U.S. Army Materiel Command

Enterprise Resources Planning (ERP) / Product Data Management (PDM) Integration Team (EPIT) Report

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Prepared by
The AMC ERP/PDM Integration Team (EPIT)

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Executive Summary

Background

The Army Materiel Command (AMC) accomplishes its mission through six Major Subordinate Commands (MSCs) that manage depots, arsenals, ammunition plants, laboratories, and procurement operations. AMC operates in 285 locations worldwide, including over 40 states and 24 countries. Each MSC has utilized some standardized systems, such as the Joint Engineering Data Management and Information Control System (JEDMICS) and the Technical Data / Configuration Management System (TD/CMS), in conjunction with development of site unique systems to support product data for their particular commodity groups. The non-standard solution/system approach was primarily taken because of a lack of AMC centralized funding and centralized support for standard systems or processes. Several MSCs have recently successfully self-funded and self-implemented various commercial Product Data Management (PDM) systems which provide more robust capabilities.

In the fall of 1999, the Commanding General, HQ AMC approved a corporate strategy and AMC Goals and Objectives which stress integrated management of AMC business processes and an enterprise data environment that provides interoperability of information technology.

In January 2001, LTG Beauchamp, Deputy Commanding General of AMC, established the AMC Enterprise Resources Planning (ERP) / Product Data Management (PDM) Integration Team (EPIT) to align engineering business processes and Information Technology (IT) efforts and capabilities with the AMC corporate strategy and with the on-going Wholesale Logistics Modernization Program (WLMP) efforts. The EPIT's basic task was to analyze AMC logistical and product data management processes, determine the correct balance between ERP and PDM systems, analyze the WLMP selected product's (SAP ERP R/3) ability to provide the support needed for product data management, and provide a recommendation for an enterprise product data management solution.

EPIT Study Methodology

To perform the task, the EPIT used a combination of techniques to determine a recommended product data management strategy that satisfied the AMC requirements and was consistent with the overall AMC IT strategy. The techniques included: Internal Analysis, Independent Industry recommendations, Industry Benchmarking, and MSC Functional Expert Interviews.

AMC contracted with CIMdata, Inc., an independent consulting firm, to obtain an unbiased viewpoint and to provide an assessment of AMC's business needs for product data management. CIMdata was also asked to evaluate and recommend possible solution strategies.

CIMdata and the EPIT members jointly conducted interviews with HQ AMC personnel, MSC functional experts, other Services (including DLA) and selected contractor partners. Those interviews were to identify AMC's business requirements for use of product data management, to identify industry best practices for satisfying those requirements and to develop industry benchmarks. The results of this effort were CIMdata reports that identified high-level AMC product data business process requirements and industry best practices, CIMdata's evaluation of alternative solution strategies, estimated costs of each alternative strategy and their recommendations for AMC.

The EPIT, using their own MSC interview and benchmarking results and the CIMdata Business Process Requirements, developed a comprehensive list of high-level AMC requirements and a list of alternative solution strategies. Each proposed solution was evaluated by the EPIT as to its ability to meet AMC requirements, its technical feasibility and its level of risk. An estimate of implementation and operation costs for a 5 year period was prepared for each proposed solution.

EPIT Study Results

The collection of business requirements comprised a combination of system technology requirements, business requirements (policy and process), and cultural change management requirements. These are documented in detail in Section 4.0 of this report and validated the requirements established in MIL-PRF-32029 (MI), Performance Specification, Automated Configuration Management System (ACMS).

The EPIT identified seven potential strategies to be considered for improvement of AMC's product data management capabilities. Assumptions that applied to all alternative strategies are: each must be compliant with the current ACMS performance specification; and that the legal issue of outsourcing of product data repositories must be addressed. The proposed strategies ranged from combining the product data requirements with the current WLMP effort to adopting a hybrid solution proposed by CIMdata. The alternative strategies are:

- *Strategy 1* – Combine with the Wholesale Logistics Modernization Program
- *Strategy 2* - Individual PDM solution, Federated Architecture, Government owned
- *Strategy 3* - Individual PDM solution, Federated Architecture, Government and Contractor owned
- *Strategy 4* - Standard PDM system, Distributed Architecture, Government owned
- *Strategy 5* - Standard PDM system, Distributed Architecture, Government and Contractor owned
- *Strategy 6* - Standard PDM system, Single Instance Architecture, Government owned
- *Strategy 7* - Standard PDM system, Single Instance Architecture, Contractor owned
- *CIMdata Recommended Hybrid Strategy* – A combination of individual MSC systems and WLMP SAP R/3 installations.

Each alternative strategy was evaluated to determine its ability to meet the stated requirements, the risks associated with implementation, other critical factors, and the estimated life cycle costs. Through this analysis, a final recommendation was made.

EPIT Recommendation

Recommended Solution: Based upon the study effort, the EPIT recommends AMC select and implement a standard PDM system, in a distributed architecture, that is Government owned and operated (Strategy 4). In this strategy AMC would select a single standard PDM solution set of hardware and software, which has a separate implementation instance at each site having a justifiable requirement. A single Enterprise Application Integration (EAI) would be developed to provide corporate visibility to all product data and an exchange capability between sites and external customers. There would be one interface to WLMP and that interface would be from the EAI. Both the site solution implementations and the EAI would be owned and maintained by the government. Interoperability would be ensured through a HQ AMC controlled and managed system architecture, including a centrally managed data schema. The recommended strategy has been given the tentative title of ***AMC Enterprise Product Data Management (ePDM) system***.

Benefits: The main benefits of this strategy are that it will provide for a single integration with WLMP and utilize a single data schema and structure and the same commercial-off-the-shelf (COTS) product at each site to create an AMC enterprise ACMS compliant solution. This will satisfy the AMC PDM requirements and modernize the business processes by leveraging best-in-class product data management capabilities found in today's PDM systems and supporting technologies. Centralized management of the hardware, software and data schema will assure consistency of the implementation across all sites while providing the needed Continuity of Operations redundancy. Additionally, implementation at multiple sites will ease the infrastructure burden by placing most of the data files in the locations where they are most frequently used. In the areas of ownership and support, the direct government control offered by this strategy avoids the additional costs associated with outsourcing of data repositories that contain proprietary data. The implementation strategy for this alternative minimizes impacts on the WLMP deployment schedule. This strategy helps AMC move towards the Army Knowledge Management (AKM) goal of total enterprise management of the infrastructure. It standardizes business processes and systems much more than the current situation or some of the other alternatives, although it doesn't totally eliminate redundancy.

Risks: This strategy is not considered a high risk option and appears technically viable. This is not to say everything will be easy, as this strategy requires establishment of a common data schema and common business processes. Other elements of the implementation roadmap include selection of a common material change management system, and completion, revision and validation of the specifications and standards needed for acquiring and exchanging product data.

With a standard system, each site would be required to relinquish control of some processes and would need to clearly define any unique requirements. By having multiple site instances of the standard system there exists the possibility that changes performed at the local level could affect site interoperability over time. Strong centralized management practices can alleviate this concern.

In addition to the risks stated above, it must be noted that this strategy recommends Government ownership of the proposed solution, while current DA and DoD initiatives are to contract out this type of function. The EPIT felt strongly that Government ownership was required, both to address proprietary data concerns as well as to best manage product data as a corporate asset. Although proprietary data concerns can be addressed and overcome in an outsourcing situation, the resource requirements would be extremely significant.

Costs: This strategy will require funding to evaluate and select a single PDM system to support the AMC requirements, implement that solution at each site having a justifiable requirement and to develop the EAI layer using COTS products. The estimated cost has been deleted from this version of the report, but is available to authorized personnel upon request.

Conclusion

A more detailed explanation of the EPIT Study methodology, AMC major business processes, requirements for product data management, alternative solution strategies, evaluation process, rationale for selection of the recommended strategy, expected benefits and a high-level Implementation Plan can all be found in the accompanying report and appendices.

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1.0 Introduction

This report summarizes and documents the results of the Army Materiel Command (AMC) Enterprise Resources Planning (ERP) / Product Data Management (PDM) Integration Team (EPIT) study to select a future product data management strategy for AMC. The EPIT study was co-sponsored by the HQ AMC Deputy Chief of Staff for Research, Development and Acquisition (DCSRDA) and Deputy Chief of Staff for Logistics (DCSLOG) and utilized personnel from all Major Subordinate Commands (MSCs), the Lead AMC Integration Support Office (LAISO) and the U.S. Army Materiel Systems Analysis Activity (AMSAA). This report outlines the AMC business process requirements for product data management, defines eight alternative strategies for modernizing and improving AMC's product data management capabilities, describes the EPIT recommended strategy and associated benefits, risks and associated costs, and proposes an Implementation Plan for that strategy.

2.0 Background

2.1 Current Army Product Data Environment

The AMC accomplishes its mission through six MSCs that manage depots, arsenals, ammunition plants, laboratories, and procurement operations. AMC operates in 285 locations worldwide, including over 40 states and 24 countries. Its 58,000 employees include both military and civilian personnel. AMC manages inventory accounts worth over $7 billion and its business volume ranks AMC among the top ten corporations in the United States. To develop, buy, and maintain materiel for the U.S. Army, AMC works closely with industry, colleges and universities, other military services, and multiple government agencies.

The MSCs are organized around commodity groups (electronics and communications equipment, aviation and missiles, ammunition, tanks, vehicles and armaments, simulators and training devices, soldier support systems and chemical and biological systems) and given a high degree of independence in the management of their commodity items/areas. Over the years, a lack of centralized AMC direction and funding has led to the situation where the MSCs have developed unique business processes and support these processes with non-standard automation systems.

2.1.1 Current Product Data Systems

In the area of Product Data (formerly known as Technical or Engineering Data), a variety of automated data management systems are in place throughout the MSCs. While all MSCs have utilized the DoD standard technical data repository system – Joint Engineering Data Management and Information Control System (JEDMICS), and most have used the AMC standard configuration status accounting system – Technical Data / Configuration Management System (TD/CMS); demands for expanded data management capabilities have led to development or purchase of replacement or enhancement systems. A summary of current MSC product data management systems follows. While not discussed below, the unique systems result in unique business process flows being used by each MSC and a lack of interoperability.

<u>Aviation and Missile Command (AMCOM)</u> – utilizes the JEDMICS data repository system together with a self-developed system for configuration status accounting and technical data package processing for procurement actions known as Interactive Configuration management and Procurement Program (ICAPP). A newer self-developed application, Engineering Data Information System (EDIS), allows for merging of Technical Data Package (TDP) information from ICAPP with the related drawings in JEDMICS to create TDPs on demand. The AMCOM developed Multi-User ECP Automated Review System (MEARS) is used by some organizations to generate and process ECPs. AMCOM has responsibility for two depots – Letterkenny and Corpus Christi, which both have their own JEDMICS systems.

<u>Communications and Electronics Command (CECOM)</u> – has purchased and implemented a commercial Product Data Management (PDM) system, Centra 2000, to provide their data repository and management functionality. At the time of this report, they have migrated most of their data into Centra 2000 and use JEDMICS only for archival purposes. TD/CMS has been shut down and JEDMICS is scheduled for shut down in late 2002. CECOM has one depot, Tobyhanna, under its purview. Tobyhanna has its own JEDMICS system, but is provided access to CECOM's Centra 2000 PDM system as well.

Operational Support Command (OSC) – uses the Rock Island Arsenal JEDMICS data repository system and purchases use of TD/CMS for configuration status accounting and TDP Tracker for TDP procurement review and processing from TACOM. Those systems support OSC's ammunition out loading, procurement, maintenance and demilitarization operations. Depots under OSC control include Blue Grass, Tooele, Sierra, and Hawthorne. Ammunition production and Load, Assemble and Pack (LAP) installations under OSC control include Crane Army Ammunition Activity and six active ammunition plants. Ammunition centers under OSC control are located at Letterkenny and Red River. Arsenals under OSC control include Rock Island and Watervliet. Other repository users include the Defense Ammunition Center and School, Quality Assurance Specialist Ammunition Surveillance (QASAS) personnel in the field, and non-Army personnel i.e., DLA.

Soldier and Biological Chemical Command (SBCCOM) – has purchased and implemented a commercial PDM system, Product Center, to provide their data repository and management functionality. They have discontinued use of JEDMICS for their own purposes, but do provide copies of their product data to the Rock Island Arsenal JEDMICS for use by non-SBCCOM personnel. This practice is expected to be discontinued in the future.

Simulation, Training and Instrumentation Command (STRICOM) – has no internal product data repository or management systems of their own. Some product data is stored in a Navy JEDMICS facility, but most active product data has been given to logistics support contractors to store, manage and maintain as part of their overall logistics support responsibilities for training systems and simulators.

Tank-automotive and Armaments Command (TACOM) – has different scenarios at each of its three command sites. The Warren, MI site has recently purchased and implemented a commercial PDM system, Windchill, to provide its data repository and management functionality. Warren is in the process of migrating all product data from their JEDMICS and TD/CMS systems into Windchill, and will soon shut-down both of these older systems. The Picatinny, NJ site continues use of JEDMICS as a product data repository system and uses a combination of TD/CMS and self developed systems such as TDP Tracker, Viewer, ProductView, and WebTDP to manage item and product data configuration and to support review of TDPs for use in procurements. TDP's are now created and provided via the Web for item and spare parts buys, and also for solicitations and bidding. Integration with the Joint Computer-aided Acquisition and Logistics Support (JCALS) system has been accomplished for interaction of Procurement Work Directives from the Acquisition Customer. Picatinny provides engineering and design support to OSC so these systems are also used by OSC personnel. The Rock Island, IL site relies on a combination of the Rock Island and Picatinny JEDMICS, TD/CMS and TDP Tracker systems to provide access to product data. TACOM has two depots, Red River and Anniston which have their own JEDMICS systems. TACOM plans to expand their implementation of Windchill to Picatinny, Rock Island and their depots in the near future.

2.1.2 Current Product Data Problems

Legacy technical data storage and management systems such as JEDMICS and TD/CMS cannot provide the enhanced capabilities that are required by the Army, and available in today's commercial PDM systems. System limitations cause AMC to take a "document centric" approach to product data management (treat all data files as if they were paper documents with no relationship to one another) rather than a "part centric" approach (relate all data files to the part/item they concern and to each other). Data contained in JEDMICS is primarily stored as 2D raster images of drawings, rather than 3D Computer-Aided Design (CAD) models with associated metadata. This choice of data format costs AMC and any other producers of the items the use of the "intelligence" that was inherent in the model and metadata, and forces them to reinvent this intelligence for each successive procurement. In this situation AMC incurs additional costs for the creation of a "Government requested" special format (i.e. raster). TD/CMS also cannot identify and manage multiple product baselines (current, previous and alternate product configurations) which forces logistics maintainers and depots to rely on unofficial sources of product data to support repairs and modifications.

Government manufacturing and repair facilities (arsenals and depots) often are not aware of and/or do not have access to MSC data repositories and data management systems such as TD/CMS. The lack of access to official and current product data causes these organic facilities to expend considerable time and resources tracking down the data from a variety of sources, and still not necessarily obtain all of the required current data. As an example, Rock Island Arsenal (RIA) has faced this problem when producing M1A1 Gun Mounts. They are not provided a full detailed TDP as part of the procurement package and were not provided access to the TD/CMS to obtain a current TDP list (TDPL).

The proliferation of different automated data management systems throughout AMC has resulted in site-specific solutions that may meet many, if not all, of each site's specific needs, but do not provide intra-MSC data access, sharing or collaboration capabilities. There are no interface systems or techniques currently in place at any MSC to allow automated access between systems or exchange of metadata between systems such that it is usable by other systems without manual re-entry and manipulation. The lack of data

sharing and collaboration capabilities between MSCs is one of the factors that has led to the on-going effort to establish an AMC "virtual" Research, Development and Engineering Subordinate Command, in order that design ideas and technologies from one R&D center can be readily shared with and leveraged by personnel at other centers. Similarly, there is no capability to interact with any weapon system Program Management Office Integrated Digital Environment (IDE) or Contractor Integrated Technical Information Service (CITIS), or Industry partner data management system for access or exchange of product data.

There have been various attempts in the past to standardize and centralize the modernization of AMC's product data management systems, but they failed due to a lack of AMC resources for centralized funding. Examples of prior centralized modernization attempts include:

- A standardized Automated Configuration Management System (ACMS) Implementation Plan proposed in May 1998 which proposed selection and implementation of an ACMS compliant system at all MSCs.
- A standardized JEDMICS Replacement Plan proposed November 1999 which proposed an AMC centrally managed and funded upgrade of AMC JEDMICS and TD/CMS systems to ACMS compliant systems.

Both of these proposals were rejected primarily due to a lack of centralized funding. The MSCs were also concerned about any central solution's ability to meet site-specific needs.

Absent any AMC centralized funding, the MSC engineering community committed to a Performance Specification based approach to modernization. The AMC Product Data Functional Coordinating Group (PD FCG) developed a performance specification that described the functional requirements of a modern product data management solution. Titled the Automated Configuration Management System (ACMS) Performance Specification (MIL-PRF-32029 (MI)), it was published in June 1998. Under the performance specification based approach, each MSC would move toward an ACMS compliant product data management solution, would support maintenance and improvement of the ACMS Performance Specification and would self-fund ACMS requirements that support their site-specific business processes and needs. The PD FCG developed a Tactical Plan that defined projects necessary to achieve ACMS compliance, but none have been funded to date. No definite schedule for MSC ACMS compliance has been established, but three of the MSCs (CECOM, SBCCOM and TACOM) have self-funded and successfully implemented PDM modernization efforts. These MSCs have realized productivity improvements and cost savings as a result of their use of PDM technology.

2.2 Establishment of EPIT

In the fall of 1999, the Commanding General (CG), Headquarters, AMC approved a corporate strategy whose objectives included integrated management of AMC business processes and an enterprise data environment that provides interoperability of information technology. The Army is taking a major step forward in the modernization of AMC's related Information Technology (IT) capabilities and services in a way that will improve the efficiency and productivity of those core activities. Key to the success of that program is the Command-wide commitment to optimize the benefits that can, and must, be derived from providing a modern solution for product data management business process requirements.

In January 2001, LTG Roy Beauchamp, Deputy Commanding General of AMC, initiated action for establishing the ERP/PDM Integration Team (EPIT) to align logistics and engineering business processes and IT expenditures with the AMC vision and corporate strategy. The EPIT charter was approved on August 16, 2001and a copy of the charter is provided at Appendix A. The EPIT was specifically tasked to:

a. Conduct an analysis of logistical and product data management processes to determine all touch points.

b. Focus the analysis upon product data requirements for engineering purposes and for support of logistics requirements.

c. Determine the correct balance of ERP and PDM systems.

d. Answer the questions:
   (1) Is there a need to interface, integrate or encapsulate ERP and PDM systems?

(2) If the EPIT sees advantages to using ERP technology, analyze the Wholesale Logistics Modernization Program's (WLMP) selected product's (SAP ERP R/3) ability to provide the process support needed for product definition.

