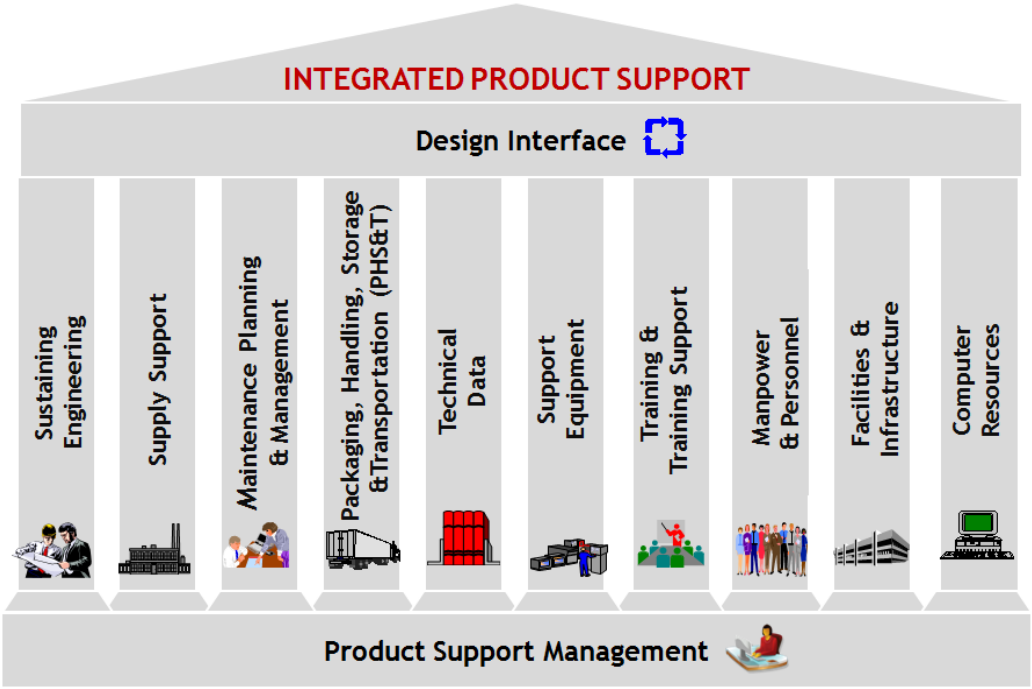

Integrated Product Support Element Guidebook

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Appendix A. ACRONYMS

Foreword

In October 2009, Section 805 of Public Law 111-84 established the key leadership position of Product Support Manager (PSM) and reiterated DoD's commitment to life cycle product support management. By 2010, the Office of the Assistant Secretary of Defense (ASD) Logistics and Materiel Readiness (L&MR) concluded the seminal work to develop and implement a Product Support Business Model (PSBM) and published a series of Guidebooks to assist the Product Support Manager (PSM) in the execution of his or her duties. These new Guidebooks include the "DoD Product Support Manager Guidebook", the "DoD Product Support Business Case Assessment (BCA) Guidebook" and the "DoD Logistics Assessment (LA) Guidebook".

This Integrated Product Support (IPS) Elements Guidebook picks up where the Product Support Manager Guidebook Appendix A left off in describing the new 12 IPS Elements which are an extension of the traditional 10 Integrated Logistics Support (ILS) elements in order to accommodate the expanded, enterprise-level role of the Product Support Manager.

Program Managers, Product Support Managers and Life Cycle Logisticians should use this Guidebook as a reference source and training aid supporting their responsibilities, tailored to the needs of each program.

The term "Integrated" in the term "Integrated Product Support Element" is critical. The Product Support Manager must understand how each element is affected by and linked with the others and should employ all of them in an integrated fashion to reach the goal of optimizing Warfighter requirements for suitability and affordability.

The value proposition of this IPS Element Guidebook is that it:

- Serves as a one stop shop for detailed information about each of the twelve Integrated Product Support Elements;
- Provides DoD approved standard definitions for each of the IPS elements and sub-elements;
- Identifies key activities and products for each IPS element;
- Provides much-needed information on who, what, why, how, where and when these activities and products are accomplished throughout the life cycle.

The reader is directed to the Preface section which provides additional information on the purpose, scope, background and use of the IPS Element Guidebook.

Preface

1. Purpose

This guidebook is a Defense Acquisition University training asset to supplement and further explain implementation of new Product Support Manager guidance published by the Office of the Secretary of Defense. The focus is on the PSM Guidebook Appendix A, "Integrated Product Support Elements".

The intended audience is primarily the Product Support Manager (PSM) and senior Life Cycle Logistician. The level of detail is to assist the PSM "Journeyman" in better understanding the scope, products, deliverable scheduling, and associated activities that are within the scope of the PSM position. Adding to the learning value of the Guidebook are a high number of references, many of them actively hyperlinked, within the text of each topical discussion. Additionally, the material in this Guidebook reflects and links with content of DAU courseware where applicable and further references DAU training materials with which the readers can further expand their knowledge of a specific topic

2. Scope

The scope of this Guidebook is intended to be a DAU training asset to explain the policy and implementation guidance associated with each of the topical areas within each of the Integrated Product Support Elements as defined in the Product Support Manager Guidebook, Appendix A. In some cases the topical areas are broken down through three or more levels of increasing detail. While the focus of this content is on DoD level policy, Service or Agency level policy is often cited for clarity, as examples and to assist the reader in locating relevant information.

This Guidebook takes the Appendix A one step further by:

- Explaining why the DoD now recognizes twelve Integrated Product Support Elements;
- Highlighting the importance of full integration among the Elements;
- Breaking down the IPS Element sub-topics into their individual products and processes;
- Explaining the who, what, where, when, how and why for the major deliverables of each IPS Element by life cycle acquisition phase.

3. Structure of this Guidebook

a. Table of Contents

The table of contents is very detailed to allow for ease of finding topical material by IPS Element. It is deliberately structured into both numbered paragraphs and alphabetically ordered sections. The numerical ordering of paragraphs coincides with Appendix A of the Product Support Manager Guidebook. The alphabetical ordering of sections corresponds to answering the "Who, What, When, Where, Why and How" for planning and management of activities and

requirements within each IPS Element. This structure was chosen so that the reader would have a continuing numerical association for each of the IPS Element sub-topics. This numerical association will become more important in the future as Life Cycle Logistics policy continues to mature.

