the government retained the authority to measure readiness. But the vendor knows how it is to be measured and their role in it.
10. The same discussion regarding readiness, applies here to reliability measure. Also at this point Reliability must be defined. Recall Weapon System B defined it as cost.
11. The inventory that currently exists in the Army should be transitioned to the PVS vendor for use. The assessment, its ownership, and its use should be addressed in the PWS. It represents a huge investment and could offset PVS costs if the vendor for example chose to needlessly produce new inventory.
12. Capital equipment should also be discussed. If the contracting agency will no longer have need of the equipment, consideration should be given to allowing the PVS contractor assume its control to defray PVS costs for new equipment.
13. It is essentially impossible to implement PVS in a relatively short period of time. A transition plan should be discussed in the PWS and further defined in the contract. Separately priced, it should address all the activity required to put the PVS vendor in the support system.
14. Finally, with any bold contracting or alliance-based arrangement an escape clause should be included. If the PVS contractor is unsuccessful in containing costs for example or the business climate changes due to mergers or market changes the contracting agency must be in a position to extricate themselves in an orderly fashion. Related to this escape clause is the authorized use or generation of proprietary operating or information systems introduced by the PVS contractor. If the contractor is permitted to introduce such systems, it will be very difficult to recover during escape.

3.7 Chapter 3 Summary

In this chapter several key issues have been presented. These include

- A detailed list of the 27 current Weapon System A (MOA) support processes.
- A detailed list of the 9 current Weapon System A (PMO) support processes

- A list of the four major PVS proposed processes accompanied by their sub-processes for use in Weapon System B.
- A consolidation of Weapon System A processes into the four major process topics used in Weapon System B (PVS) processes
- A discussion of the some of the key similarities and differences between the two sets of weapon support (A and B) processes.
- The discussion and process regarding PVS candidate selection and PWS development was presented

4 PROCESS ANALYSIS, RATINGS AND RESULTS

4.1 Introduction

This chapter will first provide more detail concerning the processes presented in Chapter 3. Chapter 3 provided only key similarities and differences between Weapon System A and B processes. In this chapter more detail is provided that was identified during the data gathering process. This additional data was used to assign the process' lean effectiveness ratings that appear in this chapter. Finally subsequent to the process rating assignments, this chapter makes use of both the LEM calibrations assigned in Chapter 2 and the assigned process lean effectiveness ratings, to perform the comparative analysis. A lean index number will be generated to give the reader a relative grade of first how effective the particular weapon support *process* is and second how effective is the overall *weapon system support-process*.

Also in this chapter a review of the research goals is presented to assess the outcome of the lean indexing.

4.2 Process Analysis / Added Detail

During the process gathering phase of this research, more peripheral detail, regarding the organizations and their personnel, was identified. For example task duplication, a lack of process knowledge and a separate system engineering function was found in Weapon System A processes. Conversely additional insight was found in Weapon System B processes that further strengthened the PVS concepts. This detail is provided here to give the reader a sense of how the ratings, which are assigned later in this chapter, were arrived at.

Task Duplication

A great deal of duplication was found in Weapon System A processes. This duplication was found in the Program Management, Integrated Materiel Management and Technical Support and Documentation areas. Specifically duplication was found in Materiel Fielding, Unit Sustainment and Readiness, Implementation of Integrated Logistics

Support Policies, Identification and Coordination of Critical Spare Part Requisitions, Procurement, Evaluation and Maintenance of Technical Data Packages, Procurement of Spares, and Sustainment of Technical Support. In all these areas, both the Army support agency within the context of the MOA and the PMO were claiming to do the same process.

Lack of Process Knowledge

When gathering the process data for Weapon System A, many people knew their processes in generalities, but when asked to provide greater detail, were unable to do so. They used vague terms such as monitor, evaluate or coordinate and when asked how does one monitor, evaluate or coordinate, very few were able to explain their processes.

Separate Systems Engineering Function

The PMO in the current Army support structure has a need for engineering support. There are two factors that require this engineering support, one is the need to improve the system's performance envelop but the other is the need to support the sustainment processes. This second form of engineering support is to be used to solve obsolescence issues, and ensure spare part production contracts are properly executed. This engineering support was not formally associated with the weapon system support processes. It was separately contracted through a second MOA similar to the one referenced in Chapter 2 of this thesis. There was very little connection between the sustainment support MOA and the engineering support MOA. This disconnect is reflected in the wide variation between the reliability lean indices. The PVS concept offers large gains in the reliability process.