The EPIT is comprised of personnel from the MSC logistics, engineering and procurement business communities. It is co-chaired by Mr. Jim Knowles, AMC Deputy Chief of Staff for Research, Development and Acquisition (DCSRDA), and Mr. Ron Lewis, Director, Lead AMC Integration Support Office (LAISO). Representatives from the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)) and the Army Program Executive Officer (PEO) structure were invited to participate on the EPIT to ensure that Army Program/Project/Product Manager (PM) PDM needs were considered and addressed in any recommendations. A Senior Steering Group (SSG) was also established to provide HQ AMC and MSC senior management supervision, guidance and review of EPIT actions/recommendations. The SSG is comprised of MSC Integrated Materiel Management Center (IMMC) Directors, Senior Engineers, and Principal Assistants Responsible for Contracting (PARC). The SSG is co-chaired by Mr. Harrel (Dick) Barnett, AMC Assistant Deputy Chief of Staff for Research, Development and Acquisition (DCSRDA) and Mr. Larry Schueble, AMC Assistant Deputy Chief of Staff for Logistics (DCSLOG). EPIT and SSG membership rosters are provided at Appendix B.

The AMC DCG, DCSLOG and DCSRDA are the final decision authority for all EPIT and EPIT SSG issues and recommendations.

2.3 What is the Wholesale Logistics Modernization Program (WLMP)?

2.3.1 Background

The U.S. Army's wholesale logistics processes are currently supported by two primary computer systems: the Commodity Command Standard System (CCSS) and the Standard Depot System (SDS). These major systems are interconnected with numerous other related subsystems. Written mostly in COBOL 74 code, this combination of systems has evolved into a complex, tightly integrated solution that is difficult to maintain and adapt for changing needs.

AMC tasked CECOM to acquire a service to modernize the Army's wholesale logistics management systems through the adoption of best commercial practices in both system selection and business process re-engineering. The WLMP was initiated to provide the required modernization and sustainment of the Army's wholesale logistics business processes. To achieve this end, AMC formed a long-term, strategic alliance, via a 10-year services contract, with Computer Sciences Corporation (CSC). The Defense Information Systems Agency (DISA) will provide data processing for the transferred legacy systems (CCSS and SDS) until transition. CSC will be responsible for providing the data processing services after transition. Using an application service provider (ASP) model, CSC will maintain the necessary licenses and manage the solution configuration to enable the modernized services. CSC will focus on delivering business processes that support the AMC logistical requirements. CSC is acting as the prime contractor for WLMP and sub-contracting activities to a number of other systems integration service companies, including IBM, KPMG, and others. CSC's WLMP solution is based upon commercial-off-the-shelf (COTS) SAP ERP R/3 software. According to CSC, all SAP modules were licensed, except payroll, for use within WLMP. CSC will maintain two data centers to provide WLMP capabilities. The Chambersburg, PA facility will be the prime WLMP site. The St. Louis, MO site will provide back-up and will also be used to support training and other uses. The two independent instances will be synchronized hourly through log files. WLMP deployment is currently scheduled to begin at CECOM on January 2003.

2.3.2 Expected Benefits

Modernization of the wholesale logistics process will result in streamlined business processes through use of industry "best practices". The WLMP will provide AMC a more flexible, adaptable, and responsive wholesale logistics process that will significantly improve AMC's service to its users. Use of an ERP system will advance "seamlessness" of wholesale and retail logistics and gives AMC an agile, responsive logistics infrastructure. WLMP provides global asset visibility, with integrated logistics and financial data, and integration of Budget and Financial Management processes. All participating MSC's logistics data will be standardized and will be resident in a central Business Warehouse to facilitate AMC reporting requirements.

2.4 What are PDM and ERP Systems?

In order to fully appreciate the EPIT study findings and recommendations, a brief description of generic PDM and ERP system technology, capabilities and industry uses is in order. Much of the material in this section of the report is extracted from a CIMdata article – *Integrating ERP and PDM*, published in the industry publication "CAE and Midrange ERP" in March 1999.

2.4.1 Product Data Management (PDM) systems

Evolving from engineering efforts in the 1980s, PDM systems were first used primarily to manage engineering drawings and related Computer-Aided Design (CAD) files. The technology eventually expanded to include management of data from a variety of separate applications including mechanical drafting, solid modelers, structural analysis, electronic CAD (ECAD), Numerical Control (NC) programming, and others such as technical publications and office applications. In this capacity, PDM systems manage a variety of engineering data and processes including design geometry, project plans, part files, assembly diagrams, analysis results, correspondence, bills of materials, specifications, engineering changes, approval processes, product structure, parts classification and retrieval, configuration management, program management, authorizations, workflow, and others.

2.4.2 Enterprise Resources Planning (ERP) systems

ERP systems trace their roots to manufacturing initiatives in the 1960s, evolving from Material Requirements Planning (MRP) systems for inventory planning and control and later Manufacturing Resource Planning (MRP II) technology which expanded into shop floor scheduling and coordination. These systems broadened into what is now termed ERP, which encompasses numerous aspects of production such as inventory control, shop scheduling, capacity planning, and master scheduling as well as purchasing, sales, accounting, and even human resources in many cases. By coordinating production operations for peak efficiency, ERP has become virtually indispensable for manufacturers to reduce manufacturing time and cost as well as facilitate teamwork and collaboration on the factory floor.

2.4.3 Integration of PDM and ERP systems

As both PDM and ERP system technologies have expanded, a growing number of areas have started to overlap including bills of material, parts classification, component information, configuration management, process workflow, and program management. And with all the apparent overlap between the two technologies, many companies are questioning the need for separate systems for PDM and ERP. An obvious issue is whether an ERP system can provide sufficient capabilities to eliminate the need for a separate PDM system.

For manufacturing-centric companies that place much greater emphasis on manufacturing efficiency than design innovation, the level of PDM provided by an ERP system may suffice. On the other hand, engineering-centric companies with considerable focus on product design and development may find the limited PDM functionality contained in a typical ERP system to be overly restrictive. In general, the applications integration routinely provided by PDM systems in installations with multiple CAD tools and other programs is not yet well supported by most ERP systems. Also, user interfaces in ERP systems are typically relatively restrictive and cumbersome, with engineering-based users often quick to reject them as unusable in favor of the more flexible and accommodating ones in PDM systems. And whereas document management is considered a basic capability in PDM, the concept of managing vaults of documents and files is fairly new to ERP systems and often very poorly supported. In addition, most ERP systems lack the flexibility of PDM systems for tailoring and customization, instead requiring users to change company operations, processes, and workflow to match the procedures and capabilities of the ERP system.

The relative strengths and weaknesses of each general type of system together with a need for enterprise-wide data management and exchange capabilities have led most aerospace and defense companies to choose both PDM and ERP systems and attempt to integrate the two. Unfortunately, integration of the two technologies is far from simple. One of the biggest problems is the fact they share some similar functionality and data but use them for different purposes. For example, one of the most extensive areas of overlap between ERP and PDM exists in product structure management. Product structures are at the heart of ERP systems, defining parts and how they are put together on the shop floor. Typically, this information is reflected in "as-planned" or "as-manufactured" views that drive manufacturing and assembly, so it is oriented toward materials and production processes. Likewise, product structures are central to PDM but are more functionally oriented toward product capabilities and how they are configured. This technology is

influenced by design engineers to reflect “as-designed” views developed in CAD systems. These product structures are coupled with documents, product information, processes, etc. to provide full definitions of the product configuration. Both of these views of product structure are valid and necessary. But unfortunately, most PDM and ERP systems have only limited capabilities for handling each others' perspectives of data.

Because of the huge overlaps of data and functionality, most companies using PDM and ERP systems view integration between the two as a natural step and see the product structure as the primary link between the two systems. Benefits are compelling for companies to integrate. Transferring information quickly and accurately between engineering and manufacturing speeds workflow, improves communication throughout the organization, and avoids redundant efforts along with reducing associated errors and delays in re-creating data. This provides an ability to leverage efforts so that data already entered in one area doesn't have to be recreated in another.

The EPIT has determined that, like any large aerospace or defense company, AMC requires both PDM and ERP systems in order to support its development, acquisition, manufacturing and logistics support missions.

3.0 EPIT Study Methodology

To perform its task, the EPIT used a combination of four techniques to lead to a recommended product data management strategy. The techniques included: Internal Analysis by the EPIT, Independent Industry Recommendations, MSC Interviews and Benchmarking.

3.1 Internal EPIT Analysis

In order to make the most effective use of resources and complete the study in a timely manner, the EPIT membership was divided into three subteams with each responsible for a different aspect of the study.

Requirements Subteam – responsible for developing a definition of product data, a determination of AMC’s business requirements for product data management and the touch-points between engineering, procurement and logistics communities.

Alternative Solutions Subteam – responsible for development of alternative solution strategies and an Implementation Plan for the selected strategy.

Evaluation Subteam – responsible for development of the criteria and process used to evaluate the alternative solution strategies against the requirements and arrive at a recommendation.

The outputs of the subteams are presented in Section 4.0 of this report.

3.2 Independent Industry Recommendation - CIMdata Inc.

To perform this study, the EPIT sought to obtain an unbiased industry viewpoint and assessment of AMC’s business needs for product data management. To obtain this industry input, the EPIT contracted with CIMdata, Inc. CIMdata provides world-class knowledge and expertise on the use of collaborative Product Definition management (cPDm) solutions that utilize best-practices methods, and related technologies such as PDM, visualization, collaboration, Collaborative Product Commerce (CPC), document management, Component Supplier Management (CSM), Configuration Management (CM), software configuration management, enterprise application integration, computer-aided design/ manufacturing (CAD/CAM), and numerical control (NC). Since CIMdata is not a developer or seller of PDM or ERP products, it serves as an unbiased independent consulting firm that evaluates many commercial

products and provides its assessments to vendors and commercial companies. CIMdata's knowledge, experience and independence are well known within the PDM, ERP and CAD/CAM industry.

CIMdata was tasked to perform the following work for the EPIT:

- Conduct interviews with MSCs, HQ AMC, other Services and selected contractor partners to identify AMC's business requirements for use of Product Definition Data (PDD) (Note: CIMdata uses the term PDD in the same way the EPIT uses the term Product Data).
- Document high-level PDD business process requirements for AMC
- Evaluate alternative solution strategies against these requirements as well as cost, risk, and other considerations
- Make recommendations to the EPIT

CIMdata documented the results of their analysis in three contract deliverables:

- AMC High-Level Business Process Requirements for product data
- Evaluation & Assessment of alternative solution approaches to meet requirements and provide a recommended approach.
- Briefings to the EPIT and HQ AMC Senior Management

Copies of the CIMdata reports, *AMC Product Definition Data Business Process Requirements Analysis* and *AMC Product Definition Data Management Alternatives Analysis*, are available upon request. Information from these two reports was used extensively by the EPIT in its study effort.

3.3 MSC Interviews

In order to aid the EPIT in gathering the total AMC product data requirements, to verify the needs and motivations of different organizations, to identify the "touch points" between the engineering, procurement and logistics communities and to determine the correct balance between PDM and ERP systems, a series of interviews were conducted. Those interviewed represented a cross-section of the organizations and users of product data including program managers, designers, engineers, testing, quality, document control, and purchasing specialists, information technology experts and managers. EPIT members and CIMdata attended all of the interview sessions held over a seven-week period during August - October 2001. The organizations interviewed were:

- Six AMC Major Subordinate Commands (AMCOM, CECOM, OSC, SBCCOM, STRICOM, TACOM), including their depots
- Selected contractor partners (Lockheed-Martin, SAIC, Boeing, ITT, United Defense LP, Alliant Techsystems)
- Headquarters, Defense Logistics Agency (DLA)
- Wholesale Logistics Modernization Program (WLMP) Program Management Office

3.4 Benchmarking

In addition to the interviews above and using CIMdata to get an industry perspective, the EPIT visited several major businesses that utilize both ERP and PDM systems to manage their product data in the hopes of benchmarking their lessons learned. The companies visited were: Rockwell Collins on July 19, 2001, Lockheed Martin on July 24, 2001, and John Deere on August 20, 2001. During the course of the EPIT study, we became aware of a Canadian Ministry of Defense implementation of the same system as WLMP - SAP ERP R/3. Visits were made to their Montreal Program Management office on October 15, 2001 and January 23, 2002 to conduct detailed discussions. A telephonic interview was conducted with Compaq Computer Corp on March 20, 2002.

4.0 EPIT Study Results

4.1 MSC Interview Results

The MSC interviews resulted in a long list of findings and observations included at Appendix C. However, there were a number of areas that the interviewees identified repeatedly (across organizations) as being the primary product data concerns.

- A clear definition is needed of AMC mission requirements regarding product data. With the advent of Acquisition Reform, this area has become unclear, especially between the PEO/PM offices and the MSCs.
- Policies and guidance for the acquisition, use, access and maintenance of product data are needed from both AMC and above. While the DoD 5000 series of documents gives general guidance, they are generic enough in nature to allow each PEO/PM to implement in totally dissimilar methods, making support extremely difficult, if not impossible, later in the life cycle.
- A clear definition of data ownership requirements is needed. The term "data ownership" includes defining who owns the data (has legal rights to), who is responsible for controlling changes to the official "copy of record", and who to contact to obtain access to the most current data. This issue goes hand-in-hand with the previous two.
- Complete visibility is needed of all AMC product data held by the PMs, MSCs and their contractors.
- A standardized product data change management process is needed to assure that all organizations concerned with those changes (including DLA) are included in the review process, to automate the process and to provide historical traceability.
- A standardized data exchange mechanism needs to be identified and directed for use to support the CITIS philosophy and to provide for data exchange between commands, between services and between AMC and its support contractors.
- The infrastructure requirements to support an AMC standard system are significant, but unknown. If the infrastructure problems within and among the MSCs are not resolved, no enterprise system will work.

4.2 Benchmarking Results

While not known beforehand, most of the companies selected for benchmarking have been long-time users of the SAP ERP system, but chose a different vendor's PDM system to complete their corporate data environment. Reasons for this decision include the lack of maturity of the SAP Product Lifecycle Management (PLM) product, its lack of a strong customer base in the United States, its lack of strong support for the dynamic changes in product configuration typically associated with design/development organizations and the relative inflexibility of SAP's underlying data model. Both Rockwell Collins and Lockheed Martin made their decisions years ago, when SAP PLM first came on the scene, and it could be argued that its newness was a much more critical issue than it is today. However, John Deere made their decision not to use SAP PLM as their corporate PDM system as recently as October 2001, for the same reasons stated above. Late in our study a telephone interview was conducted with Compaq Computer Corp. Compaq is one of the few U.S. companies who are using both the SAP ERP and PLM products. Compaq chose PLM primarily for its ease of integration with their existing SAP ERP system. They recognize its limitations in the areas of collaboration and design/development, but hope that SAP's forthcoming Product Designer tool will address these weaknesses. (Note: Product Lifecycle Management (PLM) is the product name SAP has given to the suite of R/3 functionality that directly compares with other commercial vendor's PDM software).

The Canadian Ministry of Defense has implemented SAP ERP R/3 for their Materiel Acquisition & Support Information System (MASIS), which will eventually include the majority of their business areas in Materiel Acquisition and Support. While initially implemented just to provide shop floor control and inventory management of selected maintenance facilities, the Canadians plan on extending it, using SAP PLM, to also address Configuration Management, Technical Data Management, Document Management and Procurement Management.

The following key "lessons learned" surfaced during the industry benchmarking process:

- Mindset and cultural change were the biggest challenges faced by those organizations. Management must participate and accept these changes not just direct them.

- Implementation and use of a PDM or ERP system must become a way of life and must not be treated as a short-term project. They have lasting implications on the organization and its people.
- Selection of a PDM system must be based upon the merits of the available solutions. Although a single enterprise product (a single PDM or ERP system that does everything) is most desirable, enterprise solutions must enable the enterprise to perform and improve its performance. Most companies have implemented an enterprise "solution set" that is comprised of a collection of applications (PDM, ERP, CSM, CAD, etc.) that together best achieves the required functionality.
- With SAP ERP you have a high amount of flexibility to set things up initially, but once the decisions have been made and the system has been configured it becomes very difficult to change. Companies consider this difficulty in changing SAP's configuration to be an asset in their efforts to enforce corporate business processes, but warned that configuration choices must be correct for the enterprise from the beginning.
- Most companies using both PDM and ERP systems establish the business rule that engineering will maintain control of design data within the PDM system. The master Bill of Material for the "as designed" configuration is stored in the PDM system and transmitted to the ERP and other systems as needed.
- SAP offers various industry sector versions of their ERP R/3 product. The two most applicable to AMC are the Public Sector version and the Aerospace & Defense Sector version. Some companies initially chose one version and later realized another would be more useful to them. Unfortunately, changing versions after-the-fact can be cost prohibitive. A "lesson learned" from this is to pick your SAP Industry Solution very carefully because you'll be living with it for a long time!

A more detailed set of benchmarking results can be found in Appendix D.

4.3 Business Requirements for Product Data

4.3.1 AMC Vision for Product Data

The EPIT proposes that AMC's vision for Product Data should be: ***A rapid, accurate, reliable and seamless flow of the right product data, where and when required, between authorized users in the engineering, procurement and logistics communities.***

4.3.2 AMC Definition of Product Data

In order to appreciate the above stated vision, the reader must first understand what is meant by the term "product data". Based on current industry and DoD views of the data that defines products, the EPIT Requirements Subteam developed the following definition of product data:

Product Data - denotes the totality of data elements and key relationships required to completely define a product. Product data includes geometry, topology, relationships, tolerances, attributes, and features for mechanical and electronic components, software and documentation necessary to completely define a component part or an assembly of parts for the purpose of design, analysis, manufacture, test, inspection, use, support and disposal.

In the past, the Army used the terms "Engineering Data" and "Technical Data" to primarily refer to the Technical Data Packages (TDPs) consisting of drawings, specifications, and lists that described how an item was designed and manufactured. "Product Data" is a newer term and it can be seen from the above definition that it encompasses a broader range of data elements than the prior terms. Also, note that the definition is totally independent of the type of automated data management system (PDM, ERP, or other) that houses the data. Product data could be housed in a PDM system or an ERP system or both, depending on the use to which the data is put and the functionality required by the users.

Most of the Army's product data is created by development contractors, although some is created in-house by MSC Research, Development and Engineering Centers (RDECs). PMs and MSCs buy or acquire rights to access, review and use product data throughout the life of a product.