The chapters are arranged by Product Support Element with a strong focus on The Product Support Manager scope and responsibilities inherent to each Element as follows:

- Integrated Product Support Element Objective and Description (the objectives and definitions correspond to those of the Product Support Manager Guidebook Appendix A);
- PSM Activities (the sub-elements in this section correspond to the numbering schema of the Product Support Manager Guidebook Appendix A);
- Purpose:
    - Why is Product Support Management Important;
    - Summary of Activities by Acquisition Phase;
- Major Activities by Acquisition Phase;
- PSM Deliverables;
- OSD Proponency, Policy, Regulations and Statutes;
- Who Develops, Delivers and Manages It;
- When Is It Delivered and Managed in the Life Cycle;
- How It Is Developed, Established and Managed;
- Communities of Interest and Practice;
- Lessons Learned / Best Practices;
- Training Resources;
- Key References.

b. Chapters Dedicated to each IPS Element

Users of this guidebook will find each Integrated Product Support Element and its supporting material sequentially listed by separate chapters. The user may either start by reading a chapter from start to finish or go directly to that section of interest. Each chapter is intended to be a stand-alone body of material.

Each chapter contains three sections. The chapter starts with the DoD approved IPS Element objective and description statements. Immediately after the statements there is a listing of primary activities supporting each element. Note that the numbering scheme used in the first section of each chapter is designed to exactly match to the IPS Element activity numbering sequence used in the PSM Guidebook, Appendix A. Each activity has a definition and implementation guidance to include hyperlinks within the material to key references. The third section of the chapter is implementation guidance for that element throughout the life cycle to include the “who, what, where, when, how and why” plus related best practices, training resources and key references. Each chapter is structured to contain “IPS Element relevant” training resources and reference listing at the end of each chapter. And finally, a table of acronyms is located at the end of the Guidebook in Appendix A.

4. Using this Guidebook

The new reader may be dismayed by the number of pages of content within this Guidebook. The intent is not for users to have to read all of the content, but only that which is relevant to the questions or challenges at hand. As you would use an encyclopedia, go to the table of contents and pick out those topical items of interest and read those carefully. Note: This Guidebook will become Web-based when it is hosted on the DAU Web site which will make it easier to search and navigate amongst topics of interest.

The following advice is offered:

- Read the foreword and preface first;
- Skim quickly through each of the chapters to become familiar with their contents. Each IPS Element chapter is consistently organized using the same structure as described in section 3 above. For example, the topic of "Training Resources" will always be found in section "I" and References will always be found in section "J" of each chapter;
- Use the references (many of them hyperlinked) which are located throughout the Guidebook to aid in quickly finding primary or additional information sources.

5. Background

a. Discussion of PSM Position

"The Secretary of Defense shall require that each major weapon system be supported by a product support manager…" to "maximize value to the Department of Defense by providing the best possible product support outcomes at the lowest operations and support cost." -- FY10 NDAA, Section 805.

On October 7, 2009, House-Senate Conference Committee Agreement was reached on the Fiscal Year 2010 National Defense Authorization Act (NDAA), and the next day, the House approved the FY2010 Defense Authorization Conference Report. It was signed into law (P.L. 111-84) by the President on October 28. Section 805 of the FY10 NDAA, entitled "Life-cycle management and product support," among other things, states that "the Secretary of Defense shall require that each major weapon system be supported by a product support manager" (PSM)." The PSM will be an integral member of a program office, directly supporting the Program Manager in planning and executing their Life Cycle Management (LCM) responsibilities outlined in DoD Directive 5000.01 and DoD Instruction 5000.02.

Section 805 also clarifies the role, responsibilities, and definition of the Product Support Integrator (PSI) under Performance Based Life Cycle Support (PBL) arrangements by stating that "product support integrator means an entity within the Federal Government or outside the Federal Government charged with integrating all sources of product support, both private and public, defined within the scope of a product support arrangement." This is important, both from how DoD plans, develops, fields, and manages product support and sustainment of its major weapon systems, and how Performance Based Life Cycle Product Support (PBL) arrangements are managed and executed in the future. According to Section 805 language, the PSM will have six specifically identified responsibilities:

- Develop and implement a comprehensive product support strategy for the weapon system;

- Conduct appropriate cost analyses to validate the product support strategy, including cost-benefit analyses as outlined in Office of Management and Budget Circular A-94;
- Assure achievement of desired product support outcomes through development and implementation of appropriate product support arrangements;
- Adjust performance requirements and resource allocations across product support integrators and product support providers as necessary to optimize implementation of the product support strategy;
- Periodically review product support arrangements between the product support integrators and product support providers to ensure the arrangements are consistent with the overall product support strategy; and
- Prior to each change in the product support strategy or every five years, whichever occurs first, revalidate any business-case analysis performed in support of the product support strategy.

The law mandates that:

- The Secretary of Defense issue comprehensive guidance on life-cycle management and development/implementation of product support strategies for major weapon systems;
- Each major weapon system be supported by a product support manager (PSM);
- Each PSM position be performed by a properly qualified member of the armed forces or full-time employee of the Department of Defense.

There are a number of important benefits of the establishment of a PSM, including, but not limited to:

- Focal point for development and revalidation/ revisions of Life Cycle Sustainment Plan (LCSP) (see DAG paragraph 2.3.15 or DAU community of practices website at https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3303/USA005157-11_SignedLCSPMemo_14Sep2011.pdf for detailed LCSP information) and Business Case Analysis (BCA) for Performance Based Life Cycle Product Support (PBL) support strategies
- Increased focus on Desired Performance Outcomes
- Reduces Product Support Costs
- Supports the Program Manager (PM)
- Facilitates Life Cycle Management
- Clearly Delineates Inherently Governmental Functions
- Helps Achieve Long-Term Best Value Outcomes
- Establishes Clear Lines of Authority
- Clearly Articulates Roles and Responsibilities
- Standardizes Terminology
- Encourages Development of Appropriately Rigorous, Targeted Training
- Further Integrates Acquisition and Sustainment
- Applicability beyond Major Defense Acquisition Programs (MDAP)
- Better Managed Weapon System Support
- PBL as a Weapon System Product Support Strategy is Enhanced
- Government and Industry Roles Clarified
- PM-PSM Relationship Better Understood
- More Clearly Defined Expectations.

Congressional report language stated the intent is that the PSM shall be a separate and distinct position from the weapon system program manager (PM). In the implementation of this provision, the positions of product support manager, assistant program manager for logistics, deputy program manager for logistics, and system support manager shall be considered synonymous. The question may arise as to whether this is truly a new position and whether DoD has always had Product Support Managers. They answer, of course, is yes to a large extent; however this legislation goes further in that it also:

- Provides the position statutory authorities and responsibilities;
- Explicitly establishes a PM "help-mate";
- Strengthens PM authority, including in long-term sustainment funding;
- Builds a better Life Cycle Logistics human capital asset;
- More respect for an integral program management position (front-line);
- Enhances ability for many key roles and responsibilities to be performed better;
- Ensures greater attention to enterprise approaches, including FMS;
- Enhances life cycle management;
- Facilitates long-term sustainment planning & execution, including implementation of outcome based, performance based life cycle product support (PBL) strategies.