Added PVS Insights

The following represents added insights into how the PVS contractor is to execute the PVS concept. There is considerable more detail provided below on the PVS processes over what was provided in Chapter 3. The following nine insights add more detail to the rating process and assisted in arriving at the ratings for the PVS processes..

- The PVS managers intend to be smart buyers. They do not intend to be restricted with the government procurement regulations that emanate from a centralized bureaucracy without meaning or purpose. They expect to use best commercial practices when buying and believe with a high degree of confidence they can generate significant savings.

- All contract money will be dedicated to the support of the weapon system and will not be used for other systems, as is currently being done in the Army. There is a pooling of support dollars in the Army today. This pooling takes funding from those weapon systems who are fully-funded and redistributes the funding to those systems who are under-funded. While this approach works well for the under-funded systems it can harm the fully-funded systems.
- Engineering changes that are beneficial to the support of the system will be implemented. Beneficial engineering changes of the past were never acted upon due to logistics or sustainment impacts. Now that the PVS contractor has control of the logistics system and is to some extent no longer burdened by the Army bureaucracy, these engineering changes will be implemented so their savings can be realized.
- All testing and test equipment will be validated and updated if necessary. In the current support system there is a 40% "no defect found" rate. This means that of all the actions placed on the logistics support system, 40% are unneeded. Therefore once PVS is implemented there will be a 40% reduction in repair actions in the depots.
- The team of experts (60+) to be placed in the field are also expected to further reduce the pipeline requirements by being there to prevent unnecessary support actions getting into the support process, and assist the Army maintainers. Army technicians often replace components in a random fashion searching for the defective one. This type of maintenance places unnecessary actions on the support system. These experts are to eliminate or reduce these type of maintenance actions.
- The issue of repair vs. replace will constantly be reviewed for effectiveness. The Army currently makes the repair decision based on a bloated bureaucracy and on replacement costs reflective of a terribly inefficient repair cycle. Therefore in the PVS contractor's analysis, repair will be "affordable" more times than not. The PVS contractor will reintroduce a common sense analysis to this very important process.
- The 60/40 (government over contractor) control of the depots will remain. The PVS contractor along with the depot leadership, will agree on cycle times, procedures, and

processes to level the flow through the depot. The depot and the PVS contractor will formally agree how and at what rate the flow of work through the depot is to be.

- Use of integrated product and process teams is mandated by both the contract and the performance work statement. This is a major practice in the LEM and one that is being heavily relied upon to generate the relationships needed between both the government and supplier base.
- All support activities will be controlled by the JPO. Recall the current Army organization where all these support agencies are fractured trying to support one system. The JPO will put all support activities under one office, all pulling in one direction. This action alone responds to the Army's need for a single point of accountability

4.3 Assignment of Weapon System (Lean) Effectiveness Ratings

Lean effectiveness ratings are reflective of how effective the particular process is in relation to those principles and practices outlined in the LEM. Similar to the scheme used in Chapter 2 to calibrate the LEM the lean effectiveness ratings are assigned using a 1-5 numerical range. These assignments are based on Army process information gathered during interviews, phone conversations and various discussions held throughout the research for this thesis. These lean effectiveness ratings are patterned after the LEM and its lean principles and practices. Table 4-1 below briefly defines the effectiveness ratings along with their characteristics.

In Table 4.2, effectiveness ratings are assigned to each of the major processes for Weapon Systems A and B. For a pictorial view of the effects of these ratings and the LEM calibrators in the model, refer to Appendix.

Eff. Rating	Characteristic
1	Ineffective, unsatisfying, very costly, not at all transparent, non value additive, excessive number of steps
2	Barely effective, almost satisfying, costly, not completely transparent, non value additive
3	Effective, satisfying, affordable, transparent, value adding, still too many process steps
4	Very effective, efficient, mostly satisfying, affordable, nearly transparent, adds some value
5	Highly effective, few process steps, very satisfying, easily affordable, transparent, value additive

Table 4-1 Support Process Ratings with Accompanying Characteristics

	Program Management	Technical Support and Documentation	Integrated Materiel Management	Reliability Improvement
Weapon System A	2	2	2	1
Weapon System B	3	4	3	3

Table 4-2 Weapon System Support Process Rating Assignments

4.4 The Lean Index (Score) and Other Performance and Research Goals

The following discussion will now make use of the LEM adjustments or calibrators and the process ratings assigned above. Relative scores will be generated simply by multiplying the LEM adjustment or calibrator assigned in Chapter 2 with the rating assigned above. Again the multiplication function is used to capture the two dimensional aspect of the scoring model as outlined in Chapter 1. These scores are shown in Tables 4.3 and 4.4 below.