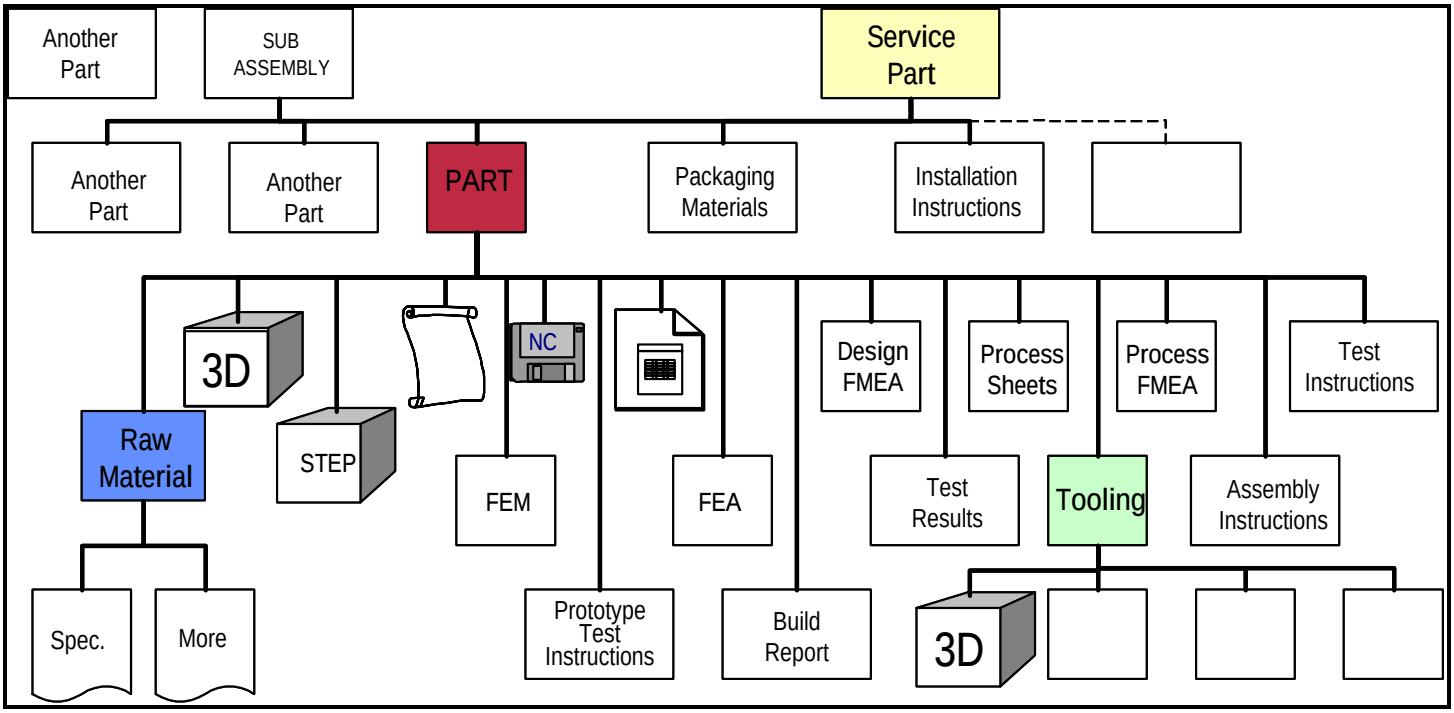
Many people and organizations throughout the Army, DoD and industry use Army product data. RDECs and analysis organizations use it for modeling, simulation, analysis and concept exploration. Item Managers use it to define requirements for end-items and spare parts. Contract Specialists use it in end-item analysis and to buy parts/end items. Logistic support personnel use it to develop

provisioning data and technical manuals and to perform maintenance actions (both organic and contractor). Demilitarization support personnel use it to perform disposal actions. The Army, as a corporation, must access and maintain product data throughout the weapon system lifecycle.

Common examples of types of product data include:

- Technical Data Packages
  - Drawings
  - Specifications
- CAD Models
- Engineering Change Proposals (ECPs), Notices of Revision (NORs), Requests for Waiver (RFW)
- Configuration Management information (metadata)
- Manufacturing Instructions
- Bills of Materials (BOMs) / Parts Lists
- Supplier Information (vendors, Part Numbers, etc)
- Test Results
- Performance Characteristics (how fast?, how far?, how high?, etc), Disposal Instructions

This is not an all inclusive list, and for any given item the Government may have ownership/legal rights to none, some or all of the associated product data. Additionally, product data can reside in many different forms and formats. Figure 1 shows a graphical illustration of the different documents and other data forms that can comprise "product data" for a given part or item.



Source: CIMdata, Inc.

Figure 1

4.3.3 AMC Major Business Processes

The EPIT used the missions of AMC and the MSCs, together with the lifecycle of product data, to define the set of major business processes AMC uses to create, modify, manage, and use product data. The AMC and MSC mission lifecycle consists of: Develop , Acquire, Equip, Sustain and Decommission. The major business processes span the areas of engineering, procurement and logistics and include:

- ***Concept Development*** - Developing new system concepts is an important part of providing AMC's customers with the latest, most capable systems. Much of the concept data, which is created during the concept development phase of the product lifecycle, is not currently captured as part of the product data set
- ***Requirements Management*** - Requirements captured as part of concept development are passed on to other phases of the development process. The ability to trace requirements all the way through to their fulfillment as part of the evolving product structure is an essential part of any world-class configuration management process. Any effort at product data management should take full advantage of the requirements management expertise and systems Army contractors are developing to meet and exceed IDE requirements.
- ***Performance Specifications*** – While acquisitions based solely on performance specifications are becoming more common across the Department of Defense (DoD), many users expressed a frustration that this process can be misapplied in a shortsighted manner. Decisions to use performance specifications may be based solely on the upfront costs and not the weapon system sustainment activities. This misapplication can thereby increase total cost across the lifecycle by not providing the detailed product data needed for sustainment operations.
- ***Tech Loop, Procurement Package Input (PPI) and Contracting*** - Integral to the PPI and Contracting Process is the Technical Data Package (TDP) preparation (Tech Loop) process. Through this process, many organizations are required to provide inputs, revisions, and attach additional documentation to complete the TDP. Some MSCs are using workflow functionality to support this process, such as the use of JCALS Work Flow Manager at TACOM. The Tech Loop process assures that the TDPs are complete and validated.
- ***Configuration/Change Management*** – MSCs have configuration management (CM) responsibility for many items. CM and change control processes normally require significant technical communication among and between the MSCs and their contractors. Some of this communication occurs electronically using systems such as JCALS and MEARS. However, it appears that much more is performed in person, over the phone, and is paper-based. Configuration Control Boards (CCBs) make decisions about change classes, and engage technical experts from different disciplines to ensure that any changes, deviations, or waivers do not affect an item's ability to meet or exceed its requirements. Problems in configuration and change management arise from fragmented product data management, data integrity, and configuration management responsibility.
- ***Tech Manuals*** - Technical manuals that support training, item usage, and maintenance are normally developed concurrently with the end items. Changes to the product data necessary to update manuals may not be received in a timely fashion. Updating these documents is primarily a manual process, with MSC staff, both engineering and technical manual developers, often redrawing 2D and 3D diagrams that could readily be exported from CAD models. The contractors, in many cases, have the models but are required to deliver 2D CALS raster images for storage in JEDMICS. Beyond paper manuals, 3D models could also be used to construct assembly/disassembly sequences, which is a common practice in commercial organizations using such tools.
- ***Working with Depots*** - Depots also require up-to-date product data, as well as current technical manuals to support on-going repairs and modifications. The interviewees mentioned problems accessing data in repositories, such as from varying instances of JEDMICS. In some cases, depots have their own unsynchronized JEDMICS instances, which results in non-value added product data maintenance efforts or broken configuration management of design revisions.
- ***Feedback from the Field*** - Information from users and field maintenance personnel is essential to close the information loop in the product management lifecycle. While some of this data is captured, it needs to be more effectively integrated within a PDM environment. This data and its management will provide, in effect, the equivalent of commercial Customer Relationship Management (CRM) functionality. It will allow customer feedback on the acceptability and usability of the product as well as problems to be resolved in subsequent versions for the product. Maintenance records as well as "as-maintained" configurations (i.e., what is actually in the field) must be more effectively managed. Keeping track of these configurations will make the provisioning and modification processes much more efficient at a significantly reduced cost. It will also allow AMC to better and more quickly understand the readiness of fielded materiel.

4.3.4 Process "Touch" Points between Logistics, Engineering and Procurement Data Management Systems

For some years now the trend in private industry has been towards collaborative work efforts, collaboration between different disciplines within an organization as well as collaboration between organizations. Under the concept of collaboration, one tends to think of an Integrated Product Team (IPT) working together to accomplish a common task and resolve problems that arise. This can work nicely when the team members are all co-located and routinely available, however not all functions are performed with IPTs and not all IPTs have members who are co-located or even part of the same organization. Below are some examples of AMC activities that cross functional discipline and organizational boundaries.

Item Procurement

The CCSS system currently generates procurement requests for inventory items (application 404) and, for some MSCs, provides that data to the product data management system to automatically trigger the generation of an engineering TDP and to start the review process. However, there are no fully automated (or AMC standard) workflow processes for the TDP review. It is anticipated that this automated handoff will continue with WLMP but will not be unique for each MSC. It is also anticipated that WLMP will be able to perform more accurate future item procurement forecasts which can reduce Acquisition Lead Time (ALT) by allowing the engineering community to effectively "pre-stage" TDPs in anticipation of future requirements.

Engineering Support for Items in Production

Many inventory items undergo engineering changes during their life. These are either production driven (manufacturing and assembly) or item support driven. Whenever an ECP or RFW is approved for implementation, information such as effectivity date, items affected, and revision numbers must all be automatically communicated to the user community (Item Manager, other Army organizations, other services, etc) and to WLMP.

Recapitalization

The Army has selected "recapitalization" as a lead concept for transforming the fighting force. Recapitalization is the rebuild and selected upgrade of currently fielded systems to maintain our technological advantage and to ensure operational readiness, while concurrently restoring the systems to a zero time, zero mile condition. Rebuild restores a system to a like-new condition in appearance, performance, and life expectancy. Recapitalization requires replacement and overhaul of all reparable components to a standard defined by the National Management Program and results in a new service life as the weapon system is returned to a completely serviceable condition with a standard configuration baseline. The development and acquisition of sufficient product data is needed to establish the maintenance standards and perform the analyses necessary for successful recapitalization. Engineering data repositories must be accessible by all personnel (Government and contractor) involved in recapitalization efforts in order to utilize the original product design models and other associated information.

The preceding examples require not only collaborative human effort, but also a collaborative data environment where a common infrastructure is in place to share and exchange data and common business processes are in place across the extended AMC enterprise. As can be seen from the earlier description of existing AMC data management systems in Section 2.1.1, AMC's current data environment is anything but integrated or collaborative! Legacy systems used to store and manage product data are different at each site, often limited in their capabilities, and have few provisions for common access and exchange of information across all of AMC. While the WLMP initiative will enhance logistics business processes and provide common access to some logistics data, it is not currently planned to have any additional automated interfaces to product data management systems beyond those currently in existence, and its interfaces with automated procurement systems are in question due to the uncertain future of the DoD Standard Procurement System (SPS).

4.3.5 AMC Business Process Requirements for Product Data

In order to support the type of major business processes outlined above, and achieve the AMC vision for product data, the EPIT identified eighteen high-level business requirements for product data management. These were derived based on EPIT analysis and

MSC interviews, validated by comparison with the ACMS Performance Specification and independently confirmed by CIMdata analysis:

Modernized Business Processes - The system must provide a modernized information exchange with internal and external organizations. It must also support current and emerging PDM strategies, to provide a roadmap of current Army practices to best practices with the PDM solution to be upgraded throughout the life of the program as required. The system must be compliant with the ACMS Performance Specification (MIL-PRF-32029 (MI)).

Clearly Define Product Definition Data Ownership - The solution must define data ownership at all phases of the lifecycle (i.e., develop, acquire, equip, sustain, and dispose). The solution must provide the ability to manage data ownership within the PDM environment and changes IAW business requirements, identify required data (type, scope, level of detail) and ensure the integrity of that data.

Establish a Common Data File/Repository - The solution must support AMC and MSC business requirements in an integrated data environment. It must provide web access with data visualization tools, leverage available classification schemas, and classify all data stored in the data repository, as it is stored. It must also provide a self-maintaining data dictionary that contains metadata of the objects to be managed. Metadata contains information describing the data object definition, properties, lifecycle states and its usage. The data dictionary must also contain all known interface metadata to include mapping of the data objects. The solution must define the process and allow/control user access to the data that is required at different points throughout the lifecycle. The solution must allow for data to be migrated from a legacy or external system. The solution must allow for notes / comments on each data object. The solution must allow for a master bill of materials

Manage Product Definition Data Throughout the Entire Product Lifecycle - The solution must provide a formal product development process with a focus on weapon system management capable of creating, extracting, deriving, transforming, and loading needed data throughout the lifecycle. This lifecycle will be compliant with DoD 5000 series guidance. The solution must accommodate Government and contractor owned product data. The solution must define a common data model to describe the range of product data to be managed and define data aging requirements (i.e., archival processes and procedures, etc.). The defined process must ensure that data is accurate, complete and auditable thereby supporting analysis, planning, tracking, management, collaboration, and decision-making. The solution must provide flexibility to allow for business process re-engineering, which includes organizational, process and function changes. The solution must provide for tailored reporting at all levels. The solution must provide for increase usage to support mobilization/surge capability.

Establish a Product Definition Data Security Schema - The solution must permit access to authorized users through a secure web portal; each user will be authorized system access (for instance download, check in/out, query, update) and content access (at the configuration item level). The solution must provide for implementation of electronic security standards that are compliant with DoD Instruction 5200.40, Information Technology Security Certification and Accreditation Process (DITSCAP). The solution will comply with Public Key Infrastructure (PKI) requirements consistent with the following: Memorandum, subject DoD PKI, dated 6 May 99; PKI Roadmap for the DoD, v 2.0 rev C, dated 12 Oct 99; U.S. DoD X.509 Certificated Policy, version 2.0 dated Mar 99. The solution must protect information from unauthorized disclosure or use, destruction, loss or modification and provide for total data recovery within a 24-hour period.

Establish a Common Change Management Process - The solution must provide for a common engineering change management process. The solution must identify the owner and configuration manager of the data. The solution must provide visibility of product changes to authorized users. The solution must allow the user to view multiple Bills of Materials (BOMs) simultaneously (i.e. as designed, as built, as maintained). The solution must allow for comparison of different BOM. The solution must allow for identification of changes from one BOM to another. The solution must allow authorized users to check-in and check-out data objects.

Establish a Common Access & Exchange Mechanism with AMC and Contractors - The solution must leverage existing data standards for metadata communication and use industry standard data formats for communicating design data (i.e. AMC-STD-2549). The solution must provide the necessary data elements for data exchange. The solution must provide exchange of 2D and 3D CAD data and fully interface and freely exchange data with AMC's emerging enterprise wide information system architectural environment as described in the AMC Information Systems Architecture (ISA).

Establish a Common ACM Product Definition Data Portal Mechanism - The solution must provide users a single point of access to all product data and use Internet based technologies to create a light client that is easy to use. The solution must provide a mechanism to connect to various legacy systems. The solution must provide the common portal technology framework and a single sign on mechanism.

Establish a Common Way to View & Comment on Visualizations - The solution must provide a tool for non-CAD users to visualize assemblies. The solution must provide markup capabilities for both 2D and 3D data for CAD and non-CAD users for lifecycle support.

Establish a Common Collaboration Mechanism - The solution must provide concurrent electronic sign-off, audit trails, electronic notification, real time review, and meetings online. The solution must support MSC-specific requirements for design reviews, bidding processes, and maintenance support which will establish an environment to share both 2D and complex 3D CAD information among design teams and embedded modeling functions.

Establish the IT Infrastructure - The solution must be flexible and customizable in its ability to meet the needs of the users and leverage existing IT infrastructure. Required hardware, software and network systems to implement the solution will be identified and provided as needed. The solution must conform to the Army Joint Technical Architecture (JTA) and Information System Architecture.

Establishing Interoperability with External Systems (contractors, other services, FMS) - The solution must leverage available interface technologies across the organization. The solution must provide data exchange and interoperability capabilities.

Manage Various Design & Concept Development Tools & Their Output - The solution must accommodate a variety of design and concept development tools.

Configuration Management Requirements - The solution must provide lifecycle configuration management and configuration status accounting.

Manage Software as Part of the Complete Product Definition - The solution must provide for integration of a variety of Computer-Aided Software Engineering (CASE) tools and the software development process.

Army Knowledge Management (AKM) - The solution must be compliant with AKM goals and objectives.

Ownership and Support - The solution must be easy to install, operate, maintain and upgrade.

Query, View, Print - The solution must allow for authorized users to query the system, view the results and print or download the results.

This collection of requirements comprises a combination of system technology requirements, business requirements (policy and process), and cultural change management requirements at a high level. The Implementation Plan for the EPIT recommended strategy (described in Section 5.3 of the report) addresses all three requirements areas.

4.4 Potential Solution Strategies

The EPIT Alternatives Subteam identified seven potential solution strategies to be considered for improvement of AMC's product data management capabilities. It must be emphasized that these are strategic in nature and are independent of the specific hardware and software used to implement them. It must also be pointed out that the word "develop", as used in the following paragraphs, does not mean to write new software code. Rather, it means purchase of COTS software and possible tailoring. This is the same approach used by industry when implementing PDM and/or ERP systems.

4.4.1 Strategy 1 - Wholesale Logistics Modernization Program. This strategy would expand the current WLMP services contract with CSC to include responsibility for all product data and related functionality. All product data would be migrated to the WLMP solution. Currently the WLMP solution utilizes SAP R/3 and would probably make use of the SAP PLM functionality, but that decision would be up to CSC, as the Application Service Provider. This strategy would require monies to be provided, an implementation plan devised in concert with the current WLMP implementation strategies, and the WLMP contract to be modified.

4.4.2 Strategy 2 - Individual PDM solution, Federated Architecture, Government owned. With this strategy, a federated architecture would be established whereby each MSC would select and implement a PDM solution (possibly all different). A single EAI (Enterprise Application Integration) (umbrella layer) would be developed to provide corporate visibility to all product data, a single sign-on access to that data and an exchange capability between sites and external customers. There would be one interface to WLMP and that interface would be from the EAI. The individual MSC solutions and the EAI would be owned and maintained by the government. This strategy would require monies to make the current MSC systems ACMS compliant or be replaced completely with an ACMS compliant system. It would also require monies to develop the EAI, using COTS products.

4.4.3 Strategy 3 - Individual PDM solution, Federated Architecture, Government and Contractor owned. Like Strategy 2, in this strategy each MSC would select, and implement, a PDM solution (again possibly all different). A single EAI would be developed to provide corporate visibility to all product data, a single sign-on access to that data and an exchange capability between sites and external customers. There would be one interface to WLMP and that interface would be from the EAI. The individual MSC solutions would be owned and maintained by the government, but in this alternative, the EAI would be owned and maintained by a contractor. This strategy would require monies to make the current MSC systems ACMS compliant or be replaced completely with an ACMS compliant system. It would also require monies to develop the EAI, using COTS products.

4.4.4 Strategy 4 - Standard PDM system, Distributed Architecture, Government owned. In this strategy AMC would select a single standard PDM solution set of hardware and software which has a separate implementation instance at each site having a justifiable requirement. The total set of AMC product data would be "distributed" among the sites such that each site stores locally needed/used data and all other sites can access the data remotely. Again, a single EAI would be developed to provide corporate visibility to all product data, a single sign-on access to that data, and an exchange capability between sites and external customers. There would be one interface to WLMP and that interface would be from the EAI. Both the MSC solution implementations and the EAI would be owned and maintained by the government. This strategy would require monies to evaluate and select a single PDM system to support the AMC requirements, implement that solution at each MSC and to develop the EAI using COTS products.

4.4.5 Strategy 5 - Standard PDM system, Distributed Architecture, Government and Contractor owned. Like Strategy 4, in this strategy AMC would select a single standard solution set of hardware and software which has a separate implementation instance and a distributed database at each site having a justifiable requirement. A single EAI would be developed to provide corporate visibility to all product data, a single sign-on access to that data, and an exchange capability between sites and external customers. There would be one interface to WLMP and that interface would be from the EAI. The MSC solution implementations would be owned and maintained by the government, but in this alternative, the EAI would be owned and maintained by a contractor . This strategy would require monies to evaluate and select a single PDM system to support the AMC requirements, implement that solution at each MSC and to develop the EAI using COTS products.

4.4.6 Strategy 6 - Standard PDM system, Single Instance Architecture, Government owned. In this strategy AMC would select a single standard PDM solution set of hardware and software which is implemented in a single instance configuration similar to WLMP. A single instance of the system (with a backup/COOP instance) would be developed and all product data is migrated to the one site. All MSCs and other sites would connect to the system via the NIPRNET to access the system and data. The system (both the primary and backup sites) would be owned and maintained by the government. There would be one interface to WLMP. This strategy would require monies to evaluate and select a single PDM system that would support AMC requirements and implement that system.