Relevant Sources:

- Defense Acquisition Guidebook (DAG) (Para 5.1.1.1. and para 5.1.3.2)

Product Support is defined by the DAG as "the application of the package of integrated logistics elements and support functions necessary to sustain the readiness and operational capability of the system. While it varies by organization typically, the product support package (PSP) includes the logistics elements...";

- DoD Directive 5000.01 (Paragraph E1.1.17).

DoDD 5000.01 requires program managers (PMs) to "develop and implement performance-based product support strategies that optimize total system availability while minimizing cost and logistics footprint. Sustainment strategies shall include the best use of public and private sector capabilities through government/industry partnering initiatives, in accordance with statutory requirements";

- DoD Directive 5000.01 (Paragraph E1.29)

"The PM shall be the single point of accountability for accomplishment of program objectives for total life cycle systems management, including sustainment";

- DoD Instruction 5000.02 (Paragraph 3.5)

"The Program Manager (PM) is the designated individual with responsibility for and authority to accomplish program objectives for development, production, and sustainment to meet the user's operational needs";

- Joint Capabilities Integration and Development System (JCIDS) Operation Manual

"Life Cycle Management is the implementation, management, and oversight, by the designated Program Manager (PM), of all activities associated with the acquisition, development, production, fielding, sustainment, and disposal of a DoD system across its life cycle";

- Article published in Defense Acquisition Review Journal, April 2010, "The Product Support Manager: Achieving Success in Executing Life Cycle Management Responsibilities", Bill Kobren;

- Also see the Defense Acquisition University Community of Practice at https://acc.dau.mil/CommunityBrowser.aspx?id=375980.

b. Development of Integrated Product Support Elements

Life-cycle sustainment planning and execution seamlessly span a system's entire life cycle. It translates force provider capability and performance requirements into tailored product support to achieve specified and evolving life-cycle product support availability, reliability, and affordability parameters.

The Performance Based Life Cycle Product Support approach to DoD sustainment relies on understanding and integrating all the functional components which are available to make up the required product support infrastructure. These functional components are grouped into twelve categories called the Integrated Product Support (IPS) Elements. These elements include:

- Product Support Management (PSM)
- Design Interface
- Sustaining Engineering
- Supply Support
- Maintenance Planning and Management
- Packaging, Handling, Storage and Transportation (PHS&T)
- Technical Data
- Support Equipment
- Training and Training Support
- Manpower and Personnel
- Facilities and Infrastructure
- Computer Resources

Each of these twelve functional elements is then further broken down into their respective constituent parts as described in this Guidebook. It is the responsibility of the Product Support Management and Life Cycle Logisticians to ensure all elements are considered, included in the infrastructure, and fully integrated to achieve the maximum availability and reliability while optimizing life cycle cost.

The Product Support Elements total scope covers all aspects of life-cycle sustainment. They have been recently updated from 10 technically focused areas to 12 areas. Several of the Product Support Elements have also been updated to reflect today's practices and requirements. Below and in Figure P1is a summary of the changes:

- Product Support Management has been introduced as a stand-alone element to include contract development and management, budget planning, IPT management, and other business, financial, contract and operational responsibilities. Per DoDI 5000.02, the

PM/PSM shall work with the user to document performance and sustainment requirements in performance agreements specifying objective outcomes, measures, resource commitments, and stakeholder responsibilities. The PM shall employ effective Performance-Based Life-Cycle Product Support (PBL) planning, development, implementation, and management;

- The second new Product Support Element is Sustaining Engineering, which focuses on engineering activities specifically related to ensuring no degradation of the technical performance of the system over its life cycle. Sustaining engineering activities also include opportunities to improve or modify the performance of fielded systems based on technological opportunities or evolving threat scenarios;

- The Maintenance Planning and Management Product Support Element has been expanded to include all activities and events associated with transitioning the early initial maintenance concept into a detailed plan that is executed during fielding and continue through the Operations & Sustainment (O&S) phase. Figure P1, Product Support Element Migration, summarizes these changes;

- Training and Training Devices is now Training and Training Support. The whole concept now spans the overall spectrum of training solutions, to include, but not limited to classroom training, special devices, simulators, and distance learning. The result is the use of training solutions that provide a continuous, yet realistic training experience;

- The Facilities element has been expanded to Facilities and Infrastructure. Due to trends such as globalization and reliance on information technologies, product support operations are no longer just “brick and mortar” facilities and include new technologies related to physical security, utilities, and operation of sites.

- Finally, Computer resources support has become simply Computer Resources to account for the significant role that information technology and the necessary computer infrastructure for both weapon system support operations as well as supporting the support operations.

The remaining Elements have not changed their titles but the PSM should review their components as many areas have either been added to the traditional list or expanded to reflect new capabilities and requirements.

Product Support Element Migration

Historical	Current	What Changed?
	Product Support Management	New per DTM 10-015
Design Interface	Design Interface	No change
	Sustaining Engineering	new - extends design interface thru O&S
Supply Support	Supply Support	No change
Maintenance Planning	Maintenance Planning & Management	Includes O&S execution responsibilities
Packaging, Handling, Storage and Transportation (PHS&T)	Packaging, Handling, Storage and Transportation (PHS&T)	No change
Technical Data	Technical Data	No change
Support & Test Equipment	Support Equipment	No change, test equipment still included
Training & Training Devices	Training & Training Support	Emphasis on life cycle training strategy and implementation
Manpower & Personnel	Manpower & Personnel	No change
Facilities	Facilities & Infrastructure	Infrastructure greater than brick & mortar buildings
Computer Resources Support	Computer Resources	Computer resources (supporting hardware and software as well as support services) necessary for Product Support

10 Elements → 12 Elements

Figure P1. Product Support Element Migration

The next two diagrams are intended to portray the difference in approach from the "traditional planning versus implementation" perspective to the current approach which views product support as one continuous plan for implementation starting from requirements determination, through integrated test and evaluation into operations and continuous improvements.

Figure P2 below shows that historically the management of product support activities was the primary responsibility of engineering and product development prior to deployment, with product support being planned and implemented under separate contract line items and separate management. The current view of integrated product support requires that the Life Cycle Sustainment Plan include and implement an integrated strategy, inclusive of all the Product Support Elements, that is reviewed and reported on throughout the acquisition life cycle.