	Program Management 2	Technical Support and Documentation 2	Integrated Materiel Management 2	Reliability Improvement 1
Enterprise Flow 5	10	10	10	5
Seamless Info 4	8	8	8	4
Opt. Cap. & People 2	4	4	4	2
Low Levl Decisions1	2	2	2	1
IPPD Teams 4	8	8	8	4
Trust/Commitment 5	10	10	10	5
Customer Focus 5	10	10	10	5
Lean Leadership 2	4	4	4	2
Challenge Process 3	6	6	6	3
Learning Org. 3	6	6	6	3
Mature Capability 4	8	8	8	4
Stability 1	2	2	2	1
Index Score	78	78	78	39

Table 4-3 Weapon System A Process Lean Index Scores

	Program Management 3	Technical Support and Documentation 4	Integrated Materiel Management 3	Reliability Improvement 3
Enterprise Flow 5	15	20	15	15
Seamless Info 4	12	16	12	12
Opt. Cap. & People 2	6	8	6	6
Low Levl Decisions1	3	4	3	3
IPPD Teams 4	12	16	12	12
Trust/Commitment 5	15	20	15	15
Customer Focus 5	15	20	15	15
Lean Leadership 2	6	8	6	6
Challenge Process 3	9	12	9	9
Learning Org. 3	9	12	9	9
Mature Capability 4	12	16	12	12
Stability 1	3	4	3	3
Index Score	117	156	117	117

Table 4-4 Weapon System B Process Lean Index Scores

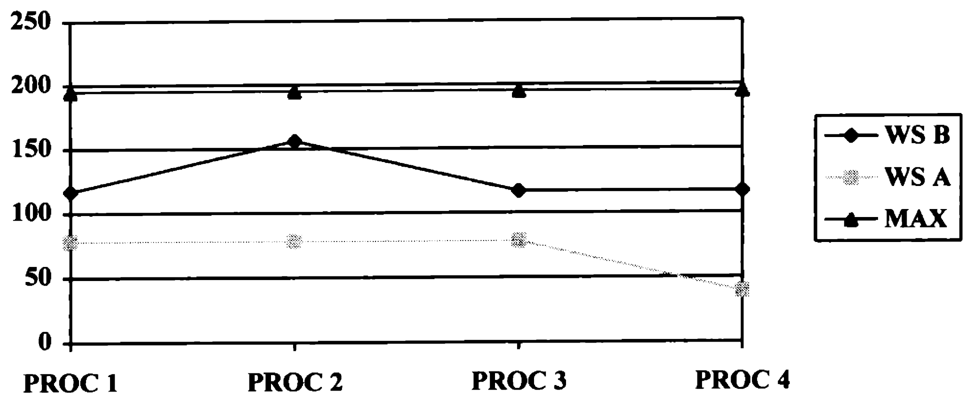

Figure 4-1 Weapon System B vs. Weapon System A vs. Max. Lean Index Score

4.4.1 Performance and Research Goals

While the Index Score is only a relative measure of the individual processes it does give a sense that the processes assessed for Weapon System B are considerably more effective and efficient than those of Weapon System A. For the processes of Program Management and Integrated Materiel Management, Weapon System B represents a 50% increase over Weapon System A. For the process of Technical Support and Documentation Weapon System B provides a 100% increase over the current system and in the Reliability process a 300% increase is noted. However now that the support processes have been presented, it is appropriate to pose several key questions concerning the performance of PVS as it relates to several research goals as outlined in Chapter 1..

Why are the Current (Weapon System A) Processes Underperforming

One of the research goals of this thesis is to assess the current processes and make a determination if they can be improved upon. The current Army processes, if the Army is to continue to support their weapon systems must change. Both the lean indexing above and everyone spoken to during this research reflected universal unhappiness with the current support provided to the weapon systems. There was some disagreement as to why the processes were deficient. Those in the Army logistics agency felt the reduction in funding was to blame. Others thought it was the Army logistics' bureaucratic infrastructure that has been built up over time that made the system inefficient.