4.4.7 Strategy 7 - Standard PDM system, Single Instance Architecture, Contractor owned. Like Strategy 6, in this strategy AMC would select a single PDM solution. That PDM solution would then be implemented in a single instance configuration similar to WLMP. A single instance of the system (with a backup/COOP instance) would be developed and all product data would be migrated to that one system. All MSCs and other sites would connect to the system via the NIPRNET. In this alternative, the system (both the primary and backup sites) would be owned and maintained by a contractor. Again, there would be one interface to WLMP. This strategy would require monies to evaluate and select a single PDM system that would support AMC requirements and implement that system.

In addition to the 7 alternative solution strategies that the EPIT developed, CIMdata recommended an eighth alternative strategy.

4.4.8 CIMdata Recommended Hybrid Strategy. In this strategy, CIMdata recommended pursuing a hybrid solution. The hybrid solution is a combination of elements from Alternatives 1 and 3. Under this strategy, CIMdata determined that, initially, those MSCs having complex, engineering-centric CM responsibilities during weapon system development (CECOM, TACOM and SBCCOM) would keep their current PDM solutions. Those MSCs without complex CM requirements (AMCOM, OSC and STRICOM) would be migrated to the mySAP PLM. An EAI would be developed using mySAP PLM. There would be one interface to WLMP and the WLMP SAP ERP R/3 would act as the common product data repository for all of AMC. The access or exchange of data by contractors, DLA and other valid users would be via the mySAP PLM interface. The individual MSC solutions would be owned and maintained by the government and both the EAI and the WLMP portion would be owned and maintained by a contractor (CSC). If it is determined that the WLMP implementation of SAP ERP R/3 can be leveraged to economically support both the required users licenses and the infrastructure, and that the U.S. SAP PLM organization is committed to the long-term enhancement and success of the mySAP PLM business, then AMC would migrate totally to mySAP PLM as an AMC standard system.

Figure 2 depicts the spectrum of alternative strategies considered.

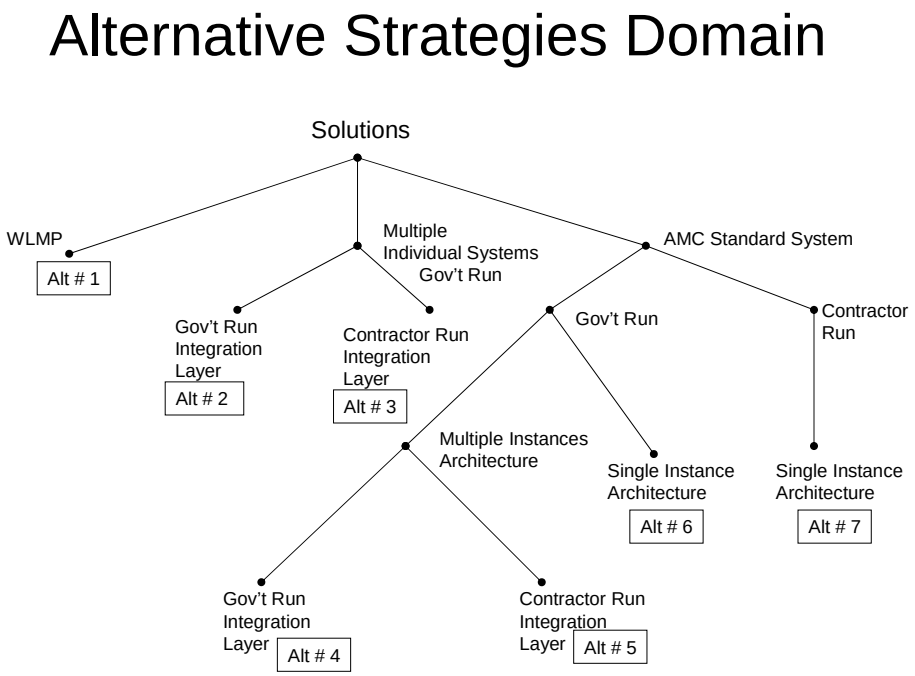


Figure 2

The following assumptions were used in the development of these alternative solution strategies:

- Strategies 1-7 must meet the detailed performance requirements contained within the ACMS Performance Specification.
- There will be equal costs associated with hardcopy data conversion for each solution strategy. Data conversion cost estimates used information from the Automated Document Conversion System (ADCS) Program Plan.
- Total Cost of Ownership is defined as cost of implementation, award and operating cost including technical refresh.
- Implementation of any strategy will be centrally funded by HQ AMC.
- Strategies 2-7 and the CIMdata Recommendation all have an inherent corporate integration. This integration is not required under Strategy 1 – WLMP.
- All strategies will require improvements to the AMC infrastructure to accommodate increased bandwidth requirements.

4.4.9 Related Issue

Legal Issues Associated with Outsourcing of Product Data Repositories – Several of the potential solution strategies involve outsourcing (contracting out) of the ownership and/or operation of the PDM system. Since an integral part of any PDM solution includes a data repository, this means the repository would also be outsourced and any data stored in the repository would be managed and could be accessed by the PDM system operations contractor. Much of the product data currently in Government data repositories is proprietary in nature, which means the Government has only limited rights to the data that have been specifically negotiated with the developing contractor. The EPIT requested and received an AMC Legal Office opinion, on August 24, 2001, regarding legal implications of outsourcing product data repositories that may contain proprietary data. The legal opinion states that while outsourcing data repository management of proprietary data is not prohibited, there are limited conditions under which it could be accomplished. One way it could be accomplished would be to have the PDM system operations contractor obtain specific legal approval from each contractor owning proprietary data stored within the PDM system. While theoretically possible, there is no way to ensure that all contractors would provide the required agreements and they would be very costly to obtain. This cost would be passed on the Government, either directly or indirectly, by the PDM system operating contractor. The other option would be to keep all proprietary data in a Government owned and managed data repository, and only outsource storage and management of data to which the Government has unlimited or Government Purpose License Rights. This option, however, requires the operation of at least two product data repositories, one of which must be Government owned and managed. The need for two repositories makes any outsourcing alternative less cost effective. A copy of the AMC Legal Office opinion can be found in Appendix E of this report.

4.5 Evaluation of Alternative Strategies

In order to evaluate the alternative solution strategies and select the best one to meet AMC's needs, the EPIT Evaluation Subteam developed criteria to be used by the MSCs to evaluate each alternative's ability to meet Business Process Requirements, and identify Implementation Risks. An evaluation package was created and sent to each MSC. The evaluation package included a Microsoft Excel spreadsheet to capture the MSC rating of each alternative strategy/requirement, a Requirements Evaluation scale (both color and narrative), an Implementation Risks scale (both color and narrative), and a Total Cost of Ownership spreadsheet. A narrative explanation of the color rating was required to assist in the evaluation process. Each MSC was required to coordinate their ratings across functional areas e.g. Engineering, Logistics and Procurement. Note: The CIMdata recommended strategy was determined early-on by the EPIT to not be a viable solution strategy, and therefore was not included in the MSC rating process. A discussion of the reasons for the EPIT determination of non-viability can be found in Section 4.6.2 of the report. A copy of the MSC Evaluation Package can be found in Appendix G of this report. The following paragraphs discuss the details of the evaluation package and the evaluation process.

4.5.1 Business Process Requirements Evaluation Scale

A five-level scale was used to rate each strategy's ability to meet each individual business process requirement, as well as the collection of requirements overall.

Outstanding (blue) - A Strategy that meets the business process requirements and has an accumulation of strengths which substantially outweighs any accumulation of weaknesses (overall strategy rating). A Strategy that will result in a major improvement for the rated business process improvement (individual business requirement rating).

Good (green) - A Strategy that meets the business process requirements and has an accumulation of strengths which outweighs, but not substantially, any accumulation of weaknesses (overall strategy rating). A Strategy that will result in a significant improvement for the rated business process improvement (individual business requirement rating).

Acceptable (yellow) - A Strategy that meets the business process requirements and has an accumulation of strengths which is offset by an accumulation of weaknesses (overall strategy rating). A Strategy that will result in some gain of efficiency for the rated business process improvement (individual business requirement rating).

Marginal (pink) - A Strategy that meets the business process requirements but has an accumulation of deficiencies substantially outweigh any accumulation of strengths (overall strategy rating). A Strategy that will result in a loss in efficiency for the rated business improvement (individual business requirement rating).

Unacceptable (red) - A Strategy that cannot meet the business process requirements (overall strategy rating). A Strategy that cannot meet the business process requirement (individual business requirement rating).

4.5.2 Implementation Risks Scale

A four-level scale was used to rate the risk associated with each strategy's ability to result in a viable AMC solution.

Low Risk (blue) - Little doubt exists, based on the strategy's performance record, that the strategy will result in a viable solution.

Moderate Risk (yellow) - Some doubt exists, based on the strategy's performance record, that the strategy will result in a viable solution.

High Risk (red) - Significant doubt exists, based on the strategy's performance record, that the strategy will result in a viable solution.

Neutral (white) - No relevant performance record identifiable; equates to having no positive or negative evaluation significance.

The risks were evaluated against the following definitions:

Business process impact - Any significant detrimental impacts or unique benefits to AMC business processes will be identified and potential impacts suggested for each of the alternative strategies. Some examples of business process impact considered were flexibility and interoperability of the system, ACMS compliance, AMC-STD-2549A compliance, rigidity of the data schema and input of stakeholders into the design.

Cultural - An assessment of the potential cultural risks that could be encountered because of the implementation of a given alternative strategy. Some examples of cultural risk considered were training requirements, change management processes and decreased production as a result of short-term negative impacts (higher ALT/PLT, inability to meet surge requirements).

Infrastructure - An assessment of potential infrastructure risks that could be encountered because of the implementation of a given alternative strategy. Some examples of infrastructure risk considered were bandwidth, Army Knowledge Management (AKM), CAD and simulation tools, and additional hardware/software requirements.

Other - An assessment of other risks associated with each alternative strategy. Some examples of other risks considered were schedule, data and distribution rights legal issues, and centralized funding.

4.5.3 Evaluation Process

The EPIT Evaluation Subteam developed a matrix to assist the MSCs in structuring their evaluation. The matrix listed and described the eighteen requirements identified by the Requirements Subteam. These requirements can be found in Section 4.3.5 of this report. This data was matrixed against each of the seven alternative strategies identified by the Alternatives Subteam. The matrix allowed the results to be displayed such that each MSCs results for a requirement, by alternative, could be viewed. Each MSC was asked to provide the rationale for each rating given. Hyperlinks to the matrix were provided for the rationale and any additional comments. For informational purposes, estimated costs for each alternative was provided as part of the evaluation package. Appendix G contains a copy of the Evaluation Package.

Each MSC received the evaluation package through their EPIT representatives. The package was then distributed to subject matter experts in each of the EPIT functional areas (engineering, procurement, logistics) for evaluation. Some MSCs also distributed the packages to other functional areas, such as corporate information and resource management, to obtain their inputs as well. The

evaluations were then consolidated into a command position and was provided to upper management as appropriate. The results were then provided to the EPIT Evaluation Subteam.

4.6 Evaluation Results

The MSC's submitted their ratings on the Rating Matrix spreadsheet to the Evaluation Subteam. The rating matrixes were consolidated and a clustering method was applied as the initial attempt toward achieving consensus. This method involved translating the color scheme into numerical values for the purpose of pattern analysis . From the Color Ratings described in Section 4.5.1 the colors were given numerical values from 0 = red to 4 = blue. The individual MSC ratings, together with the EPIT average ratings, can be found in the Excel Spreadsheet = "Revised_EPIT_Report_Eval_Spreadsheet_1Apr02.xls". Table 2 below shows the tabulated results of the MSC ratings of the alternative strategies, not including the "Risk" ratings. The actual MSC evaluation forms are not included in this report but can be provided upon request.

	AMCOM	CECOM	OSC	SBCCOM	STRICOM	TACOM	EPIT
Strategy 1	2.50	1.56	2.17	2.22	0.00	1.28	1.62
Strategy 2	2.44	2.94	1.39	3.28	2.00	2.89	2.49
Strategy 3	2.44	2.94	1.39	3.28	2.00	2.56	2.44
Strategy 4	3.06	2.78	2.33	3.28	3.00	3.00	2.91
Strategy 5	3.00	2.83	2.39	3.28	3.00	2.89	2.90
Strategy 6	3.89	2.44	3.17	2.83	0.00	2.58	2.49
Strategy 7	3.83	2.11	3.11	2.72	0.00	2.33	2.35

Table 2

Using Table 2, the top 4 choices were identified for each MSC. The emerging patterns showed Strategies 4 and 5 as commonly acceptable strategies for every command.

4.6.1 Process for consensus building

Table 2 was submitted to the EPIT members prior to the "face-to-face" EPIT meeting in Orlando, FL, in February 2002. Based on the apparent patterns, the Evaluation Subteam formulated the following questions to be used as initial discussion points for the meeting.

1) What are the reasons Strategy 1 is so bad when Strategy 7 is similar?
2) Could we live with Strategies 4 or 5 as our recommended strategy?
3) What are the Pros/Cons for the other Strategies compared to Strategies 4 & 5?

At the meeting each MSC was allotted time to address these issues. Each command discussed their preferred strategy and identified any Pros/Cons they saw with each strategy. While not every command's first choice, Strategies 4 & 5 were highly rated by all commands. None of the commands had strong objections to the use of Strategy 4 or 5, however each of the other alternative strategies was strongly objected to by one or more of the commands.

The advantages and disadvantages of each strategy are provided below. These write-ups incorporate input from both the Evaluation Matrix and the meeting discussions.

4.6.2 Strengths and Weaknesses of Each Alternative Strategy

Strategy # 1 – WLMP Implementation:

The evaluation of Strategy 1 by the MSCs identified both pros and cons of migrating all product data to the WLMP solution. WLMP provides a common Portal to access Government data, using the industry-proven SAP Portal.

While this strategy would most easily provide engineering information to WLMP, the lack of a common EAI means that all product data exchange mechanisms with external partners (PMs, contractors, etc) would have to be accomplished via custom interfaces. There is no current requirement for WLMP to be AMC-STD-2549A or MIL-PRF-32029 compliant, although under this strategy these requirements would have to be added to the WLMP contract. While WLMP is currently exempt from AKM compliance, any additional task orders could come under AKM scrutiny. Strategy 1 will support the Joint Technical Architecture (JTA), but the ability to provide for flexibility is suspect. It is believed the planned WLMP-driven infrastructure does not have the bandwidth capacity to handle engineering business processes efficiently. Significant upgrades would be necessary.

This strategy would provide a common data model and file structure, but as stated in the CIMdata Analysis Report, Para 8.2.2: "SAP data model is not very flexible and incorporation of AMC-STD-2549A would probably not be feasible." The inflexibility of SAP's data model will make this integration effort a difficult expensive task that will most likely require continuous modification when new mySAP PLM versions are released.

Strategy 1 would establish a common change management process. It is believed all commercial ERP/PDM COTS have the necessary workflow tools to accomplish this task.

This strategy does not have any past performance information to support the collaboration requirement. The CAD integration has not been demonstrated and appears to lack the capability to handle management of constraints and features in a 3D environment, with integration to local data management systems, and lacks coverage for Software CM and Electronic CAD data management.

The WLMP business model inhibits individual site flexibility and adaptability to changing business processes. An Application Service Provider cannot store or manage propriety design data in a legal and/or cost effect manner given the AMC Legal Office determination. Under an Application Service Provider set up, it will be difficult to get rapid turn-around on desk-side support, fixes, updates, etc which also has the potential to degenerate into a constant legal battle. The basic contract must have a lot of very well structured performance measurement metrics to make this work.

Regarding the risk of possible negative impacts on WLMP schedule; WLMP may be too far along with major data decisions to accommodate inclusion of product data.

Strategies # 2 and 3 - Multiple Individual Solutions implemented in a Federation

The following comments apply to both Strategies 2 & 3 with the exception that for Strategy 3, being contractor operated, the AMC Legal Office determination regarding limited access data causes significant additional costs to establish and maintain a separate system to support that data.

Both strategies will allow AMC to improve their business process by modernizing with commercial PDM solutions. By allowing the MSC's to pick their own PDM solution, the MSC could pick the solution that best meets their needs and provides them the flexibility to tailor the system to their specific business processes. The integration layer will allow for standardization of information to WLMP as well as giving AMC-wide visibility to "corporate" data and leaves individual MSC specific information at the site level.

Both strategies did have some negative factors. The strongest negative was that these strategies did not support AMC's vision of a standard system. By allowing different systems to be implemented at each MSC, there could never be a "standard system". Another negative is the complexity of the interfaces that would need to exist. If each MSC were allowed a separate system, then interfaces

would have to be developed from each system to the integration layer. This would be more complex than developing a single interface. In addition, it would be more difficult to monitor and implement any changes. Thirdly, under these strategies the MSCs would be allowed to continue with any divergent business processes. AMC is trying to move toward having common business processes across the MSCs and these strategies would allow MSCs to maintain their unique business processes. Fourth, it would be difficult to achieve a common data schema across AMC if each of the MSCs were allowed to maintain a separate system. There would be no common data dictionary and a possible conflict between the data from the different systems could result. Finally, these strategies do not support the AKM goals.

Strategies # 4 and 5 – AMC Standard System implemented in a Distributed Configuration:

The following comments apply to both Strategies 4 and 5. It is to be noted that with Strategy 5, there is a single integration layer that would be Contractor-owned. The AMC Legal Office determination regarding limited access data causes Strategy 5 to have significant additional costs to establish and maintain a separate system to support that data.

The advantages for both strategies are similar. Both strategies would provide each MSC with the same COTS product to create an ACMS compliant solution, which will modernize business processes, by leveraging best-in-class product data management capabilities found in today's PDM systems and supporting technologies. This strategy will capitalize on today's COTS PDM solutions' proven visualization and collaboration support and the incorporation of solid EAI technologies. In addition, the architecture's flexibility and scalability will provide the capability to implement site unique requirements without impacting the core capabilities. These benefits significantly reduce AMC's risk. A single standard solution will reduce the number of interfaces required, will facilitate establishing interoperability with external systems (i.e., contractors, other services, and FMS), and will provide a single interface to WLMP. Additionally, acquisition and maintenance of the software could make use of bulk discounts. Centralized management of the software, data elements and interfaces will assure consistency of the implementation across all MSC's while providing the needed Continuity of Operations redundancy needed. It will also provide consistency of process, terminology, and semantics that, over time, will improve communications between individuals and organizations as well as reduce the time needed for new personnel to become productive. As with all the alternative strategies, there is a requirement to establish a common data schema and processes. A dedicated effort will be required to define and concur on data elements required in the core capabilities and on the core processes. Distributed implementation at multiple locations will ease the infrastructure burden by placing the large data files in the locations where they are most frequently used. The use of a common data schema and core capability at the integration layer can enable the single access requirements and reduce the appearance of redundancy by utilization of a single logical database. These strategies could serve as an evolutionary step to a single centralized solution as some future point in time.

There are negative factors which have been reviewed and analyzed. Each MSC would be required to relinquish control of some processes and would need to clearly define unique requirements. The choice of the standard product may or may not be the same product currently implemented at any of the MSCs and therefore migration from current PDM implementations would be required.