The current view represents product support activities being heavily influenced prior to system deployment by the design interface activities which focus on ensuring that the program Key Performance Parameters (KPPs) are achieved through a design to optimize availability and reliability at reduced life cycle cost. After deployment and during Operations and Sustainment, the activities of sustaining engineering (including product improvement, reliability fixes, continuing process improvements and technology refresh) continue those of design influence and

integrate both back with engineering and manufacturing activities and forward to collect and validate system operational performance with the user. The Product Support Manager is thus capable of implementing a total enterprise sustainment strategy inclusive of all acquisition phases and all product support element scopes.

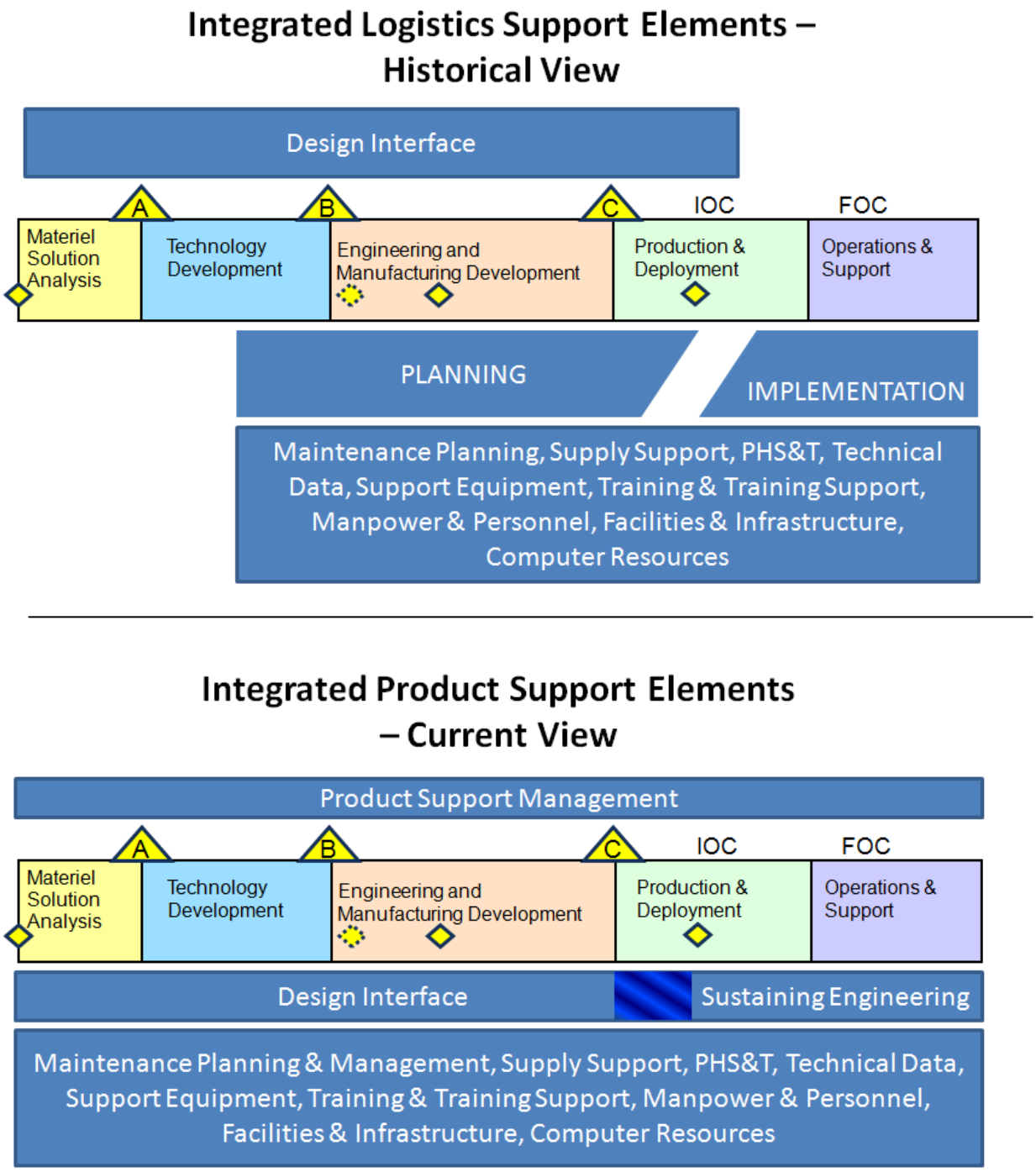


Figure P2. Restructuring Product Support to Reflect New Challenges in Acquisition & Operations

c. Integration of the IPS Elements: How and Why

The Integrated Product Support (IPS) Elements have the word "integrated" specifically included in the name to reinforce the approach of constructing the product support infrastructure to ensure all functional areas are mutually supporting and non-duplicative in terms of funding, usage of resources (both personnel and materiel), capability and outcomes. Each of the Elements should become a "force multiplier" to add value (either through improving outcomes or reducing life cycle costs) across the entire scope of weapon system support.

Each IPS Element or combination of elements supports the production of a plan, process or specific product which in term contributes to the successful acquisition, operation and support of the weapon system.

During each phase of the acquisition life cycle, there are a number of documents which are required deliverables for DoD acquisition programs per statute and by regulation. A complete listing of these acquisition documents by life cycle phase is found on the DAU Acquisition Portal website at https://dap.dau.mil/aphome/das/pages/mdid.aspx. The PSM and Life Cycle Logistician is strongly encouraged to become familiar with each of these documents to understand any program specific product support input requirements.

The IPS Element products are either required documents themselves or major supporting inputs to the required acquisition documents. The figure below illustrates the major IPS Element products which the PSM is responsible for during each phase of the weapon system's acquisition life cycle. These products are generally not "develop once and then forget", but are typically developed during an acquisition phase and then updated as necessary. The products are represented in this diagram only once for simplicity of the model.

All twelve of the IPS Elements are represented by these products. The reader will note that this chart deliberately does not assign each product to a specific Element because typically the resources and capabilities of more than one Element are required to complete each product. It is up to the PSM and Life Cycle Logistician to determine which IPS Elements will need to be included to support the development of each product. Within this Guidebook, however, in Section (B.a.) of each chapter is a section highlighting those deliverables by acquisition phase most closely aligned to that respective IPS Element.