The issue of budget reductions is not without merit. It is true that over the past decades the DOD budgets have been declining. Making the supportive business model argument one may posit correctly that with the declining budgets the DOD lost the ability to leverage economies of scale when buying spare parts and therefore support costs have risen. It is also true that the numbers of personnel in the DOD have also been declining. One may now arrive at the conclusion(s) that with the budgets and staff declining an increase in support costs and a decline in service could have been predicted. However this conclusion is not consistent with what has been recorded. The fact is the logistics support has always had a poor perception even when the budgets were high and staff at record levels. Eroding this argument further is the fact that the Army is much smaller than it was earlier in the decade. There is far less hardware to support and the creation of new systems has slowed dramatically. The new systems historically were the most difficult to support. Today however the support involves the continuation of support for legacy systems; systems that should be familiar, hence easier to support.

The issue of the bureaucracy and hierarchical organizations is a credible argument. One might ask; why does all support guidance or structure emanate from the one location, in the Army, that does not support any weapon system, Washington DC? This is a particularly insightful question when one considers the events over the past 5-7 years. Those in Washington have instructed each PMO establish business relationships with all their prime contractors or OEMs. With this instruction the PMOs have established such relationships. Along with these relationships however come a natural tendency to decentralize the Army bureaucracy. As just a brief example, if the PMO sets up long term spare part procurement relationships with the PMOs, why then is it necessary to go through hundreds of bureaucratic administrative steps dictated from the centralized leadership to buy these spare parts? The process has the potential to be solved through decentralization at the PMO level, but yet is forced into the wasteful centralized paradigm from Washington. No one was willing to argue the centralized bureaucracy is a good thing.

Will the PVS Contractor Utilize a Better Set of Processes?

No, was the answer given by the PVS contract business and technical managers. As stated above, the PVS contractors in this case are the same contractors currently producing and supporting Weapon System B in the Army, from a Contractor Logistics Support framework. As mentioned earlier, CLS does not have the flexibility offered by the PVS concept. But the PVS managers agree that the current Army processes are a good framework with which to support the weapon and stated they will continue to frame their support structure after these processes. In other words configuration management will still be performed, test equipment will still be updated and improved, etc. But the point is that neither of these managers intended to eliminate any of the current processes. As stated in Chapter 3 they intend only to leverage them and do them in a more efficient manner.

When asked about the lean aspect, they were familiar with the lean issues. They did not however formally state their efficiency gains are due to "lean" practices or principles per se. They agreed many of their improvements are based on the lean approach. Continuous improvements, optimizing people, establish trusting relationships with their suppliers, mature existing processes, teaming, etc. When shown the LEM they were able to identify improvements in all the practices listed in the LEM.

Will PVS Generate Savings?

Yes, was the answer provided by both the business and technical managers of the PVS contract. A 32% reduction in materiel expenditures alone, is forecasted. They intend to accomplish this by:

- Improving Inventory efficiency and asset visibility by:
    1. Improving requirements forecasting
    2. Increasing inventory rates
    3. Repairing in lieu of procurement
    4. Eliminating obsolete non-reparable assets
- Multiyear requirement procurements
- Creating a certified vendor base
- Reducing repair turnaround time with a 45 day objective
- Improving reliability by reducing maintenance requirements

Further the number of annual operating hours is to be increased 20% from about 100K today to approximately 120K each contracted year. Accompanying this increase in operating time, is a 16% reduction in cost of operation.

Will PVS Reduce Manpower?

The initial answer to this question from the Weapon System B mangers was a reserved, yes. The personnel or manpower referred to here are those government personnel who are currently supporting Weapon System B. The MOA described in Chapter 2 is formalized after the PMO and the support agency agree on what level of manpower support is needed. This process never culminated in an agreement between the support agency and Weapon System B managers (PMO). The two organizations simply argued and negotiated but never reached an agreement. There are no non-collocated personnel in place who have been supporting Weapon System B.

With regard to the personnel collocated with the PMO a similar answer was given. Weapon System B managers claimed there are no personnel in the PMO who are performing such tasks. This research has identified several major topics to be addressed by PVS. They include: Modernization, Best Commercial Practices, Obsolescence Avoidance, Reliability Improvement, Technical support, etc. Each PMO as stated earlier in this thesis, typically has a need for engineering support that is related to engineering issues involving sustainment or postproduction. Surprisingly this was not the case with the Weapon System B PMO. They claimed, that no one in the PMO was working this coordination activity.

Therefore in answer to the research goal of reducing manpower, there does not appear to be anybody supporting Weapon System B in this regard and therefore one must assume there are to be no manpower reductions as a result of PVS. In fact, the JPO is in need of 26 government personnel to staff the office. In this regard PVS will require an apparent increase of 26 personnel from current staffing levels.