Strategies # 6 and 7 – AMC Standard System implemented in a Single Instance/Site:

The following comments apply to both Strategies 6 and 7 with the exception that Strategy 7 is contractor operated and the AMC Legal Office determination regarding limited access data causes Strategy 7 to have significant additional costs to establish and maintain a separate system to support that data.

Both strategies would streamline the business processes by modernizing to a commercial PDM solution that is ACMS compliant. The common solution eases implementation across AMC. By using a single implementation, these strategies would reduce the system administration burden from the commands and eventually provide a single uniform process. They meet the AKM goals to eliminate redundancy and standardize business processes. They facilitate more efficient controls with less administrative overhead ensuring data integrity and product consistency by managing control of all changes to product configurations. They facilitate external interfaces. It is believed that all commercial ERP/PDM COTS products have the necessary workflow tools to support AMC's needs. By being able to separate the integration level from the data management level, they allow for "best in class" tools for common process management to be selected. The requirement for a strong portal capability can be made one of the COTS PDM selection criteria. With fewer interfaces, they would be less resource intensive to maintain and easier to sustain management controls. They allow for the complete storage of all AMC product data at a single physical repository. System security is easier to maintain at a single installation. A centralized system will require that the configuration management and engineering change process be implemented uniformly across all the commands.

The strongest negative factor affecting both strategies stemmed predominantly from the technical side, e.g., the lack of adequate bandwidth. The transmission of large CAD files is difficult within an installation today, let alone multiple users at various locations attempting to access large files at the same time. With the current technological level of equipment, a centralized system on the scale being planned will be agonizingly slow. A significant breakthrough in transmission speed will be required, or an expensive network of dedicated T1/T3 lines would have to be established. As CIMdata pointed out, no commercial enterprise has attempted this effort on a scale as large as that anticipated by AMC. Interfacing with the myriad of customers within a command is difficult, but across AMC it could be very daunting. From the management side, centralized systems are less flexible regarding changes or tailoring that would be germane to only one command, and the time to actually implement a change is usually longer. If data migration or data loading is done centrally there is usually a greater chance of data misinterpretation.

Although these strategies have many strengths, the negatives indicate that, at this time, these approaches are very risky and could result in failure or significant increases in implementation costs and time to complete. It is conceivable that these may become viable strategies in the future.

CIMdata recommended Hybrid strategy:

As stated earlier, this strategy was not formally evaluated by the MSCs because it was not considered to be a viable strategy by the EPIT for the following reasons. In recommending the hybrid alternative, CIMdata assumed that since AMCOM, OSC and STRICOM did not already have a PDM system, their product development process did not require strong, dynamic CM support (a weakness of the production-oriented mySAP PLM). This is not believed to be accurate. Those MSC's decision to not yet implement a PDM solution is based on a lack of resources, and available work-arounds and not on a lack of firm requirements. In addition, CIMdata qualified their recommendation to the extent that certain issues must be resolved prior to it being considered a "preferred" strategy. Those issues are:

- The potential cost and schedule advantages of this strategy depend on taking advantage of the WLMP instance to leverage risks, and implementation and administration costs (licenses, support resources, software/hardware, network infrastructure, and integrations). If the existing WLMP licenses will not cover a suitable portion of the product data workforce and if the planned WLMP infrastructure is insufficient to support enterprise product data exchange, functionality and response time, then the projected cost avoidances of this strategy will fail to materialize.

- SAP is having difficulties in establishing its PLM team in North America. This could negatively impact future large-scale SAP implementations in this country.

- Legal issues associated with outsourcing the storage and management of proprietary product data via the WLMP contract.

Since it is felt that AMCOM, as a minimum, requires strong dynamic CM capabilities, that there are risks associated with SAP's commitment to their PLM team in North America, and it is not economical or efficient for the Army to implement outsourcing of proprietary product data storage and management in the manners legally allowable, the CIMdata recommended strategy was not considered a viable alternative. However, CIMdata also stated that if these issues reduce the benefits from or prohibit leveraging the WLMP contract, AMC should select and implement an AMC Standard PDM solution, as described in the EPIT alternative Strategies 4-7.

5.0 EPIT Recommendation

5.1 Description of Recommended Alternative

The EPIT chose Strategy # 4 as the best choice to meet AMC's needs for future product data management. It is recommended that AMC select a single standard PDM solution set of hardware and software which has a separate implementation instance at each site having a justifiable requirement. AMC's product data would be "distributed" among the sites such that each site stores locally needed/used data and all other sites can access that data remotely. A single EAI would be developed to provide corporate visibility to all product data, a single sign-on access to that data, and an exchange capability between sites and external customers. Both the MSC

solution implementations and the EAI would be owned and maintained by the government. Interoperability would be ensured through AMC controlled and managed system architecture, including a centrally managed data schema. There would be one interface to WLMP and that interface would be from the EAI. The recommended strategy has been given the tentative title of *AMC Enterprise Product Data Management (ePDM)* system.

This strategy is consistent with CIMdata's independent findings and recommendations, given that their initial recommended strategy was based on assumed conditions that could not be achieved in a cost effective and efficient manner.

5.2 Reasons for Selection

5.2.1 Benefits

This product data management strategy will allow AMC to:

- be more in-line with their major contractors
- implement a common product data management backbone from the ground up.
- provide a centralized data/file repository.
- implement a common change management process that links all product data and can be easily supported.
- capitalize on today's COTS PDM solutions' best-in-class product data management capabilities, proven visualization and collaboration support and the incorporation of solid EAI technologies. In addition, the COTS PDM product's architecture's flexibility and scalability have been proven in large, distributed environments. These benefits significantly reduce AMC's risk.
- reduce the number and complexity of the integrations that will be created and maintained as opposed to some of the other strategies considered.
- reduce any adverse impact on the WLMP schedule. It is assumed that the current WLMP fielding schedule will occur as planned. Interfaces between the current legacy technical data systems and WLMP must be created, as planned, to support the mission until the new EPIT solution system is in place.
- provide a consistency of infrastructure that will reduce overall support costs. Since most AMC PDM solutions have very long lives, these support costs eventually will dwarf the acquisition and implementation costs.
- retain centralized system software configuration management at the enterprise level in lieu of at each MSC
- reduce the number and cost of software maintenance contracts and effort. Again, support costs will make up a major portion of lifecycle costs for any solution.
- improve the ability of personnel to move between commands and programs, as they will be working with a common tool.
- provide consistency of process, terminology, and semantics that, over time, will improve communications between individuals and organizations as well as reduce the time needed for new personnel to become productive.
- retain the flexibility of engineering solutions targeted at supporting the Program Managers.
- have a "single sign-on" capability.

5.2.2 Cost Estimate

Deleted from this version of the report, but available upon request from HQ AMC.

5.2.3 Risks

This strategy is not considered high risk and is considered technically viable. This is not to say everything will be easy. The most difficult part will be defining the data schemas, common data elements and common processes while still retaining the flexibility required to support the PM's.

Other risk areas include:

- There will be a need for increased infrastructure bandwidth to support this strategy;
- It will be difficult to define a common change management process acceptable to all commodities;
- A multiple instance approach invites changes at the local level that affect interoperability over time (note TD/CMS); Each MSC must not have individual software configuration control;
- Possible conflicts in data (and metadata) between systems can occur if strong central management isn't enforced;
- There is a higher level of technical complexity required to implement this strategy;
- Specific candidate products to implement this strategy are undefined;
- An incomplete AMC-wide view of product data will be achieved if all current systems (both major and minor) are not migrated into the standard system;
- No fully compliant ACMS system is fully installed at this time, therefore no performance record has been developed.
- It may be difficult to exchange product data between sites in a timely manner.

5.3 Next Steps

The EPIT recommends the following actions be initiated immediately in order to begin the process of implementing the ePDM strategy. These actions can occur prior to receipt of program funding.

- The EPIT should obtain HQ AMC senior management approval of EPIT results and recommended strategy. AMC central management and funding of this strategy are critical to its success. Senior management approval indicates long-term senior management commitment to the effort and its resultant business process changes. Assuming approval is obtained, HQ AMC should assign management responsibility for ePDM to AMCRDA.
- AMCRDA and AMCRM continue to monitor the DA and DoD FY04 POM build process and the status of the OPA-2 ePDM and OMA Lifecycle Product Data project funding requests. Provide required information and support as needed.
- AMCRDA and AMCRM should seek opportunities for FY02 and 03 funding required for initial ePDM implementation actions.
- AMC must market/coordinate this system and philosophy with ASA (ALT) and the PEO community. They are the data developers and are instrumental to the success of any effort. It is imperative that everyone be "on-board" to insure the utility of future data in the ePDM.
- AMCRDA should establish a working group (possibly the PD FCG) to formulate a description of the product data "end state" concept of operations and develop the combination of standards, policies, procedures and processes required to achieve it. Source documents for this work include the EPIT report, the *Contractor Integrated Data Services (CIDS) Final Report*, and the ASA(ALT) *Final Plan to Transition to Digital Operations*. See Section 5.4.1 below for more information about this effort.
- Coordination with the WLMP Program Office must occur to determine product data elements common to ePDM and WLMP and harmonize them to enable a seamless exchange between the two systems. An example is the harmonization of ePDM's product structure with WLMP's Bill of Materials. An Engineering Data Integration Team (EDIT) has been established within the AMC engineering community to coordinate this particular issue with the WLMP BOM Long Lead Team.
- AMCRDA should assign detailed project management responsibility for implementation of ePDM to an organization or Integrated Product Team. The involvement and relationships of other organizations to the ePDM Program Office should also be determined.
- AMCRDA and the ePDM Program Office should develop an Acquisition Strategy and detailed Implementation Plan. A draft high-level Implementation Plan is discussed in the next section and contained in Appendix I of the report.
- The ePDM Program Office should develop a Statement of Work for hiring of an integration contractor to assist in the evaluation and selection of the specific COTS hardware and software products needed to implement ePDM. Upon receipt of program funds a contract would then be executed and managed by the ePDM Program Office. Depending on the chosen Acquisition Strategy, either this same contractor or a different one would be used to implement and deploy the selected COTS products throughout AMC.

5.4 Implementation Plan

There are three major parts to the total implementation of the recommended strategy. These are: Standards, Policies, Procedures, and Processes; ePDM Program Management; and ePDM System Implementation. Some of these tasks may be accomplished by in-house Government teams prior to the receipt of the requested funding and the actual program start for ePDM. Each of these is discussed below with a more detailed plan included at Appendix I.

5.4.1 Standards, Policy, Procedures and Processes

This area of the Implementation Plan addresses standards, policies, procedures and processes, some of which need to be developed and put in place prior to actual physical ePDM system implementation. As stated above in Section 5.3 an AMC chartered working group should be established to begin working some of these issues immediately upon approval of the EPIT recommendation. The working group should have membership from the MSCs, the Army PM/PEO community, HQ AMC and ASA(ALT). The resultant standards, policies, procedures and processes formulated or recommended by the working group must be coordinated with and endorsed by HQ AMC and ASA(ALT). Once an ePDM Program Office is established, the working group will coordinate all activities with them to ensure a smooth implementation.

- Lifecycle responsibilities for development, acquisition, management, use, planning for, and disposal of product data for managed systems must be defined. Must also develop associated policy and guidance to ensure these responsibilities are carried out correctly by data owners. The term "data owner" includes defining who owns the data (has legal rights to), who is responsible for controlling changes to the official "copy of record", and who to contact to obtain access to the most current data. As part of this effort, current data ownership deficiencies must be identified and a "get well" plan developed.
- Common requirements for a data model, data security, data management processes, collaboration, and configuration change management, across the enterprise, must be developed. This should include enterprise licensing and centralized management of enterprise and MSC software and interfaces.
- A standardized data exchange mechanism needs to be identified and directed for use to support the CITIS philosophy and to provide for data exchange between commands, between services and between AMC and its support contractors. Need to decide whether to complete AMC-STD-2549A, adopt EIA-836, or use something else.
- AMC needs to identify how the ePDM system conforms to the prescribed AKM philosophy and present it to the DISC4 for concurrence.

5.4.2 ePDM System Program Management

These elements will be developed and managed by the assigned ePDM Program Office.

- The Program Management effort, team and high level schedule must be developed. Quality control measures must be adopted to ensure flexibility does not impede interoperability.
- The amount and type of funds required for full ePDM implementation must be developed with more accuracy. The program office will prepare, justify and ensure full coordination of budget submissions covering a five-year period to initiate and implement the Army ePDM system.
- Centralized configuration management of the Army ePDM system requires identification of the personnel and processes to be used for the system hardware and software.
- System Continuity of Operations Plans (COOP) must be developed that identifies both the business process continuity and IT perspectives.
- Program Implementation. The steps and plans to assure coordinated and complete implementation with roles and responsibilities for sustainment. Scenarios must be developed to negotiate for support options (regional DOIM, network operation centers, etc).
- An effort to review current COTS products, and evaluate them to select the specific Army ePDM system solution set, should be one of the first actions undertaken.
- All contract vehicles required for system evaluation, selection and implementation must be established and managed.
- Corresponding contract requirements for each contract effort must be developed.
- The results of the project, including "lessons learned" must be documented. It is suggested that "lessons learned" be published via AKM.

5.4.3 ePDM System Implementation

These are the elements that will be required for system configuration and installation. It also includes business process re-engineering across the enterprise. These elements will be conducted and managed by the assigned ePDM Program Office, in conjunction with an integration contractor.

- Install testbed
- Conduct IT site surveys
- Conduct systems site surveys
- Conduct business process review and engineering
- Configure system and develop interfaces
- Conduct Training site surveys
- Conduct Training
- Conduct system installation and data migration
- Production
- Coordinate Help Desk requirements to define roles and responsibilities
- Install COOP data at COOP site

APPENDICES

Appendix A – EPIT Charter

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY MATERIEL COMMAND
5001 EISENHOWER AVENUE,
ALEXANDRIA, VA 22333-0001

CHARTER FOR
ENTERPRISE RESOURCE PLANNING and PRODUCT DATA MANAGEMENT SYSTEMS INTEGRATION TEAM (EPIT)
AND EPIT SENIOR STEERING GROUP (SSG)

1. PURPOSE:

This charter establishes the Enterprise Resource Planning (ERP) and Product Data Management (PDM) systems Integration Team (EPIT) within the U.S. Army Materiel Command (AMC) to align logistics and engineering business processes and Information Technology (IT) expenditures with the AMC vision and strategic intent. The management of Army materiel utilizes two basic sets of processes; i.e.; decision-based (research, development and acquisition) and transaction-based (logistics support). Industry has identified two basic types of automated systems to support these processes; e.g. PDMs and ERPs. The EPIT will provide a mechanism by which proposed process re-engineering, and associated automation improvement/implementations, can be reviewed/evaluated in order to provide recommendations on the optimal mix of interface/integration of ERPs and PDMs to support AMC's core competencies and business areas. The EPIT will address required logistics and engineering business areas, as well as any interfaces/interactions with procurement, but it will not address specific procurement systems. This charter also establishes the EPIT Senior Steering Committee (SSG) to provide senior level oversight and guidance to the EPIT.

2. VISION:

The AMC vision is a seamless flow of the right product data, where required and when required between authorized users, rapidly, accurately and reliably between the engineering, procurement, program management and logistics communities.

3. REFERENCES:

a. AMC Corporate Strategy Direction – AMC Strategic Application Blueprint (20 Feb 98).

b. AMC Corporate Strategy Direction – AMC Information Technology Blueprint (16 Jan 98).

c. Wholesale Logistics Modernization Program contract, DAAB07-00-D-E252, (29 Dec 99). See WLMP website at www.wlmp.com for the basic contract and all delivery orders.

d. Reference SAAL-DS Memorandum, 18 Oct 2000, subject: Delegation of Authority for Engineering and Technical Data Management.

e. MIL-PRF-32029(MI), 30 June 1998, PERFORMANCE SPECIFICATION, Automated Configuration Management System (ACMS).

f. AMC-STD-2549A, Configuration Management Data Interface Standard, Nov 00.

g. AMC Corporate Strategic Goals, 20 Apr 01.

h. AMC Command Objectives, 20 Apr 01.

4. SCOPE:

This charter is applicable to AMC's logistics and engineering business areas and any interfaces with the procurement business area or other participating activities, such as the PEOs, PMs and DSAs. Procurement systems, themselves, are not currently included.

5. MISSION AND FUNCTIONS:

The mission of the EPIT is to provide recommendations for AMC strategic direction and policy for life cycle management and funding allocation for current and future logistics and engineering information systems. The EPIT will:

a. Conduct analysis of those logistical and product data management processes to determine all touch points.

b. Focus the analysis upon product data requirements for engineering purposes and for support of logistics requirements.

c. Determine the correct balance of ERP and PDM systems.

d. Answer the questions:

(1) Is the need to interface, integrate or encapsulate ERP and PDM systems?

(2) If the EPIT sees advantages to use ERP, analyze the SAP product to provide the process support needed for product definition.

6. RESPONSIBILITIES:

a. The AMC Deputy Commanding General (DCG), Deputy Chief of Staff for Research, Development and Acquisition (DCSRDA) and Deputy Chief of Staff for Logistics (DCSLOG) will provide final decision authority for the EPIT.

b. AMC will provide resource guidance for the EPIT to consider in recommending alternatives, and resources for the MSC's to support both the EPIT and the task order contractor.

c. The EPIT Senior Steering Group (SSG) will provide general supervision, guidance and review of EPIT actions/recommendations.

d. The AMCDCG will appoint:

(1) Chairperson(s) for the EPIT.

(2) Chairperson(s) for the EPIT SSG.

e. The AMC DCSRDA will:

(1) Provide day-to-day staff supervision of the EPIT activities.

(2) Provide personnel and support to the EPIT, as required.

(3) Provide final authoritative positions regarding engineering issues.

(4) Provide updates to the Wholesale Logistics Modernization Program (WLMP) Oversight Board of Directors (OBOD) as required by the OBOD Chairman.

(5) Provide updates to the AMC Senior Engineers and PARCs as required.

f. The AMC DCSLOG will:

(1) Provide personnel and support to the EPIT, as required.

(2) Provide final authoritative positions regarding logistics issues.

g. The AMC Corporate Information Office (CIO) will:

(1) Provide personnel and support to the EPIT, as required.

(2) Provide final authoritative positions regarding AMC's Information Technical Architecture issues.

h. The AMC Command Counsel will provide personnel and support as required.

i. AMC Major Subordinate Command's:

(1) For each MSC, the Integrated Materiel Management Center (IMMC) Director, Principal Assistant Responsible for Contracting (PARC) and Senior Engineer, or their designated representatives will, serve as members of the EPIT SSG.

(2) Each MSC will appoint one representative each from their logistics, procurement and engineering functional areas with authority to act for their Command on all aspects of their functional area to serve on the EPIT.

(3) Each MSC may assign other logistics and engineering representatives, as deemed appropriate, to fully represent their entire engineering and logistics communities on the EPIT. Such additional representation can come from DSA's, AMC PMs, arsenals, depots, and government-owned ammunition plants.

(4) When asked for an MSC position, the three principal representatives will be asked to develop and state their command's position.

(5) Each MSC may propose processes for re-engineering, interface and/or integration as appropriate.

(6) Each MSC will support the EPIT and EPIT SSG as required.

7. COMPOSITION AND STRUCTURE:

a. The EPIT SSG will consist of:

(1) One AMCRDA representative.

(2) One AMCLOG representative.

(3) One IMMC Director, Senior Engineer, and PARC for each MSC.

b. The EPIT will consist of:

(1) One AMCRDA representative.