The arrows in the chart connecting two or more products indicate a progression of capability during the course of the acquisition life cycle. For example, the Manpower Estimate Report (MER) feeds into the Training Needs Analysis (TNA) which in turn provides supporting information to develop the System Training Plan. Note that all products will support the Life Cycle Sustainment Plan (LCSP) initiated for Milestone A and subsequently updated for each Milestone, Operating Capability and during Operations and Sustainment. All products also are assessed for the development of the Business Case Analysis (BCA) and Logistics Assessments (LA).

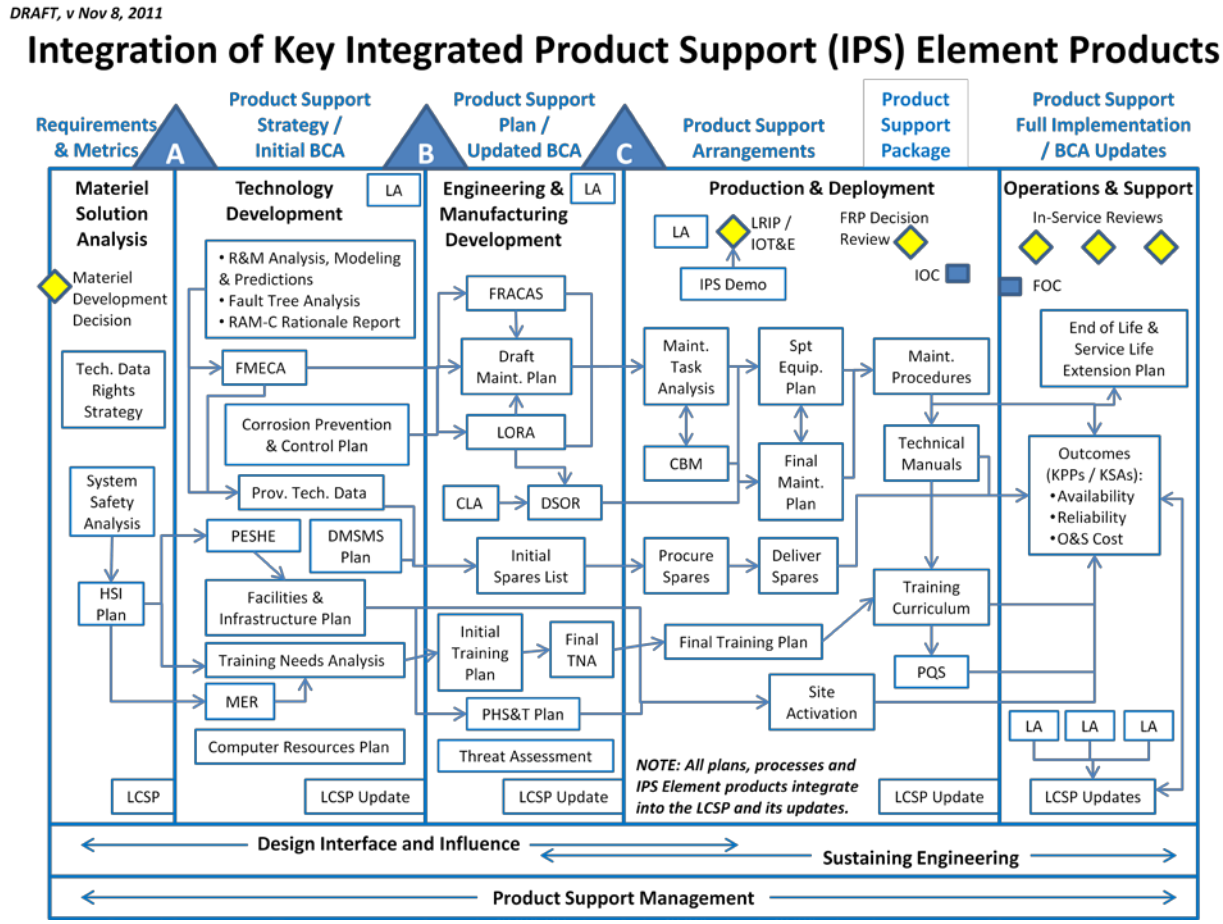


Figure P3. Integration of IPS Elements Product Deliverables

On the back of the chart is a listing of each IPS Element product with a short definition as stated below:

Integrated Product Support (IPS) Element Product Terms and Definitions

- Availability (A_o) – The sustainment KPP: materiel availability & operational availability;
- Business Case Analysis (BCA) – considers cost , quantifiable and non-quantifiable factors supporting investment and determining the optimal product support strategy;
- Computer Resources Life Cycle Management Plan – comprehensive plan addressing computer resources / information technology over the life cycle of a weapon system;
- Core Logistics Analysis (CLA) – defines the degree to which the program meets 10USC 2460, 2464, 2466, and 2474;
- Core Depot Assessment (CDA) – determines whether a system can be supported by existing organic capability to repair, overhaul, modify, or restore a system;

- Depot Source of Repair (DSOR) decision process – addresses effective use of commercial and organic depot maintenance resources; maintains core depot capabilities;
- Diminishing Manufacturing Sources and Material Shortages (DMSMS) Plan – proactive practices for managing risk of obsolescence and a diminishing supply base;
- Facilities and Infrastructure Plan – a comprehensive plan for facilities, real property, related infrastructure, and facility equipment, technology and telecommunications;
- Failure Reporting, Analysis and Corrective Action System (FRACAS) – reports, classifies, analyzes failures and plans corrective actions in response to failures;
- Fault Tree Analysis – a deductive analysis of undesired states or outcomes;
- Human Systems Integration (HSI) Plan – addresses the synergistic interaction between the human, the weapon system and the support environment;
- In-Service Reviews –assessment of technical and operational health of the deployed system to substantiate in-service support and budget priorities;
- IPS Demonstration (Demo) – also "M-Demo" or "Log-Demo", is a demonstration in a simulated operational environment to determine achievement of support requirements;
- Key Performance Parameters (KPPs) – system attributes or characteristics most critical or essential for an effective military capability. The sustainment KPP is Availability (A_o);
- Key System Attribute (KSA) – Measures to provide an additional level of capability prioritization below the KPP level. Sustainment KSA's: Reliability and Ownership Cost;
- Life Cycle Sustainment Plan (LCSP) – a comprehensive plan for programs to effectively and affordably satisfy life-cycle sustainment requirements;
- Logistics Assessment (LA) – analysis of a program's supportability planning conducted by an independent and impartial subject matter expert team;
- Manpower Estimate Report (MER) - the proposed force structure for a weapon system;
- Corrosion Prevention and Control Plan – addresses corrosion-related issues;
- Failure Modes and Effects Criticality Analysis (FMECA) - an inductive analytical method plus a criticality analysis to chart probability of failure against severity of consequences;
- Level of Repair Analysis (LORA) – optimizes location selection for repair;
- Maintenance Plan – identifies maintenance requirements and resources;
- Maintenance Procedures –actions and resources to complete required maintenance tasks;
- Maintenance Task Analysis (MTA) – identification of IPS element inputs plus elapsed time for performance of each maintenance task;
- Ownership Cost - The sustainment KSA ensuring the O&S costs are associated with availability decision-making;
- Packaging, Handling, Storage and Transportation (PHS&T) Plan – comprehensive plan to identify and meet PHS&T requirements for system operation and support;
- Personnel Qualification Standards (PQS) – program personnel requirements to validate and improve job performance qualifications;
- Procure and Deliver Spares – spares process for initial fielding & on-going operations;