Will PVS Limit the *Control* the Army Has Over the Weapon System?

While the answer received from the PVS mangers seem to think PVS will not impose any loss of control of the weapon system the contract states differently. According to the contract, if hostilities occur, the PVS contractor may only be required to deliver spare parts to a pre-designated location in the U.S. From that point the Army would be required to ship the items to their destinations, located within the area of hostilities. This is a serious blow to PVS. It has always been of great advantage to fight as you train. With PVS during peace time the supply availability will be very close to the user and creates the expectation that the supply parts are within just a few hours away.

If hostilities occur the spare part delivery may be delayed for several days or weeks. Further in the case of hostilities if the support processes have settled into a state of equilibrium, pushing the distribution point out by several days or weeks could affect how many parts are left on the shelf or in the pipeline. If too many parts find their way into the pipeline that would leave an insufficient number of assets on the shelf to maintain a repair program. Just as the new parts are delayed in their delivery the defective parts will also be delayed on their way back to the repair station or the depot.

The issue of control becomes important when the support managers cannot go direct to industry to procure necessary assets. With the entire support infrastructure turned over to the PVS contractor, this will introduce another level of complexity resulting in the loss of weapon system control to some degree. Instead of imposing the will of the Army on the support system, the Army will be required to impose itself on the PVS contractor to solve the support problems.

4.5 Chapter 4 Summary

In this chapter several key issues were discussed. These included:

- Before the process ratings were assigned additional pertinent process-related data was identified. The reason for discussing this information was to put the subsequent ratings in perspective.
- The process ratings were subjectively assigned based on information gathered and discussions conducted during the research related to this thesis.
- The lean index numbers were generated to provide a relative association between those support processes used by Weapon System A and those of Weapon System B.
- Finally a discussion is presented that associates the research goals of this thesis with facts relating to the benefits of PVS, why is it better, will it generate savings, will it reduce manpower, etc.

5 CONCLUSIONS, AND RECOMMENDATIONS

This chapter summarizes the key points of the thesis. The benefits of PVS are summarized in the context of what the Army leadership expects of PVS.

5.1 Key Issues

The key motivation of this research was: Can significant savings be generated? Can the current support processes be improved? Are the PVS contractor's processes better than those of the Army? Can the criteria for PVS candidates be identified? Can a generic Performance Work Statement development process be identified? Will the Army lose significant control of the weapon system? and finally will PVS provide the single point of accountability desired by the Army?

The conclusion quite simply is that PVS looks very appealing as a solution.

- Yes significant savings can be generated. A 16% reduction in operating costs accompanied by an increase of operating hours. In addition a 32% decrease in materiel expenditures are to be realized as well. These savings to a large degree are due to process innovation or improvement. As we will see below and heard earlier the PVS contractor wants to use relatively the same processes being employed by the current Army system. This is a key element and a key finding of this thesis. The PVS contractor is able to save $280M in operation and maintenance costs over five years and $255M obsolescence avoidance over the next ten years. All these savings by simply optimizing existing support processes.
- Yes, the PVS processes are better than those of the current Army processes although their basis is the current Army processes. The PVS processes are not better because they reinvented a new way to manage technical data, or provision spare parts. The processes are better because they have been optimized around principles that are closely related to those of the LEM.
- Yes, it is possible to identify PVS selection criteria. As stated in Chapter 1, acquisition reform is sweeping the DOD. Some of it is of great value some of it is not worthy of review. PVS however is being heralded as the Wave of the Future by LTG Kern. Weapon System B has spent nearly two years deciding if their system is

a PVS candidate. This at one point was a hotly contested debate. Other PMOs are now being challenged that they too should implement PVS. There is therefore a significant amount to interest in determining what would make a good PVS candidate and what would not make a good candidate. Having started down the PVS path, changing course may prove difficult. Therefore knowing if the objective system is a good candidate is beneficial.

- Yes, it is possible to identify PVS performance works statement requirements. Likewise with the PVS candidate selection, knowing what to look for in the PVS PWS is also important. A key element of implementing Weapon System B PVS is the "transition." It is estimated that the transition alone will take nearly a year.
- Yes, the Army will loose some degree of control over the weapon, but the savings generated by the PVS concept can be put to use to both modernize and avoid obsolescence, either one of which can end the useful life of the weapon. This is a difficult choice but not an impossible one. In the case of Weapon System B the weapon currently has an sensor which is critically important during armament operations. The sensor is also very unreliable. If this sensor is unreliable it endangers both the operators and those on the battlefield it is designed to protect. Yet the PVS contractor has agreed to redesign the sensor with savings generated from the PVS contract. Therefore by the Army implementing PVS, it does lose some degree of control but in the balance it will receive a weapon system that is more effective and safer to operate.
- Yes, lastly and perhaps most importantly, the PVS approach does offer the single point of accountability that the Army leadership desperately seeks. With the one PVS contractor, costs can be traced directly to each support process, therefore if support funding is reduced, some portion of that support will not be performed. Today because of the pooling effect no one can tell what is getting done and what is not getting done. Budgets get reduced and the weapon readiness continues to remain at acceptable levels for reasons that are not full understood..