(2) One AMCLOG representative.

(3) One logistics, one procurement, and one engineering representative from each MSC with authority to act for their Command on all aspects of their functional areas;

c. Advisors, as required, will be as follows:

(1) AMCLG;

(2) AMCRDA;

(3) AMC Command Counsel (AMCCC);

(4) AMC Resource Management (AMCRM);

(5) AMC Corporate Information Officer (AMCIO).

(6) WLMP Program Manager.

(7) Assistant Secretary of the Army for Acquisition, Logistics and Technology, ASA(ALT) (invited);

(8) Army Deputy Chief of Staff for Logistics

(9) Others as deemed appropriate (i.e.; – PMs, PEOs, DSAs, AMC PMs, Arsenals, Depots and Army Ammunition Plants). The role of PEO and DSA representatives is defined in Appendix A.

8. METHOD OF OPERATIONS:

a. **Meeting Schedule**: The EPIT will meet quarterly or at the call of the chairperson(s). To the maximum extent possible, meetings will be conduct using video conferencing to minimize TDY and travel expenses. The EPIT SSG will meet semiannually or more often if required.

b. **Decisions**:

(1) EPIT matters will normally be decided based on a consensus agreement basis. In matters where there is no consensus agreement, a vote will be taken from all voting organizations. When a "vote" is required, efforts will be made to conduct the vote by e-mail within 5 working days after definitization of the issue to be voted on. This will allow for development of a MSC Command position on the issue. When there is no majority, the issue will be referred to the EPIT SSG for a decision.

(2) EPIT SSG matters will normally be decided based on a consensus agreement basis. In matters where there is no consensus agreement, a vote will be taken from all voting organizations. When there is no majority, the issue will be referred to the DCG, DCSLOG and DCSRDA for a final decision.

(3) The DCG, DCSLOG and DCSRDA will be the final decision authority for all EPIT and EPIT SSG issues:

c. **Subgroups**: The EPIT can appoint subgroups at its own discretion to accomplish Team mission and functions. These subgroups will consist of representatives from voting organizations such as AMCRDA, AMCLG and the MSCs.

/s/16Aug01/
ROY E. BEUACHAMP
Lieutenant General, USA
Deputy Commanding General

APPENDIX A

ROLE OF
PROGRAM EXECUTIVE OFFICE (PEO) and Deputy for Systems Acquisition (DSA)
REPRESENTATIVES

- Review the submission of AMC ERP and PDM related information to determine how it relates to corresponding PEO/DSA ERP and PDM information.
- Oversee the submission of PEO/DSA ERP and PDM related information. This information would be submitted for informational purposes only. The information submitted would be:

- Type of ERP and PDM information maintained by PEO/DSA.
- ERP and PDM automation resources used.

- To position PEOs/DSAs for transition of legacy systems to AMC management.
- Keep visibility over AMC ERP and PDM initiatives that could impact or be employed to support PEO/DSA managed systems.
- To coordinate standardization of ERP and PDM automated systems and data between PEOs/DSAs and AMC/MSCs.

Appendix B – EPIT and SSG Members

Legend:

C = Co-Chair
P = Primary Member
A = Alternate Member
S = Support

EPIT Members

CMD	ORG		NAME	DSN	COMM	E-MAIL
AMC-HQ	RDA	C	Jim Knowles	767-5100	703-617-5100	knowlesj@hqamc.army.mil
AMC-HQ	LOG	C	Ron Lewis	645-8717	256-955-8717	ron.lewis@redstone.army.mil
AMC-HQ	RDA	S	Chris Neubert	767-5638	703-617-5638	NeubertC@hqamc.army.mil
AMC-HQ	RM	S	Dana Burrows	767-2941	703-617-2941	BurrowsD@hqamc.army.mil
AMC-HQ	CIO	S	Danny Shearer	767-8674	703-617-8674	ShearerD@hqamc.army.mil
AMC-HQ	CC	S	Ed Stolarun	767-8051	703-617-8051	estolarun@hqamc.army.mil
AMC-HQ	ACQ	S	Gene Duncan	767-1923	703-617-1923	duncang@hqamc.army.mil
AMC-HQ	RDA	S	Sam Fukuda	767-4473	703-617-4473	FukudaS@hqamc.army.mil
AMC-HQ	RDA	S	Maj Jeff Grover	767-9526	703-617-9526	GroverJ@hqamc.army.mil
AMC-HQ	LOG	S	Al Comaduran	767-8668	703-617-8668	acomaduran@hqamc.army.mil
AMC-HQ	LOG	S	Jean Shipley	767-5414	703-617-5414	shipleyj@hqamc.army.mil
AMCOM	LOG	A	John LaFalce	788-9126	256-842-9126	John.Lafalce@redstone.army.mil
AMCOM	LOG	P	Artro Whitman	746-0930	256-876-0930	Artro.Whitman@redstone.army.mil
AMCOM	ENG	P	Deborah Cornelius	746-2196	256-876-2196	Deborah.Cornelius@rdec.redstone.army.mil
AMCOM	IDE	S	Jessica Jackson	746-0432	256-876-0432	Jessica.Jackson@redstone.army.mil
AMCOM	PROC	P	Cathy Dickens	746-2015	256-876-2015	mary.dickens@redstone.army.mil
AMCOM	PROC	A	Eddie Mays	788-7600	256-842-7600	james.mays@redstone.army.mil
AMSAA	RDA	S	Tom Schneider	793-7794	309-782-7794	schneidert@ria.army.mil
AMSAA	RDA	S	Gordon Ney	793-6586	309-782-6586	neyg@ria.army.mil
CECOM	PROC	P	Matt Meinert	987-1498		Matthew.Meinert@mail1.monmouth.army.mil
CECOM	RDA	P	Gary Saloman	992-2224	732-532-2224	Gary.Salomon@mail1.monmouth.army.mil
CECOM	LOG	P	Gary Webber	992-5844	732-532-5844	gary.webber@mail1.monmouth.army.mil
CECOM	EA - IT	S	Darrell Boyer	879-3389	520-538-3389	boyerd@hqisec.army.mil
CECOM	WLMP	S	Rod Knecht	x3301	836-234-1100	Roderick.Knecht@mail1.monmouth.army.mil
EDMS PO	RDA	S	Gayle Booker	788-8277	256-842-8277	bookergs@redstone.army.mil
EDMS PO	RDA	S	John Montgomery	746-8251	256-876-8251	john.montgomery@redstone.army.mil
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LAISO	LOG	S	Cynthia Gill	645-8871	256-955-8871	gillcl@redstone.army.mil
OSC	RDA	P	Carey Anderson	793-6518	309-782-6518	AndersonC@osc.army.mil
OSC	PROC	P	Larry Mickelson	793-8096	309-783-8096	MickelsonL@osc.army.mil
OSC	LOG	P	Rosanne Mohr	793-2457	309-782-2457	MohrR@osc.army.mil
SBCCOM	ENG (RI)	A	Angel (Willie) Felix	793-8024	309-782-8024	Angel_Felix@ria.army.mil
SBCCOM	LOG (N)	A	Frank Howe	256-4572	508-233-4572	Frank.Howe@natick.army.mil
SBCCOM	LOG (N)	A	Tony Hober	256-6262	508-233-6262	Anthony.Hober@natick.army.mil
SBCCOM	LOG (PBA)	A	Mike Farris	966-3663	870-540-3663	mike.farris@pba.army.mil
SBCCOM	RDA (N)	A	Ken Rice	256-4271	508-233-4271	Kenneth.Rice@natick.army.mil

SBCCOM	RDA (E)	P	Mike Cantrell	584-5587	410-436-5587	michael.cantrell@sbccom.apgea.army.mil
SBCCOM	LOG (E)	P	Michael Lee	584-2642	410-436-5587	michael.lee@sbccom.apgea.army.mil
SBCCOM	RDA (E)	A	Tony Yablonicky	256-4883	508-233-4883	anton.yablonicky@natick.army.mil
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STRICOM	PROC	P	Mac Whisner	960-8137	407-380-8137	Mac_Whisner@stricom.army.mil
STRICOM	RDA	S	Leonard Hobbs	970-5433	407-384-5433	Leonard_Hobbs-Contractor@stricom.army.mil
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TACOM	RDA (P)	A	Angelo Castellano	880-3877	973 724-3877	angeloc@pica.army.mil
TACOM	LOG (RI)	A	Gerald Moeller	793-7823	309-782-7823	MoellerG@ria.army.mil
TACOM	PROC (W)	P	Mary Hernandez	786-7132	810-574-7132	hernandm@tacom.army.mil
TACOM	PROC (W)	A	Suzi Manning	786-8134	810-574-8134	mannings@tacom.army.mil
TACOM	RDA (W)	P	Patricia Martinez	786-6067	810-574-6067	MartineP@tacom.army.mil

Legend:

C = Co-Chair
P = Primary Member
A = Alternate Member
S = Support

EPIT SSG Members

CMD	ORG		NAME	DSN	COMM	E-MAIL
AMC	RDA	X	Sally Flavin	767-8168	703-617-8168	Flavins@hqamc-exchg.army.mil
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AMC-HQ	RDA	P	Jim Knowles	767-5100	703-617-5100	knowlesj@hqamc.army.mil
AMC-HQ	LOG	P	Ron Lewis	645-8717	256-955-8717	ron.lewis@redstone.army.mil
AMC-HQ	RDA	S	Chris Neubert	767-5638	703-617-5638	NeubertC@hqamc.army.mil
AMC-HQ	RM	X	Dana Burrows	767-2941	703-617-2941	BurrowsD@hqamc.army.mil
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AMC-HQ	RDA	**C**	**Dick Barnett**	767-9848	703-617-9848	BARNETTH@hqamc-exchg.army.mil
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AMCOM	LOG	P	John Chapman	746-3108	256-876-3108	John.Chapman@redstone.army.mil
AMCOM	ENG	P	Ken Dulaney	746-3776	256-876-3776	Kenneth.Dulaney@rdec.redstone.army.mil
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ASAALT	RDA	X	Steve French	664-7238	703-604-7238	steve.french@saalt.army.mil
CECOM	LOG	P	William Riehl	992-0530	732-532-0530	william.riehl@mail1.monmouth.army.mil
CECOM	RDA	P	Gerald Stoops	992-0530	732-532-3460	Gerald.Stoops@mail1.monmouth.army.mil
CECOM	PROC	P	Ric Kelemen	992-5603	732-992-5603	Michael.Kelemen@Mail1.monmouth.army.mil
EDMS PO	RDA	S	John Montgomery	746-8251	256-876-8251	john.montgomery@redstone.army.mil
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OSC	PROC	P	Mary Maland	793-2824	309-782-2824	MalandM@osc.army.mil
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SBCCOM	LOG(N)	P	Mike Ahearn	256-5525	508-233-5525	Michael.Ahearn@natick.army.mil
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STRICOM	LOG	P	Dave Manning	970-3690	407-384-3690	david_w._manning@stricom.army.mil
STRICOM	RDA	P	Leah Treppel	970-3802	407-384-3802	Leah_Treppel@stricom.army.mil
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TACOM	RDA (W)	P	Pandu Rao	786-7448	810-574-7448	RaoP@tacom.army.mil
TACOM	LOG (RI)	P	Tom Boyle	793-3560	309-782-3560	boylet@ria.army.mil
TACOM - PEO	GCSS	P	Al Puzzuoli	786- 6268	810-574 6268	puzzuola@cc.tacom.army.mil
TACOM - PEO	GCSS	A	Sherri Adair	786-7797	586-574-7797	adairs@tacom.army.mil
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	A					
AMC-HQ	CIO	X	Jim Buckner	767-8627	703-617-8627	Bucknerj@hqamc-exchg.army.mil
AMC-HQ	DCSLG	X	John Deyermond, MG	767-9270	703-6179270	DeyermondJ@hqamc-exchg.army.mil
AMC-HQ	DCG	X	Roy Beauchamp, LTG	767-0115	703-617-0115	RoyB@hqamc-exchg.army.mil

Appendix C – EPIT and CIMdata Joint MSC Interview Results

The following are the findings and observations made by the EPIT and CIMdata during the MSC interviews conducted during August – October 2001 to help determine AMC product data requirements. They have been grouped into categories to aid in the extraction of key points:

C.1 General

- AMC is comprised of multiple commands that perceive that they operate in a unique manner. This is a common situation in many large-scale, distributed organizations where individual tasks are assigned with little overall enterprise coordination or control. Based on the interviews, it is believed that the overall AMC chartered responsibilities and business processes are essentially the same across the MSCs. The unique differences that do exist are driven by the unique characteristics of the specific products lines and services for which the MSCs are responsible.

- The products managed by the different commands range from the very simple, off-the-shelf commodity goods to very complex, highly engineered weapon systems.

C.2 Product Data

- The knowledge of how products evolve as they progress through the lifecycle, from concept development through sustainment and decommissioning, is currently not captured consistently. This information is key in supporting AMC's desire to improve the lifecycle usability of its products.

- There is no clear and consistent definition for AMC owned products of what constitutes the complete set of product data that must be managed through the product lifecycle. The distributed work environment that exists within AMC has resulted in incomplete data being delivered to downstream users and customers, which causes many to spend time recreating or reverse engineering that data.

- The definition of data ownership (i.e., AMC, contractors, specific commands, specific organizations within a command, etc) is inconsistent at best. Some programs have it well under control, others do not even realize it is an issue. The term "data ownership" includes defining who owns (has legal rights to) the data, who is responsible to controlling and changing the official "copy of record" of the data, and who to contact to obtain access to the data.

- There are no consistent guidelines at the DA level for PMs to follow for buying data, buying data access, what that access actually means, and for contingency plans if access fails.

- There is a lack of product data visibility and ownership at both the MSCs and AMC level. This has a negative impact on weapon systems composed of items managed by multiple commands, such as the MLRS program where the platform is managed by TACOM, the missiles by AMCOM, and the communications by CECOM. Another example is STRICOM's inability to access in-development product data so that it can develop and deliver training and simulation devices coordinated with the fielding of the product.

- Another area that lacks product visibility is in the area of weapons system embedded software. While some of the Life-Cycle Software Engineering Centers manage their software very well (one has been recognized as a Center of Excellence), the visibility of that software data to the remainder of the AMC community is minimal.

- Historically there has been an engineering drawing baseline managed and maintained by the engineering community and a provisioning baseline managed and maintained by the logistics community. Unfortunately, there has been little, if any, reconciliation / synchronization between the two baselines after initial creation.

- Because of the lack of easy access to the correct and most current product data, it is difficult to keep the technical manuals up-to-date

- For the engineering community, there is limited access to field data to support on-going engineering efforts.

- The MSCs have no effective means to capture lessons learned, and the history of bids, quotes, contractors, and design variations and optimizations. At best, this information is spread across multiple systems, some accessible by only a few individuals.

- AMC's product data management environment should be, at a minimum, a common logical repository for all product data with all of the proper attributes so that anyone in the extended enterprise can access the right information at the right time, provided they have the proper security authorization. A common logical repository does not necessarily mean a single physical repository, but rather can be a set of physically distributes repositories that are linked together electronically such that an authorized user can access them all equally in order to obtain data.

- AMC has historically used drawings as the source of product data because some legacy systems could not store anything else. Contractors have been creating 3D modeling data for some time, and even though most of the current repository systems store them, the data requirements haven't changed to require delivery. This causes the government in some cases to have to pay extra to get data delivered in formats not used by the contractor. Additionally, product data is often not in the correct form required by subsequent contractors to produce or sustain the spare parts. This also limits AMC's ability to leverage the advanced application systems used by a majority of the contractors.

- AMC is not taking advantage of the intellectual assets developed and/or purchased from various contractors. In fact, many times, organizations within AMC do not even consider product data to be part of their intellectual assets.

- Each MSC relies heavily on manual processes to tie their automated systems together for product data management.

- Because of the multiple data systems (including manual files in drawers) within the MSCs and the lack of commonality / standardization between the MSCs, significant data was lost during the previous Base Realignments and Closures (BRACs). This reiterates the problem with AMC asset visibility.

C.3 Acquisition Reform

- Acquisition reform has had broad, significant impacts on AMC's business processes and its ability to consistently define product data management requirements. The acquisition or availability of product data at a sufficient level to perform AMC's mission effectively is not consistent across programs and will seriously impair AMC's abilities in the outyears of new programs.

- The PMs and PEOs don't fully consider the downstream lifecycle product data requirements. It is believed that this is a result of the PM's priority to acquire and deploy hardware based on limited finding and the lack of a clear charter and long-term accountability for full product lifecycle management.

- Acquisition reform has resulted in limitations and restrictions to the scope and level of specificity of product data detail and to the standards and formats to which that data must conform. The inability to contractually define such requirements is having significant downstream impact on the sustainment mission of AMC and complicates defining an AMC-wide product data strategy and implementation of a common or shared product data system.

- Piecemeal conversion of detail drawings to performance specifications has resulted in inconsistencies between documents causing problems in the levels of maintenance (field vs depot/special repair activity).

C.4 Product Data Systems

- There is a diverse set of manual and automated systems used to manage and store product data with little consistency of use within and across commands. There is no single source providing access to a complete set of data for a product either at the AMC level or within the responsible MSC.

- The logon procedures, passwords (expiring every 30 days), and screen navigations are different for each of those systems. This causes the users to spend a lot of time reinstating passwords and re-learning system navigation for those systems that are used only occasionally.

- If data is not stored in the command's primary data repository, that data is not accessible to most employees. That data cannot be linked to or have relationships created to the product or other product data. Many interviewees indicated concern with the integrity and currency of product data maintained in the myriad of different manual and automated systems. Significant effort is spent finding and then validating information that should be easy to find, complete and up-to-date.

- There is no AMC capability to provide multiple views of product data to support different functions. Currently, Bills of Material (BOM) are maintained by the logistics community, but that BOM is basically the same as the engineering community's product structure. There is no consistent use of as-designed, as-built, as-maintained versions of the BOM or the product structure.

- Product data is often duplicated both in a single command but contained in different systems, and between commands.

- Lack of common viewing applications and common technically robust formats to access the variety of product data leads to unnecessary work, delays, generation of additional hardcopies, and potential translation errors, both manual and automated.

- Previous automation efforts were frequently more mechanizations rather than automation with very little business process review for people, cost or time savings.

C.5 Configuration Changes

- The extent to which configuration management is practiced varies widely by MSC and by weapon system.

- AMC's configuration change process is minimally sufficient and is generally not automated. This prevents the automatic routing and history traceability that is required by AMC. Additionally, there is no current, consistently applied standard for the implementation of changes since the cancellation of MIL-STD-973.

- The notification of product data changes is critical and requires considerable effort to maintain using current practices. In many cases, ECPs are not fully executed to update relevant product data. At best, this results in additional work to update the product data before its next use. At worse, it results in errors in the integrity of product data leading to quality and functional failures.

C.6 Workflow

- Automated workflow and document management technologies are greatly needed within AMC. The use of these technologies would support AMC's need to drive its critical business processes . Both the JCALS and MEARS systems provide some level of these capabilities, but AMC-wide use and acceptance is relatively small.

C.7 Data Exchange

- There is no consistent approach to using standards or technology to share product data with key contractors, consequently each program/contractor establishes their own exchange mechanisms, such as Contractor Integrated Technical Information Services (CITIS) systems.