- Product Support Arrangements – a binding agreement (may be non-contractual) between organizations to implement weapon system sustainment;
- Product Support Plan –describes detailed product support implementation;
- Product Support Package – the product support functions necessary to achieve the program's performance based metrics;
- Product Support Strategy – the documented approach describing the process to achieve performance based metrics;
- Programmatic Environmental, Safety and Occupational Health (ESOH) Evaluation (PESHE) – communicates status of ESOH efforts and system risk management;
- Provisioning Technical Documentation (PTD) – compilation of scope and quantity of support items to operate and maintain a system for an initial time period;
- Reliability – The sustainment KSA measuring probability that the system performs without failure over time;
- Reliability &Maintainability (R&M) Analysis / Modeling / Predictions – develop and apply reliability and maintainability growth strategies to meet requirements;
- Reliability Centered Maintenance (RCM) – systemic approach to identifying preventative or scheduled maintenance tasks and task intervals;
- Requirements and Metrics – early development of product support requirements and outcome-based metrics (KPPs, KSAs and subordinate metrics);
- Site Activation – rendering operational those facilities required to house, service, and launch prime mission equipment;
- Spares List – identifies spare and replacement parts required for system support;
- System Safety Analysis - a method for evaluating the hazards and risks posed by a system and ways to minimize them;
- Technical Data Rights Strategy - addresses acquisition of and the rights to use, modify, reproduce, release, perform, display, or disclose technical data;
- Technical Manuals –instructions for installation, operation, maintenance, training and support of weapon systems and its support equipment;
- Support Equipment Plan – comprehensive plan addressing the acquisition, fielding and support of a weapon system's support equipment;
- Training Curriculum – defines the scope of the training course;
- Training Needs Analysis (TNA) – identification of skill s to complete required tasks;
- Training Plan- identifies the skills, most effective approach and cost efficiencies to meet training requirements.

Figure P4. List from the Back of the "Integration of Key IPS Elements Product Chart" showing Terms and Definitions of each Product

As additional discussion on the topic of integration among the IPS Elements, below are examples based on real life solutions to clarify what is meant by integration and the resulting benefits focusing on each IPS Element.

- Product Support Management

Product support management is based on integrating all activities across the IPS elements in order to achieve the program's KPPs and KSAs. The integration starts during Milestone A (before the PSM is officially designated for the program) as part of requirements and metrics determination. Requirements will drive emphasis towards specific approaches. As the program matures through the acquisition life cycle phases, the Product Support Manager will develop the product support concept, plan and package to optimize availability, reliability and reduce cost. Selection of the type, quantity, complexity and affordability will require trade-offs among different support options.

For example, a system expected to be operated primarily in remote locations will need higher reliability with emphasis on unit level or geographically local maintenance capabilities. Available facilities infrastructure may be unsophisticated and regular resupply of large, heavy and/or environmentally sensitive components may be unaffordable. The PSM will emphasize design interface and sustaining engineering activities to minimize depot or intermediate maintenance and supply support requirements.

- Design Interface

Design interface focuses on involvement of product support within the systems engineering process to impact the design to reduce the burden and cost of product support on the weapon system and on the existing DoD logistics infrastructure. Life cycle logisticians will seek system designs that are easy to maintain, simple to maintain, require few if any unique tools or support equipment, utilize existing personnel skill sets, modular to allow for upgrades and modifications using the existing platform configuration, and have long life spans. In order to achieve product support optimized system designs, logisticians will need to model, test and demonstrate the proposed system within the context of existing DoD and industry product support capabilities for each IPS Element.

For example, the Life Cycle Logistician should create a supportability demonstration during test & evaluation to determine parameters such as:

- whether the current DoD personnel skill categories are sufficient to perform the tasks to maintain the system or can be trained in the required tasks;
- if current DoD organic capability (facilities and infrastructure) can repair the system;
- which spare parts and support equipment are already provisioned in DoD systems or are new, unique items requiring new infrastructure to be acquired;
- is the weapon system transportable to the intended operational sites;
- can resupply be carried out effectively and affordably.

- Sustaining Engineering

Sustaining engineering supports in-service systems in their respective operational environments to ensure continued operation and maintenance of a system with managed (i.e., known) risk. The integration activities are focused on how to minimize the downtime of the weapon system while

also lowering the risk for downtime. Sustaining engineering outcomes can range from recommendations for weapon system design changes to plans for modification of the facilities and infrastructure and also to other changes within any of the IPS Element areas.

For example, root cause analysis of in-service problems (including operational hazards, deficiency reports, parts obsolescence, corrosion effects, and reliability degradation) often results in recommendations for design changes to:

- eliminate components requiring frequent maintenance;
- minimize or eliminate maintenance tasks;
- maximize commonality with existing infrastructure such as type of fuel, available support equipment, etc.;
- allow greater modularity for upgrades.

- Supply Support

While the focus of supply support is on the provisioning and delivery of repair parts, it is a major area within the field of supply chain management. Supply chain management, as described in the PSM Guidebook, integrates sustaining engineering, maintenance, PHS&T, support equipment and technical data. The system's supply chain is an integrated network that extends from the supplier's supplier to the customer's customer and back through a return cycle.

For example, a poor provisioning list will result in either missing or incorrect spare parts being procured, stored and delivered to the Warfighter. Missing or incorrect parts result in higher equipment downtime, higher costs for procuring the wrong item, and higher maintenance failure rates if the wrong, or a counterfeit, part is installed on the weapon system. In some cases, a defective component can result in system failure causing loss of life.

- Maintenance Planning and Management

Maintenance planning and management is the prevention or correction of weapon system failure or the failure of its support equipment. The ultimate goal of the PSM is to influence design to minimize or eliminate the need for maintenance on the weapon system. For those maintenance actions that cannot be eliminated, the next priority is to implement preventative or condition based maintenance and operator training to minimize the type, severity and cost for maintenance procedures.