So much bureaucracy built up over the years around a totally different paradigm has made PVS appealing. In the abstract though it is not rocket science. And in some cases it is not even "best" business practices. The current system by comparison makes PVS look much better.

For Weapon System B there is no question, the current support system is so ineffective that they are going to PVS regardless, without even so much as looking at or reviewing the new PVS processes. For other systems the future is not so certain. Weapon System A enjoys marginally acceptable support from the logistics agency. Its review of PVS is proceeding in a far more conservative manner. Is it possible that the Army can save itself and solve these problems without the move to PVS? Absolutely. But the change must start at the PMO level not at the Washington level and it must occur in a flexible fashion. Regrettably much of the planning data for future support systems reviewed during the preparation of this thesis, is doomed to fail. It is still based on a centralized, hierarchical logistics agency dictating to the PMOs and weapon mangers. This will not work. The only support function that should be centralized, is perhaps the distribution channel. The distribution channel is the only function that is required from the logistics agencies in the future from a central viewpoint. There is simply no rational reason why the logistics managers need to have continued involvement in the unique details of the weapon system support, Technical Manuals, Spare Part procurements, Fielding, Maintenance, etc. These functions can no longer be accomplished by the centralized paradigm. Each issue is being approached differently by each prime contractor and associated PMO. The notion that the weapon can at some point be transferred to the logistics agency for total support (the current program management dictum) under a rigid set of processes, is no longer possible. Weapon system management is decentralizing at the PMO level. To maintain a support system guided by a one size fits all paradigm simply will no longer work. In the next section several recommendations of how the current system can be made better, without reverting to the PVS alternative are suggested.

5.2 Recommendations

It is quite clear that the top down centralized logistics agency is no longer viable. Because the PMOs are forming close alliances with the prime contractors, the logistics agency must leverage *this* relationship, not one which no longer exists. This chapter includes recommendations that were formulated as a result of the research performed in preparing this thesis. The recommendations are directed at fixing or optimizing the current support processes.

5.2.1 Recommendations for Current Army Support Processes

The following recommendations are directed at improving the current support processes in the Army. They are centered on organizational changes as well as business management changes. These recommendations are consistent with improvement suggestions discussed throughout the data collection process.

- Recommend that all support personnel and processes be placed under the single authority of the pertinent PMO. Figure 5-1 would reflect this type of organization. Note that all highlighted areas reflect those functions currently being done by organizations, other than the PMO. With this centralized organization the likelihood of task duplication is eliminated. The centralized management organization must now take ownership of the support processes. These processes can be tailored to the systems being supported. The PMO now has full authority to alter or otherwise optimize all support processes.