- AMC relies on the hard work and dedication of its people. Most data exchange within an MSC and with other MSCs is based on networking with other people. This leads to a large amount of duplication in effort and longer process times

- The diversity of CITIS systems in the contractor base, coupled with AMC's inability to contractually define data formats and exchange standards, complicate AMC's ability to access and acquire specific product data managed by a contractor. This especially affects the depots, who must access information from multiple contractors.

- The communication of product data changes will play an even greater role throughout AMC as the pressure builds to increase the speed at which new systems are deployed and to reduce the total cost of ownership. This communication will also play a

significant part in the modernization of current weapon systems in an effort to increase their lifecycle (Recapitalization). This will require AMC to effectively integrate with their main contractors throughout the product lifecycle.

- It is thought that if implemented and enforced, AMC-STD-2549 would provide a basis to meet the metadata product data exchange requirements both between the MSCs and their major contractors.

C.8 Defense Logistics Agency (DLA)

- DLA has no single mechanism for access to AMC product data. Like the AMC employees above, they have to hunt for data and then wonder whether the data found is current. They are not participants on the change boards for items that they procure for AMC so they have no method of input to the change process. There is also no automated distribution mechanism for providing the DLA with ECPs to the products that they procure. This, much too frequently, leads to the procurement of the wrong or unusable, parts.

C.9 Integrated Data Environment (IDE)

- Contractors are developing some very promising innovations to meet the Integrated Data Environment requirements imposed by many Army contracts. Capturing the lessons learned from these efforts for any AMC product data management effort would be very beneficial. This effort has been started by the joint ASA(ALT) and AMCRDA sponsored Contractor Integrated Data Services (CIDS) study. Phase 1 of this study is currently underway.

C.10 System Implementation

- There was consistent concern expressed that the process of replacing or interfacing current local systems to an AMC standard solution could significantly adversely impact production levels.

- The infrastructure requirements for the exchange of large 3D models are unknown. This requirement alone could cause a show-stopper for any AMC solution and would require a detailed study to determine what an adequate infrastructure entails. This study should be conducted with the WLMP efforts to determine what has already been provided for.

C.11 WLMP

- There is some concern that the current WLMP effort has some overlap into the product data management areas of responsibilities. However, as currently defined, it will not cover a significant portion of AMC's product data requirements and is therefore currently unsuitable as a solution set.

- There is limited understanding of WLMP across the MSCs. Of the people interviewed, those earlier in the WLMP implementation schedule seem to understand it better than those scheduled later.

- WLMP has not provided a consistent message to the MSCs. This lack of a thorough communications plan should not be repeated for a product data management effort.

Appendix D – Results of Benchmarking

The following "lessons learned" resulted from the industry and Canadian Ministry of Defense interviews/visits and reflect issues related to corporate ERP and PDM system implementation in general and not just SAP products.

Rockwell Collins - Rockwell Collins has implemented the same ERP system being utilized by the Wholesale Logistics Modernization Program (WLMP), i.e. SAP. For engineering operations and applications, they have implemented eMatrix from MatrixOne. Rockwell Collins chose the SAP ERP system first and later chose to implement a PDM system. Both systems have been implemented corporate-wide.

- Mind Set/Cultural change was the biggest challenge. Management must participate/accept change not just direct it.
- Implementation and use of a PDM or ERP system must become a way of life and not be treated as a short term project.
- Selection of a PDM system must be based upon the merits of the available solutions. Although one single enterprise solution (single PDM or ERP that does everything) is most desirable, enterprise solutions must enable the enterprise to perform and improve its performance.
- Although committed to an enterprise solution, Rockwell Collins determined that SAP's PLM product was not adequate for its purposes at the time (1997).
- The basic priorities during product evaluation should be: Technology, Integration, and Functionality, in that order. Technology used in the product must be state-of-the-art and be maintained that way. Integration of the product with other legacy corporate systems is critical to successful enterprise implementation and operation. Functionality of the product is of no value if it can't be made to work in the enterprise. The only functionality that counts is the functionality that works in an integrated state-of-the-art enterprise environment.
- Vendor claims must be fully evaluated. No interfaces or data exchanges with any 'bolt on' product will be easy and will be definitely more expensive than proposed. The implementation cost can be expected to be on the order of 3-times the cost of the software package.
- Rockwell Collins currently has one-way data transfer from their PDM to their ERP, and is striving for two way data exchange.
- The planned Architecture and data schema/model must be understood early on. Data mapping is essential to successful implementation. Data standards and standardization must be understood up front to avoid problems with implementation.
- An independent systems integrator is essential, however, caution must be exercised to not allow the integrator to make management decisions or become a 'crutch' as implementation moves to full operation.
- SAP is a major barrier to process re-engineering. To re-engineer and implement SAP at the same time is extremely hard and may be too hard.

Lockheed-Martin – Missiles and Fire Control Division (LM/MFC) implemented SAP ERP during 1998-2000. They later implemented and integrated a PDM solution, Eigner + Partner, CADIM/EDB product.

- LM/MFC has implemented the ERP and PDM systems at Dallas, TX and Orlando, FL locations.
- They have also implemented a Component and Supplier Management (CSM) system that interfaces with both the ERP and PDM systems.
- Utilization of the ERP and PDM tools together with business process re-engineering led to a common CM system across all programs, a single data repository and standardized part definitions.
- LM/MFC is allowing some Government PM Office access to their systems via web browser.

John Deere – John Deere has been a strong user of SAP ERP for many years at all of their factories. They recently made the corporate decision to choose a corporate-wide PDM system. They are considering and evaluating SAP PLM, Windchill and eMatrix.

- Four sites are currently running on a single instance, enterprise-wide SAP implementation (small facilities). Eleven sites are currently using Division peculiar SAP ERPs. John Deere intends to move all their sites to the single instance, enterprise-wide ERP with standard processes. Upon completion of the move to an enterprise architecture approximately 40 sites will be running on the single enterprise ERP application.
- They have not yet implemented mySAP.com webportal. They're using dedicated communication lines for now.

- Deere used IBM as a systems integrator to help initially in the implementation of SAP ERP.
- With SAP ERP you have "infinite" flexibility to set things up initially but once the decisions have been made and the system has been configured, it becomes very difficult to change. Deere considers this resistance to reconfigurability an asset in the effort to enforce corporate business process, but warned that configuration choices must be correct for the enterprise from the beginning.
- Currently, Deere has several site specific PDM systems with no common interface or data access.
- Deere has decided that, after corporate-wide PDM implementation, engineering will maintain design control within the PDM system. The master Bill of Material for the "as designed" configuration will be stored in the PDM system.
- Deere's PDM system will be the planning environment for product and process definition.
- The biggest business case driver for their acquiring a corporate PDM system is the collaboration capabilities and benefits.
- Deere plans on approximately 6000 licenses with an estimated $60 million implementation cost (20% for software purchase and 80% for implementation using approximately 60% external staff and 40% internal staff) and 3 year implementation schedule.
- Deere's most important business requirements for a PDM system's capabilities include: Product Modeling, Configuration Management, Quality Planning, Target Costing Analysis, Simulation and Change Control.
- Deere is still in the evaluation of PDM products, but has effectively eliminated SAP PLM from further consideration.

Canadian Ministry of National Defense – The Ministry of National Defense has selected SAP ERP R3 to serve as their new Material Acquisition and Support Information System (MASIS). MASIS provides the maintenance and repair planning element of their enterprise system. It currently does not provide for the configuration management, technical data management, data management or some of the other engineering elements. National Defense is moving to include more of the engineering functionality's, i.e. Technical Documentation, Configuration Management, etc.

- The Canadian National Defense force is using SAP R/3, in a manner that appeared to be exactly what is proposed as the EPIT alternative strategy for using the WLMP. The Canadian SAP R/3 implementation will be the "front-end" of their life cycle. MASIS supports and must be interfaced with the Canadian National Defense force's standard supply system (CFSS).
- The Canadian's have successfully implemented SAP/R3 at their WD202 depot. The WD202 handles both rebuilds and upgrades to weapon systems. WD 202 is using SAP to track and manage production Since implementation, WD 202 has realized a 25% increase in productivity and a 50% decrease in inventory.
- Under the MASIS concept of operations SAP provides the software via license agreements, maintenance and upgrades. This is for the duration of the contract period. Each contract must be renegotiated. IBM provides the systems integration and interfacing of the entire system. National Defense provides the hardware, or at least controls the hardware and National Defense operates the system.
- National Defense contracted for the "Public Sector" version of SAP R/3 through, and with urging from, IBM. It is the current opinion that National Defense would much rather be using the "Aerospace & Defense Sector" version. However, the change is currently cost prohibitive. A "lesson learned" from this is to pick your SAP Industry Solution very carefully!
- SAP R/3 modules/elements are very flexible before they are set for specific applications. The capability is there if enough time and effort is taken to fully understand the capability and to "set the switches" properly. Once the "switches are set" the modules/elements become almost totally inflexible.
- WD 202 had an extremely enthusiastic lead within the depot and their project manager was insightful in both the technical and political realms of the project.
- The program re-engineering was spurred by dramatic cuts in the budget and was intended to shake-up firmly entrenched business methods. Rather than taking the former "cuts across the board" approach to manpower and processes, they accepted the challenge of "getting down to the details" by using activity-based costing. This enabled them not only to see where improvements and "cuts" should be made but also where additional manpower was needed. They clearly knew that they had to decide the policy, then the process, then the data and then the systems - in that order.

Compaq Computer – Compaq has been using SAP ERP for the last six years and recently decided to implement a corporate PDM system as well. They looked at Windchill, eMatrix, Metaphase and SAP PLM, and chose SAP PLM primarily due to its ease of integration with SAP ERP.

- They had SAP ERP version 3.1, but PLM requires a minimum of Version 4.6, so they are having to upgrade their ERP systems before they can install PLM.
- They implemented PLM at their Houston site about 18 months ago. Other sites are waiting for their upgrade to SAP ERP version 4.6.

- They currently have about 1500 PLM users (including supply chain partners), but have an ultimate goal of approximately 10,000 users within the next couple of years.
- Compaq has implemented SAP ERP in a "regionalized" manner. Each region has an instance of the SAP product, but all share and access a single central database. There are 5-6 plants within the North American region and a series of dedicated T1 or T3 lines connect the sites. Due to the large size and volume of data transfers that would occur with the PLM product in design development, Compaq will not use the central database approach with it. More data repositories will be established with PLM to address response time and bandwidth concerns.
- Compaq has 12 legacy systems that must be migrated into SAP PLM. One other legacy system, Aspect's CSM product, will remain external to SAP but will be interfaced with it.
- Compaq realized that SAP PLM was not strong in the areas of conceptual design development, collaboration, and document management, but made their selection primarily on its ease of integration with SAP ERP. They hope that an upcoming product, Product Designer, will provide the missing functionality in concept design development and collaboration. They use IXSO's repository software to provide document management capabilities.
- Compaq feels SAP has good workflow tools and a good web portal that is easy to use.

Appendix E – AMC Legal Office Opinion of Legal Issues Regarding Engineering and Technical Data (ETD) Repositories and WLMP

Deleted in this version of the report, but available upon request from HQ AMC.

Appendix F – Cost Estimates for Alternative Solution Strategies

Deleted in this version of the report, but available upon request from HQ AMC.

Appendix G – MSC Evaluation Package

TO: EPIT Primary Members:

Attached to this email is the form that the EPIT evaluation team developed to gather each MSC's ratings of the 7 Alternative EPIT strategies verses the EPIT Requirements.

GENERAL INSTRUCTIONS:

1. The entire, completed workbook for your MSC is to be returned via email to Patricia Martinez, by **COB 1 Feb 2002.** Please do not delete any of the links or tabs from the workbook.
2. The EPIT primary representatives are responsible for completing this task. Any additional MSC representatives may be involved at the MSC's discretion.
3. Your MSC sub-team representative should be your first source for clarification on either Requirements, Alternatives or Evaluation issues.

WORKBOOK EXPLANATION

1. The tab marked EPIT EVALUATION FORM is the main navigation and evaluation page. Again, please do not delete any links or tabs, nor should you add any columns or rows to the workbook.
2. In the upper left hand corner is a cell to identify your command, the main POC for your MSC 's spreadsheet, their email and phone number .
3. Down the left most column (A) are the EPIT Requirements. Each cell is a hyperlink and will display a definition of that requirement when it is clicked. These definitions are found on the tab marked DEFINITIONS
4. Near the bottom of Column A is the row for RISK . This is a hyper link to a cell for each MSC to provide a short narrative of the rational for the color chosen. The complete text you provide can be found on the tab marked RATIONALE near the bottom.
5. At the bottom of the sheet is Summary Cost data for each alternative. The complete Cost spreadsheet is found on the tab marked COST SUMMARY.
6. Across the top row are the EPIT Alternatives .
7. Within each intersection of Requirement vs. Alternative is RATIONAL LINK. This is a hyper link to a cell for each MSC to provide a short narrative of the rational for the color chosen. The complete text you provide can be found on the tab marked RATIONALE .
8. The final column on the sheet is a comment section. This area may be used to provide additional information to discuss overall impacts of a requirement. Items such as major differences between alternatives; why a particular alternative is the same across all alternatives; or major impacts of a particular alternative may be discussed. This is a hyper link to a cell for each MSC to provide a narrative of the rational. The complete text you provide can be found on the tab marked RATIONALE .

DIRECTIONS for completing worksheet

1. For each intersection of Requirement vs Alternative, use the Requirements rating scale color to define your rating. The color may be applied to the cell by either of the following processes:
    a. VIA FORMAT TOOL BAR
        i. On the menu bar, click VIEW, click TOOLBARS, and verify that the toolbar titled "FORMATTING" is checked
        ii. Navigate to the desired cell to color (use caution: if you click on the desired cell you will be taken to the RATIONALE cell). Using the arrow keys will allow you to highlight the desired cell without enabling the rationale link.
        iii. On the FORMATTING toolbar, there is a paint bucket icon (FILL COLOR). The color displayed under the icon is the current fill color. Clicking the arrow to the right of the icon will display the color pallet. Clicking directly on the icon will

fill the highlighted cell with the fill color, clicking on one of the colors when the color pallet is displayed will fill the highlighted cell with that color.

b. VIA RIGHT CLICK ON CELL
   i. Place your cursor arrow over the desired cell
   ii. "Right Click" your mouse button and select "Format Cells"
   iii. Click on the tab marked "Patterns"
   iv. Click the desired color, click OK

2. For each intersection of Requirement vs. Alternative, click on the "RATIONALE LINK" within each cell and provide a text explanation of your rating. This explanation should provide further information about impacts to your MSC for this alternative. Please fill each link, even if your ratings are the same across all alternatives .
3. For each intersection of RISK vs Alternative please use the RISK rating scale color to define your rating.
4. The Cost data is provided for reference only. No rating is necessary, however, please examine the entire cost summary sheet to become familiar with it and to be prepared to discuss at the Orlando meeting. Any significant issues with the cost sheet should be noted in your comment section.

ASSUMPTIONS AND OTHER COMMENTS

The CIMData recommended strategy can be found in alternatives 2, 3, 4 and 5 . The 7 alternatives further refines the ownership of the solution layers not addressed by CIMData. Please refer to the CIMData reports emailed to you prior to this.

EPIT ALTERNATIVES TEAM GLOBAL ASSUMPTIONS:

1. There will be equal costs associated with data conversion regardless of alternative. Ref: ADCS Program

2. Life cycle cost is defined as cost of implementation, award and operating cost includes Tech refresh.

3. All non-WLMP alternatives are ACMS compliant.

4. ACMS alternatives all have an inherent corporate integration layer.

For Technical assistance with the spreadsheet, contact Matt Meinert DSN 987-1498 or Gordon Ney DSN 793-6586. Other questions may be directed to the undersigned or Gordon Ney.

Thank you for your support in this important effort.

Trish

EPIT Evaluation Form, Command _____, Command POC_____, Command email address _____, Phone number _____	**Alternative 1**-Wholesale Logistics Modernization Program. Migrate all PDD to the WLMP Solution.	**Alternative 2**-Individual ACMS-Gov Maintained. Each MSC has a site selected ACMS solution with a single integration layer. The single integration layer is gov maintained and interfaces to WLMP.	**Alternative 3**-Individual ACMS-Gov Maintained. Each MSC has a site selected AMCS solution with a single integration layer. The single integration layer is contractor owned and interfaces to WLMP.	**Alternative 4**-Standard ACMS solution-Gov maintained. Each MSC has the same COTS product to create an ACMS solution. There is a single integration layer that is govt maintained and interfaces to WLMP.	**Alternative 5**-Standard ACMS solution-Gov Maintained. Each MSC has the same COTS product to create an ACMS solution. There is a single integration layer that is Contractor owned and interfaces to WLMP.	**Alternative 6**-Single ACMS solution-Govt maintained. There is one instance of a govt maintained ACMS solution. That one instance is interface to WLMP.	**Alternative 7**-Single ACMS solution-Contractor owned. There is one instance of a contractor owned ACMS solution. That one instance is interfaced to WLMP.	**Comments**
REQUIREMENTS								
Modernized Business Processes - The system will provide a modernized information exchange with AMC internal and external organizations.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Clearly Define Data Ownership -The solution will define data ownership at all phases of the lifecycle (I.e., develop, acquire, equip, sustain, and dispose).	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Establish a Common Data File/Repository -This solution will support the organization's business requirements in an integrated data environment	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link

Manage Product Data Throughout the Entire Product Lifecycle - The solution will provide a formal product development process with a focus on weapon system mgmt capable of creating, extracting, deriving, transforming, and loading needed data throughout the lifecycle.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Establish a Product Data Security Schema - The solution will permit access to authorized users through a secure web portal; each user will be authorized system access (I.e., download, check in/out, query, update) and content access (at the configuration level).	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Establish a Common Change Management Process - The solution will provide for an engineering change management process.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Establish a Common Access & Exchange Mechanism with AMC and Contractors (ie. CIDS) - The solution will leverage existing data standards for metadata communication and use standard data formats for communicating design (I.e. AMC-STD-2549).	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link

Establish a Common AMC Product Data Portal Mechanism - The solution will provide users a single point of access to all PD and use Internet based technologies to create a client that is easy to navigate.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Establish a Common Way to View and Comment on Visualizations - The solution will provide a tool for non-CAD users to visualize assemblies.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Establish a Common Collaboration Mechanism - The solution will provide concurrent electronic sign-off, audit trails, electronic notification, real time review, and meetings online.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Establish the IT Infrastructure -The solution will be flexible and customizable in its ability to meet the needs of the users and leverage existing IT infrastructure.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Establish Interoperability with External Systems (contractors, other services, Foreign Military sales) - The solution will leverage available interface technologies across the organizations.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link

Manage Various Design & Concept Development Tools & Their Output -The solution will accommodate a variety of design and concept development tools.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Configuration Management Requirements -The solution will provide lifecycle configuration management and configuration status.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Manage Software as Part of the Complete Product Definition -The solution will provide for integration of a variety of Computer-Aided Software Engineering (CASE) tools and the software development process.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Army Knowledge Management - The solution will be AKM compliant.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Ownership and Support - The solution will be easy to install, operate, maintain and upgrade.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
Query, View, Print - The solution will allow for authorized users to query the system, view the results and print or download the results.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link
RISK - is defined as business process, cultural, infrastructure and other.	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link	Rationale Link

EPIT Evaluation Package Terminology Definitions

Requirement	Detailed Definition
Modernized Business Processes	The system will provide a modernized information exchange within AMC internal and external organizations. It will also support current and emerging PDM strategies, to provide a roadmap of current Army practices to best practices with the PDM solution to be upgraded throughout the life of the program as required. The system will be compliant with the Automated Configuration Management System (ACMS) MIL-PRF-32029(MI).
Clearly Define Product Data Ownership	The solution will define data ownership at all phases of the lifecycle (I.e., develop, acquire, equip, sustain, and dispose. The solution will provide the ability to manage data ownership within the PDM environment and changes IAW business requirements, identify required data (type, scope, level of detail) and the integrity of that data.
Establish a Common Data File/Repository	The solution will support the organization's business requirements in an integrated data environment. It will provide web access with data visualization tools, leverage available classification schemas, and classify all data stored in the data repository, as it is stored. The solution will provide a self-maintaining data dictionary that contains metadata of the objects to be managed. Metadata will contain information describing the data object definition, properties, life cycle states and its usage. The data dictionary will also contain all known interface meta-data to include mapping of the data objects. The solution will define the process and allow/control user access to the data that is required at different points throughout the lifecycle. The solution will allow for data to be migrated from a legacy or external system. The solution will allow for notes/comments on each data object. The solution will allow for a master bill of materials.
Manage Product Data Throughout the Entire Product Lifecycle	The solution will provide a formal product development process with a focus on weapon system management capable of creating, extracting, deriving, transforming, and loading needed data throughout the lifecycle. This lifecycle will be compliant with DoD 5000 Series. The solution will accommodate government and contractor owned PD. the solution will define a common data model to describe the range of PDD to be managed, define data aging requirements (i.e., archival processes and procedures, etc.) The defined process will ensure that data is accurate, complete, and auditable thereby supporting analysis, planning, tracking, management, collaboration, and decision-making. The solution will provide flexibility to allow for business process re-engineering, which includes organizational, process and function changes. The solution will provide for tailored reporting at all levels. The solution will provide for increase usage to support mobilization/surge capability.