For example, a new engine of a high performance aircraft has been designed that requires depot level skills and specialized support equipment. The PSM may be able to influence design to develop engine diagnostic equipment that can be run at the organizational level of maintenance to check on engine performance, thus reducing the frequency of returning the engine to the depot for major service work.

- Packaging, Handling, Storage and Transportation (PHS&T)

PHS&T's four activity areas should be closely integrated among themselves as well as integrating PHS&T with the other IPS Elements. PHS&T for the DoD is very different from

commercial PHS&T activities and the PSM should be especially careful to recognize the military's unique requirements.

Examples of unique military requirements include storage of materiel in extreme environments for long periods of time, transport into and out of remote regions where commercial carriers are not present, international customs and inspection requirements, and the routine shipping of dangerous and hazardous items.

These unique requirements are high value opportunities to use the benefits of IPS Element integration to minimize risk and cost associated with these areas.

Specific examples include:

- Designing an item, such as a battery, for a longer shelf life to minimize risk of the Warfighter receiving an inoperable product;
- Designing to remove hazardous materials or components to eliminate the need for special transportation requirements. Often hazardous items cannot be carried on a cargo aircraft but must be transported via surface ground or sea, thus increasing the time for delivery;
- Incorporating innovating RFID technology to reduce risk of item loss or delay during shipping and storage.

- Technical Data

Technical data pervades all IPS elements in virtually everything that is done to sustain a weapon system. Everything plan, process and product has technical data associated with it. Within this IPS Element, technical data includes engineering data, product data, contract data, and logistics data. Technical data management includes identification and control of data requirements; the timely and economical acquisition of all weapon system related data; the assurance of the adequacy of data for its intended use; distribution or communication of the data to the point of use; and actual data analysis. The integration of technical data into all aspects of the weapon system program occurs both because of, and in spite of, the efforts of program managers and technical experts. The challenge is to ensure that technical data is appropriately and correctly acquired, shared, used, and disposed of.

Examples of recommended technical data integration efforts include:

- The development of a technical data rights strategy (discussed later in this Guidebook);
- Attention to security and access of technical data – both to prevent unauthorized usage and to ensure program personnel with the need for access correctly have it;
- Processes to integrate engineering data with logistics data to allow for feedback on operational and support information;
- Establishing procedures to integrate the program's performance based life cycle metrics to the appropriate technical data which can be used to improve outcomes.

- Support Equipment

Support equipment, consisting of all equipment (mobile or fixed) required to support the operation and maintenance of a system, has inherently various points of integration with the

weapon system platform as well as each of the IPS element components of the supportability infrastructure. The goal of the design engineers and the life cycle logisticians during early acquisition is to minimize or eliminate the requirements for support equipment, especially that equipment which would be unique to the weapon system.

This early support equipment minimization focus drives IPS Element integration and the maximization of system characteristics such as reliability (Design Interface), built in diagnostics (Sustaining Engineering & Computer Resources), usage of existing maintenance procedures and skill sets (Maintenance with Manpower & Personnel), commonality of maintenance facilities (Facilities and Infrastructure), etc.

- Training and Training Support

Training is one of the IPS Elements that has a very high return on investment when integrated with the other IPS Elements but is often not used due to program managers not being fully aware of its benefits. Training is often considered a cost to the program and requires the trainees to be absent from their daily duties for a period of time. This investment in skills improvement is a long term investment - often short term needs preclude the training.

Specific examples of the return on investment by integrating training include:

- Many maintenance failures are due to operational error, a good operator training program will reduce equipment failure, reduce accidents, and allow for higher system availability at reduced cost (cost avoidance in this case);
- The skill level of the maintainer is critical to a quick and effective repair process;
- Item managers and procurement specialists need to be trained on the automated supply systems (often part of an enterprise resource program) in order to correctly enter information, understand reports, and be able to diagnose supply deficiencies. Even minor errors or misunderstanding of the system can result in significant spare part shortages, incorrect items ordered, or mismanagement of the supply base;
- Design engineers should be trained on product support approaches and how system design influences (both positively and negatively) the availability, reliability and ownership cost of the weapon system.

- Manpower and Personnel

Manpower and Personnel involves the identification and acquisition of personnel (military and civilian) with the skills and grades required to operate, maintain, and support systems over their lifetime. Early requirements for weapon system operation often establish manpower goals which in turn have a strong influence on design of the system. The life cycle logistician in turn drives support strategies which flow down from these early manpower requirements.

In the current environment of cost reduction, minimizing the manpower workload and simplifying tasks to avoid costly and complex training requirements is important. From a support perspective, integrating manpower and personnel requirements into the product support strategy is the only way to achieve program goals. These integration activities may include minimizing and simplifying unit level maintenance tasks, eliminating repair part requirements,

automating previously manpower intensive tasks such as submitting data reports, maintenance diagnostics, and converting classroom training into computer based instruction, all contribute to improved manpower usage and lower weapon system ownership costs.

- Facilities and Infrastructure

The Facilities & Infrastructure IPS Element has traditionally been a more "stand-alone" than the others in regards to integration. Requirements and strategies are now changing due to technologies and global defense strategies. Technologies and processes are also changing the requirements for facilities and infrastructure: the advent of on-line parts ordering, on-line meetings and conferences, interactive electronic technical manuals, greater emphasis on temporary or semi-permanent facilities to support a shorter logistics tail for the Warfighter, and greater awareness of environmental impacts.

A specific example of integration is the Defense Logistics Agency's usage of the War-Stopper Program which minimizes and optimizes the usage of facilities and infrastructure by collecting data on supplier capabilities, matching these capabilities to Warfighter requirements and then applying business case analysis and best practices to effectively managing the entire life cycle from commodity provider through manufacturing to distribution of the required items.

- Computer Resources

The scope of Computer Resources is rapidly changing from maintaining off-board computer hardware and software to an integrated information technology community of which everyone, including the Warfighter, plays a role. Product support now extensively uses computer technologies both on-board and off-board weapons platforms to perform a myriad of activities from predicting failures to diagnosing the problems and automatically requesting parts and creating maintenance work orders.

A current example of a state-of-the-art computer resources application is the Joint Strike Fighter's integrated Automated Life Cycle Support System (ALIS). The reader is encouraged to pursue additional information on this capability at the JSF website, http://www.jsf.mil/program/prog_org_autolog.htm.

6. Deployment of this Guidebook

This Guidebook is located on the Defense Acquisition University (DAU) Acquisition Community Connection (ACC) website. It can also be found using publicly available internet search engines by searching with the keywords: "DAU IPS Elements Guidebook".