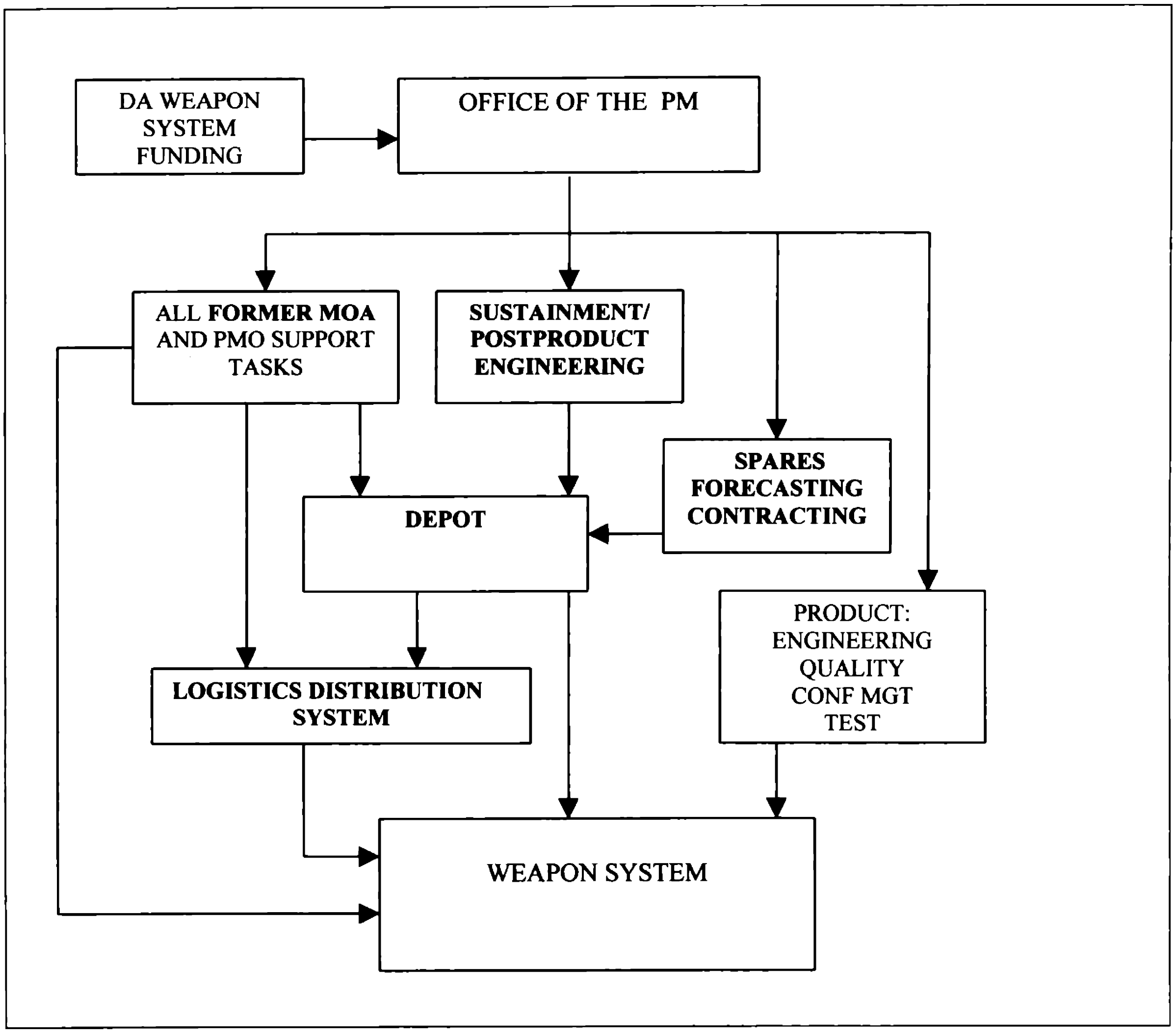

Figure 5-1 Recommended PMO Structure

- Establish transparent Lean processes that clearly add value in the eyes of the customer. Processes which are understood by those who are performing them as well as those who are benefiting from them. In other words the 36 processes reviewed during the preparation of this thesis should be reviewed with the objective of making them weapon system unique, Lean, and value additive. This should be done in the framework of the LEM. As was seen in Chapter 4 there is room for improvement to optimize these processes.

Particularly in the reliability improvement process area. There is a marked reduction in the lean index number representing this process. Reliability is a key parameter tied directly to operating cost and readiness.

Further the Army interface environment forcing the use of Army or Global databases and agencies can be reduced. An optimized lean index table appears below. Note the potential increases by optimizing both the LEM calibrators and the process ratings. Improvements could be gained in the Program Management, Integrated Materiel Management and Reliability processes along with increased calibration numbers in the Personnel Optimization, Decision Levels, Leadership and Stability LEM practices.

	Program Management 5	Technical Support and Documentation 5	Integrated Materiel Management4	Reliability Improvement 4
Enterprise Flow 5	25	25	20	20
Seamless Info 4	20	20	16	16
Opt. Cap. & People4	20	20	16	16
Low Levl Decisions4	20	20	16	16
IPPD Teams 4	20	20	16	16
Trust/Commitment 5	25	25	20	20
Customer Focus 5	25	25	20	20
Lean Leadership 4	20	20	16	16
Challenge Process 5	25	25	20	20
Learning Org. 3	15	15	12	12
Mature Capability 4	20	20	16	16
Stability 3	15	15	12	12
Index Score	250	250	200	200