Establish a Product Data Security Schema	The solution will permit access to authorized users through a secure web portal; each user will be authorized system access (I.e., download, check in/out, query, update) and content access (at the configuration item level). The solution must be able to prevent aggregation of unclassified that when aggregate becomes classified. The solution will provide for implementation of electronic security standards that are compliant with DoD instructions 5200.40, Information Technology Security Certification and Accreditation Process (DITSCAP). The solution will comply with Public Key Infrastructure, enabled and consistent with the following: Memorandum, subject DoD PKI, dated 6 May 99; PKI Roadmap for the DoD, v 2.0 rev c dated 12 Oct 99; U.S. DoD X.509 Certified Policy, version 2.0 dated Mar 99. The solution will secure information from unauthorized disclosure or use, destruction, loss or modification and provide for total data recovery with in a 24-hour period.
Establish a Common Change Management Process	The solution will provide for an engineering change management process. The solution will identify the owner and configuration manager of the data. The solution will identify the owner and configuration manager of the data. The solution will provide visibility of product changes to authorized users. The solution will allow the user to view and compare multiple configurations simultaneously (i.e., as designed, as built, as maintained). The solution will allow for identification of changes from one configuration to another. The solution will allow authorized users to check-in and check-out data objects.
Establish a Common Access & Exchange Mechanism with AMC and Contractors (i.e. CIDs)	The solution will leverage existing data standards for metadata communications and use standard data formats for communicating design data (I.e. AMC-STD-2549). The solution will provide the necessary data elements for data exchange. The solution will provide exchange of 2D and 3D CAD data and fully interface and freely exchanged data with AMC's emerging enterprise wide information system architectural environment as described in the AMC Information System Architecture.
Establish a Common ACM Product Data Portal Mechanism	The solution will provide users a single point of access to all PD and use Internet based technologies to create a client that is easy to navigate. The solution will provide a mechanism to connect to various legacy systems. The solution will provide the common portal technology framework and single sign on mechanism.
Establish a Common Way to View & Comment on Visualizations	The solution will provide a tool for non-CAD users to visualize assemblies. The solution will provide markup capabilities for both 2D and 3D data for CAD and non-CAD users for lifecycle support.

Establish a Common Collaboration Mechanism	The solution will provide concurrent electronic sigh-off, audit trails, electronic notification, real time review, and meetings online. The solution will support MSC-specific requirements for design reviews, bidding processes, and maintenance support which will establish an environment to share both 2D and complex 3D CAD information among design teams and embedded modeling functions.
Establish the IT Infrastructure	The solution will be flexible and customizable in its ability to meet the needs of the users and leverage existing IT infrastructure. Required hardware, software and network systems to implement the solution will be identified and provided as needed. The solution will conform to the Army Joint Technical Architecture (JTA) and Information System Architecture (ISA).
Establishing Interoperability with External Systems (contractors, other services, Foreign Military Sales)	The solution will leverage available interface technologies across the organization. The solution will provide data exchange and interoperability capabilities.
Manage Various Design & Concept Development Tools & Their Output	The solution will accommodate a variety of design and concept development tools.
Configuration Management Requirements	The solution will provide lifecycle configuration management and configuration status accounting.
Manage Software as Part of the Complete Product Definition	The solution will provide for integration of a variety of Computer-Aided Software Engineering (CASE) tools and the software development process.
Army Knowledge Management	The solution will be AKM compliant.
Ownership and Support	The solution will be easy to install, operate, maintain and upgrade.
Query, View, Print	The solution will allow for authorized users to query the system, view the results and print or download the results.
Risk	Is defined as business process, cultural, infrastructure and other.

Appendix H – Results of MSC Ratings of Alternative Strategies

The Evaluation Subteam consolidated the individual MSC ratings and applied a clustering method as the initial attempt toward achieving consensus. This method involved translating the color scheme into numerical values for the purpose of pattern analysis . From the Color Ratings described in section 4.5.1 of the report the colors were given numerical values from 0 = red to 4 = blue.

The ratings from the MSC's can be seen in the Excel Spreadsheet "**Revised_EPIT_Report_Eval_Spreadsheet_1 Apr02.xls**" . There are three sheets. The first and second sheets are identical except that the second sheet hides the MSC rows columns for each strategy. From this it can be seen that numbers were assigned to colors as indicated above. The EPIT colors were based on rounding the average MSC color numbers for each requirement. The same is true for the overall EDIT color for each strategy.

The third sheet serves as a summary of the MSC ratings, except that it is based on the 0 – 4 scale (0 = red to 4 = blue) and does not include the risk row. The table below shows the tabulated results of the MSC ratings of the alternative strategies, not including the "Risk" ratings.

	AMCOM	CECOM	OSC	SBCCOM	STRICOM	TACOM	EPIT
Strategy 1	2.50	1.56	2.17	2.22	0.00	1.28	1.62
Strategy 2	2.44	2.94	1.39	3.28	2.00	2.89	2.49
Strategy 3	2.44	2.94	1.39	3.28	2.00	2.56	2.44
Strategy 4	3.06	2.78	2.33	3.28	3.00	3.00	2.91
Strategy 5	3.00	2.83	2.39	3.28	3.00	2.89	2.90
Strategy 6	3.89	2.44	3.17	2.83	0.00	2.58	2.49
Strategy 7	3.83	2.11	3.11	2.72	0.00	2.33	2.35

Appendix I – Implementation Plan

STANDARDS, POLICY, PROCEDURES AND PROCESSES

Lifecycle

- Define the AMC weapon system lifecycle view
- Define the AMC data lifecycle process with formal gates and reviews
- Determine what data is required to support the AMC mission during the weapon system lifecycle
- Develop policies for government-owned versus contractor-owned data (roles & responsibilities)
- Develop AMC policy and guidance for use by the MSCs for determining what product data (type, scope and level of detail) should be purchased or made available
- Coordinate ePDM vision, strategy, system implementation, lifecycle data, and data ownership with ASA(ALT)

Data Ownership

- Identify the weapon systems for which AMC is responsible (or partially responsible)
    - Identify the product data requirements for that weapon system to support the remainder of the lifecycle.
    - Identify the current data repository and data access provisions for that weapon system.
    - Do gap analysis
- Prepare a get-well plan

Common Requirements *Use Simulation and Modeling during each of the efforts below to help determine detailed requirements.*

- Define common data model
    - Define objects & metadata
    - Define classification schemes
    - Define 3D model & tools metadata
- Define common security scheme
    - Define top-level security requirements by law, regulation and policy
    - Define types of use and required access levels
- Define common data management processes
- Define common change management process
- Define common data review processes
- Define common collaboration & view/visualization requirements
- Define common access & exchange mechanism
    - Review, revise and complete AMC-STD-2549
        - Assure adequate data ownership identification and data ownership transfer tracking
    - Continue participation with GEIA to review, revise and complete EIA-STD-836
    - Develop/adopt OTHER exchange mechanism
- Develop policy and guidance for use of the data exchange mechanism
- Develop revision to MIL-PRF-32029 to include the above and for technology insert
- Review ANSI/ASME standards for 3D models
    - Determine AMC policy for 3D model data access and exchange
- Define required interfaces to WLMP, both to current systems and the future ePDM system

Army Knowledge Management (AKM)

- Determine AKM Requirements

PROGRAM MANAGEMENT

Program Management

- Identify Scope of effort
- Identify Army oversight organization
- Identify Army decision authority
- Identify Army IPT membership
    - MSC implementation organization / team
    - Government / Contractor technical support personnel
    - Technical review / approval personnel
    - Contractor personnel
- Define coordination / decision methodology
- Develop program schedule (achieve as much parallelism as possible)
- Identify beta site / site schedule

Budget Planning & Coordination

- Prepare Economic Analysis including Return on Investment (ROI)
- Develop Budget ROM
    - Government personnel
    - Contractor personnel
    - Business process re-engineering
    - Data migration
    - Site surveys
    - System tailoring
    - System interfaces
    - Training
    - Hardware / Software / Infrastructure
    - Operations
    - Testbed
    - COOP
- Receive and disperse funds for entire ePDM program

Functional / Technical Requirements

- EPIT Final Report (Reference)
- ISO 10007(Quality Management – Guidelines for Configuration Management)
- EIA / ANSI 649 (National Consensus Standard for Configuration Management)
- MIL- PERF-32029 (ACMS Performance Specification)
- AMC-STD-2549A (Configuration Management Data Interface standard)
- EIA 836 (DRAFT Configuration Management Data Interface standard)
- Strategic Business Drivers
    - AKM
    - Army IT Regionalization
    - DoD Architecture Framework (JTA?)
- ANSI/ASME Standards (Y14.100, Y14.41, Y14.42, etc)
- ISO 10303 (Industrial Automation Systems Integration – Product Representations & Exchange)
- Contracts Data Requirements List (CDRL) (DD 1423 Form)

Configuration Management of ePDM System

- Identify change authorities
- Identify coordination / decision processes
- Develop plans for centralized CM of:
    - Requirements
    - System
    - Requirements traceability matrix

Develop System Continuity of Operations Plan (COOP)

Program Implementation

- Analyze Functional and Technical Requirements
- Perform "mini" Site Survey
- Develop Concept of Implementation
- Develop System Selection Plan
- Develop System Infrastructure Plan
    - Conduct in-depth infrastructure site surveys and infrastructure hi-fidelity simulation representing total operation of the system modeling to determine detailed requirements, such as bandwidth, degree of distribution required.
- Develop System Security Plan
- Develop System Supportability Plan
- Develop System Migration Plan
- Develop System Interface Plan
- Develop Business Process Re-Engineering Plan
- Develop System Training Plan
    - Management
    - Database Administration
    - System Administration
    - Users
    - Testers
    - Help desk
- Develop System Test Plan
- Develop testbed Concept of Operations
- Develop System Technical Support and Maintenance Plan

System Selection

- Prepare Request for Proposal
- Perform Customer visits
- Downselect to two or three systems
- Load the two or three systems to the Test Bed
- Evaluate the systems to the requirements
- Select a system

Contract Management

- Identify contracting agency / COR / COTR
- Develop Request for Information
- Identify contract requirements
- Define earned – value methodology
- Define contract performance reviews
- Establish Source Selection Board
- Develop contract Request for Proposal
- Establish contract evaluation factors
- Develop source selection criteria
- Establish contract deliverable review / decision / approval procedure

Contract Requirements

- Project Management
    - Identify contractor project manager
    - Identify contractor IPT membership
    - Identify project strategy
    - Provide goals & objectives

    - Establish work breakdown structure (Utilize constructive PERT charts that feature as much parallel work effort to make a rapid installation)
    - Develop program schedule
    - Deliverables – Program Management Plan
        - Program Schedule
        - Lessons Learned
- Web-based Contractor Integrated Technical Information Service (CITIS)
    - Establish Website
    - Determine access and security procedures
    - Provide contract deliverables through website
    - Coordinate decision documents through website
    - Develop Lessons Learned Database
    - Deliverables – CITIS Access

Project Completion

- Deliverables – Project Completion Analysis & Recommendation Report
    - Project Completion & Analysis Recommendation Brief (Detailed)
    - Project Completion & Analysis Recommendation Brief (Manager)
    - Project Completion & Analysis Recommendation Brief (Executive)

SYSTEM IMPLEMENTATION

Install Test Bed

- Identify all H/Q, S/W and facilities required
- Order H/W, S/W, Network equipment required
- Prepare facilities
- Install H/W, S/W and network equipment

The following item requirement are repeated for each site

Conduct IT Site Survey

- Identify current capabilities
    - Hardware
    - Software
    - Network
    - Facilities
- Identify current site shortfalls
- Develop IT Infrastructure Plan for site
- Develop IT Infrastructure Test Plan
- Order required H/W, S/W, Network
- Install required H/W, S/W, Network
- Load test data
- Perform required data cleansing
- Conduct test
- Analyze test results
- Correct problems

Conduct Systems Site Survey

- Identify all product data systems and their required interfaces
    - Hardware
    - Embedded Software
    - ECPs
    - Others

Conduct MSC Business Process Review & Re-engineering *(Processes include: Data ordering, Data receipt and quality assurance, Technical loop review, Engineering changes, and Automatic distribution)*

- Analyze current processes
- Identify required changes
    - Identify impacts on infrastructure, culture, and local procedures
- Develop system Spec, Sub-system specs, and SOPs

Tailor COTS System and Develop Interfaces

- Develop & customize the system
    - Requirements
    - Common data model
    - Common business processes
    - Current and new interfaces
- Develop and load test data
- Develop test scenarios
- Test system

Conduct System Migration

- Prepare Data Migration Plan for each product data system
- Provide copy of each database
- Prepare data migration scripts
- Perform database cleansing
- Freeze database
- Benchmark database counts and deports
- Run data migration scripts
- Perform database cleansing
- Rerun database counts and reports
- Provide copy of database to COOP

Production

- Conduct parallel operations, as required
- Provide COOP updates

Conduct Training Site Survey

- Identify Training Requirements
    - Technical
    - Functional

Conduct Training

- Conduct System Administration training
- Conduct Management training
- Conduct User training
    - Data ordering
    - Data loading/QA
    - Data reporting

Help Desk

- Develop Help Desk Guidelines / policies / procedures

Install COOP Data at COOP site

- Load site database
- Conduct database test

- Run database counts and reports
- Identify discrepancies

Appendix J – Acronym List

2D	Two Dimensional
3D	Three Dimensional
ACMS	Automated Configuration Management System
AKO	Army Knowledge On-Line
ALT	Administrative Lead Time
AMC	Army Materiel Command
AMCOM	Aviation and Missile Command
API	Application Programming Interface
ARDEC	Armaments Research, Development, and Engineering Center
ASP	Application Service Provider
BOM	Bill of Material
BPR	Business Process Reengineering
CAD	Computer-Aided Design
CAD/CAM	CAD/Computer-Aided Manufacturing
CAE	Computer-Aided Engineering
CALS	Computer-Aided Logistics Support
CASE	Computer-Aided Software Engineering
CCB	Configuration Control Board
CCSS	Commodity Command Standard System
CDCA	Current Document Change Authority
CDRL	Contract Data Requirements List
CECOM	Communications-Electronics Command
CIDS	Contractor Integrated Data Services
CITIS	Contractor Integrated Technical Information Service
CM	Configuration Management
COTS	Commercial-Off-The-Shelf
CPC	Collaborative Product Commerce
cPDm	collaborative Product Definition management
CRM	Customer Relationship Management
CSC	Computer Sciences Corporation
CSM	Component Supplier Management
DFAS	Defense Finance and Accounting Service
DISA	Defense Information Systems Agency
DLA	Defense Logistics Agency
DMZ	Demilitarized Zone
DoD	Department of Defense
DUST	Dual-Use Science and Technology
EAI	Enterprise Application Integration
ECAD	Electrical Computer-Aided Design
ECM	Engineering Change Management
ECP	Engineering Change Proposal

EPIT	ERP-PDM Integration Team
ERP	Enterprise Resource Planning
FMS	Foreign Military Sales
FTE	Full Time Equivalent
HQ	Headquarters
HTML	HyperText Markup Language
ICAPP	Interactive Configuration Management and Procurement Program
IDE	Integrated Data Environment
IT	Information Technology
JCALS	Joint Computer-aided Acquisition and Logistic Support
JECMM	Joint Engineering Change Management Model
JEDMICS	Joint Electronic Data Management Information and Control System
JIT	Just-In-Time
LAR	Logistics Assistance Representative
MCAD	Mechanical CAD
MEARS	Multi-User ECP Automated Review System
MLRS	Multiple Launch Rocket System
MRP	Manufacturing Resource Planning
MSC	Major Subordinate Command
NAC	National Automotive Center
NC	Numerical Control

Appendix K – Definition of Terms

Collaboration: A mechanism to support effective interaction of product data within AMC and with its contractors to support concurrent engineering principals. (i.e. e-mail, Web, verbal, teleconferencing, and visualization communications)

Common Portal: A system access capability that allows a single sign-on (SSO) using Light Directory Access Protocol (LDAP). This allows data to be brought together on the desktop without the need to physically log into multiple systems.

EAI Layer: Enterprise Application Integration (EAI) layer is a layer of software (middleware or umbrella) that acts as a connecting mechanism to knit together multiple systems in a federated environment.

CADIM/EDB: A system implemented by Lockheed-Martin for their PDM solution. Eigner + Partner is the company that is responsible for the design and development of this family of integrated products for the management of product data.

Distributed Architecture: In the context of this study and report, an automated system environment, where separate instances of the same system are configured and connected in such a manner that they are capable of accessing and exchanging data in a seamless process. Each system "instance" has an associated data repository that stores data used primarily by that site. Each site can query and access data contained in another site's data repository. The total collection of data contained in all site repositories is known by a single data index, accessible by all users, that points to its location. The hardware, software and data model used by all "instances" is centrally managed and controlled.

Federated Architecture: In the context of this study and report, an automated system environment, where different products are configured and connected in such a manner that they are capable of accessing and exchanging data. Each product has an associated data repository that stores data used primarily by that site. Each site can query and access data contained in another site's data repository. No centralized management of the hardware or software is performed, and no business processes are necessarily standardized. A common data model will probably be required to enable data access between products.

Metadata: Elements of information that describe data, such as document identifier, date, owner, release level, format, keywords, data location, approval authorizations, part identifier, and part name. These elements help users locate and distinguish particular data stored in automated data management systems.

MySAP PLM: The product name SAP has given to the suite of R/3 functionality that directly compares with other commercial vendor's PDM software.

SAP ERP R/3: A commercial off-the-shelf (COTS) Enterprise Resource Planning (ERP) software product selected by CSC to support the logistics business process re-engineering of WLMP.

Touch Points: A term used to identify the current and future business process interfaces between the engineering, procurement and logistics communities.