Table 5-1 Weapon System Processes and LEM Practices Optimized

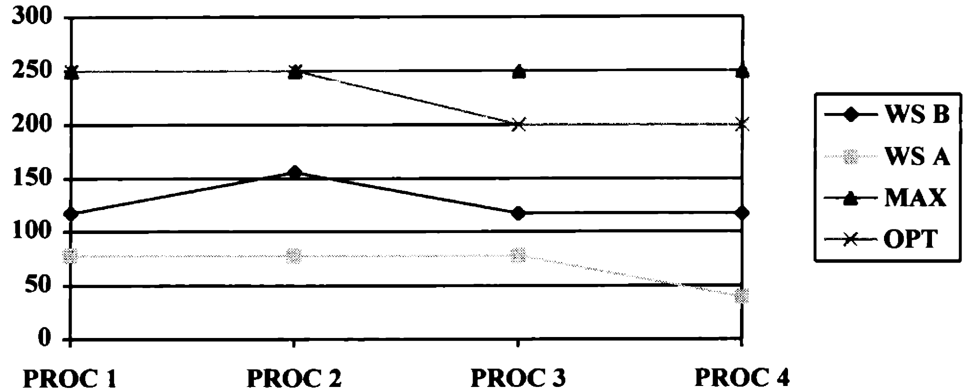

Figure 5-2 Weapon System B vs. Weapon System A vs. Max. vs. Optimized Lean Index Score

- Implement an Activity Based cost accounting system, so that a clear path is shown from the process to the amount of funding expended in the process. This could be done very easily with almost any of the off the shelf time and attendance systems in use today. As discussed in Chapter 4 the pooling of the support money may help the under-funded systems but it also brings degrades the fully-funded systems. Support processes have built into them certain lead-times for procurement. If a system is enjoying relative success and some of its funding is put on another system, by the time the successful system is feeling the effects of underfunding, the lead-time wil! make the case much worse.
- Ensure that every weapon system development program includes an Integrated Logistics Support Plan and that the development closely follows that plan. In both the cases discussed in this thesis the development plans for either the weapon itself or a major modification did not follow a ILSP and therefore made the post-production support far more difficult. In the case of Weapon System A for example, a planned major modification to the powerplant was so poorly planned from the support standpoint, that postproduction support from the OEM was a requirement not an option. The new powerplant was unsupportable because none of the provisioning had been completed, making the planning for spare part procurements impossible.

5.3 Suggestions for Future Research

During the preparation of this thesis and getting the needed support process data in depth, was a problem. It was difficult to determine whether the personnel simply did not know what it was they were doing or were unwilling to share this data. But in any case the current Army support processes need further study and improvement. Some of the support processes require hundreds of steps and several different levels of approval. Many of them seemed far too complex. Optimization of these processes may necessarily include replacement.

Therefore as future research topics, it is suggested that each of these processes be looked at in great detail and reinvented for efficiency. In this regard the LEM will make an outstanding framework with which to do the research. All its practices are generic enough that it can be used for such analysis.

Finally there is need for further work on a Model that would adapt the LEM to the governmental organization. The governmental environment is so restrictive that implementation of the LEM in such an environment will only result in limited success. Further when talking to government managers the LEM and its principle are not seriously considered because of such environmental conditions. A model that appropriately applies the LEM to a governmental will prevent overstatement of the potential outcomes but will also indicate to those managers within the government that the LEM's proponents do recognize the profound differences within the government

APPENDIX

The following diagrams give a notional view of the LEM/Rating Model used in this thesis. All X axes represent the lean effectiveness rating (Chapter 4). All Y axes represent the LEM practice calibrator adjustments (Chapter 2). The relative Index Scores shown in Chapter 4 reflect the resultant area of the product of the LEM calibrator and the lean effectiveness rating. In the optimized process for both effectiveness and environment of each lean practice see Exhibit C below. Exhibits A and B reflect processes which are less effective and in a less restricted environment and more effective in more restrictive environment. The goal is to increase shaded areas by embracing lean principles fully on the one axis (effectiveness) and providing an environment that accommodates lean principles on the other axis (LEM calibration). Exhibits are not to scale.

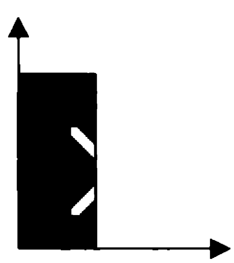

EXHIBIT A

EXHIBIT B

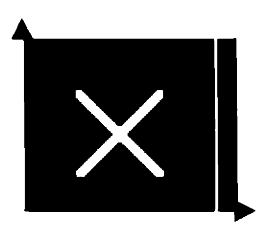

EXHIBIT C

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