For ease and speed of navigating this document, the table of contents contains hyperlinks to each Element while the beginning of each chapter contains a hyperlinked mini-outline. The complete Guidebook is also downloadable as a .pdf file via the link on the DAU ACC website.

7. Disclaimers

The following disclaimers are included due to the rapidly changing nature of policy and the need to use only current policy *as it is published* in directives, instructions, directive-type memorandums, and other mandatory guidance.

This IPS Element Guidebook:

- Only reflects current policy as of the publication of this guidebook as written in directives, instructions, and other written guidance by OSD and its Components;
- Pending policy is not included;
- Supply Chain Management is more than adequately addressed in the Product Support Manager Guidebook, April 2011, and is not duplicated in this IPS Element Guidebook;
- During the development of this Guidebook, the organization of the IPS Elements and their sub-topics was discussed and vetted with leadership throughout the DoD Product Support community to ensure compliance with existing policy. Policy is changing very rapidly, however, and the topics and/or their supporting material may become superseded by future changes;
- Website locations change so hyperlinks may become obsolete;
- Future updates to this Guidebook are not scheduled as of this writing;
- Feedback to DAU on this Guidebook can be provided directly from the DAU ACC site. Please note that feedback is only permitted by Acquisition Community Connection account holders;
- The scope is intended to be comprehensive but not all inclusive. The reader may be aware of additional references not specifically noted in this guidebook and is encouraged to submit proposed changes and additions.

1.0 Product Support Management
1.0.1 Objective
1.0.2 Description
Product Support Manager Activities
Product Support Management in the Life Cycle
A. Purpose
B. Data Item Descriptions (DID)
C. OSD Proponency, Policy, Regulations and Statutes
D. Who Develops, Delivers and Manages Product Support Management
E. When Is Product Support Management Delivered and Managed in the Life Cycle
F. How Product Support Management Is Developed, Established and Managed
G. Communities of Interest and Practice
H. Lessons Learned / Best Practices
I. Training Resources
J. Key References

1.0. Product Support Management

1.0.1. Objective
Plan and manage cost and performance across the product support value chain, from design through disposal

1.0.2. Description
Plan, manage, and fund weapon system product support across all Integrated Product Support (IPS) Elements

Product support management is the development and implementation of product support strategies to ensure supportability is considered throughout the system life cycle through the optimization of the key performance outcomes of reliability, availability, maintainability and reduction of total ownership costs. The scope of product support management planning and execution includes the enterprise level integration of all twelve integrated product support elements throughout the lifecycle commensurate with the roles and responsibilities of the Product Support Manager position created under Public Law 111-84, Section 805.

Product Support Manager Activities

1.1. Product Support Strategies
Product support strategies describe the supportability planning, analyses, and trade-offs used to determine the optimum product support concept for a materiel system and to identify the appropriate metrics for continuous readiness and affordability improvements throughout the product life cycle. The product support strategy evolves in detail, so that by Milestone C, it defines how the program will address the support and fielding requirements necessary, reflected in the 12 Integrated Product Support (IPS) Elements which make up the product support package, and the Warfighter's needs to meet readiness and performance objectives, lower total

ownership cost, reduce risks, and avoid harm to the environment and human health. The product support strategy should address how the program manager and other responsible organizations will maintain oversight of the fielded system. It should also explain the contracting approach for product support throughout the system life cycle.

1.1.1. Interim Contractor Support (ICS)

ICS refers to temporary contractor support that allows a Service to defer investment in all or part of required support resources (spares, Technical Data (TD), support equipment, training equipment, etc.), while an organic support capability or permanent contractor delivered support is phased in.

1.1.2. Performance Based Life Cycle Product Support (PBL)

Performance Based Life Cycle Product Support (also referred to as Performance Based Logistics or PBL) is a performance-based product support strategy for the development and implementation of an integrated, affordable, product support package designed to optimize system readiness and meet the Warfighter's requirements in terms of performance outcomes for a weapon system through long-term product support arrangements with clear lines of authority and responsibility.

1.1.3. Transactional Based

A transactional based strategy is characterized by a defined scope and payment for that scope based on a discrete event happening. The business model will usually reflect increasing revenues or costs directly related to the volume of events or transactions which occur. Incentivizations to achieve success typically serve to increase the number of transactions per some pre-defined unit of measure, i.e., Deliveries per day, new orders per cycle, number of repair actions per service, etc.

1.1.4. Hybrid

The hybrid product support strategy is a best value blend of a PBL outcome based product support strategy and a traditional transactional based product support strategy which reflects the fact that PBL product support rarely applies to the entire system or all the IPS elements. Those sub-systems and components that do not fall under PBL product support default to transactional based product support. The hybrid product support strategy is defined further as the best value mix of government and industry product support providers to implement an affordable product support strategy based on their capabilities, capacity and cost to perform the twelve IPS elements.

The Product Support Decision Matrix shows the continuum between component and system centric strategies and partnerships using predominately commercial or industry capabilities to government or organic capabilities. See Figure 3 in the DoD Business Case Analysis Guidebook, also found at http://www.dau.mil/pubscats/PubsCats/BCA%20Guidebook%20April%202011.pdf. A hybrid product support strategy may evolve over time to become a full PBL product support strategy as more components and IPS elements fall under the responsibility of the PBL product support provider. A Public Private Partnership is an example of a hybrid product support strategy.

1.2. 12 Step Product Support Process Model

Development and implementation of the product support strategy consist of 12 discrete steps reflected in the Product Support Process Model as defined in the DoD Product Support Manager Guidebook, page 35. https://acc.dau.mil/psm-guidebook These steps are also described in detail on the DAU community of practice website, found at https://acc.dau.mil/CommunityBrowser.aspx?id=32529, with directions to support the successful completion of each step, as well as supporting materials to provide users the resources they need. Each of the steps is listed below with a short description.

1.2.1. Integrate Warfighter Requirements & Support

The translation of system operational requirements into the sustainment product support strategy that will deliver those requirements to the Warfighter in the form of optimized operational readiness at an affordable, best value cost. An effective PBL outcome-based product support strategy begins with the Joint Capabilities Integration and Development System (JCIDS) process by focusing capabilities needs on overall performance and linking supportability to performance.

The process of identifying the Warfighter's needs is known as the Joint Capabilities Integration and Development System (JCIDS). If the Warfighter's needs include procurement of a new weapon system, then the Defense Acquisition System is used in tandem with JCIDS to satisfy the Warfighter's needs. The following diagram shows how the stages of the acquisition system and JCIDS work together:

The JROC will conduct a DOTMLPF (doctrine, organization, training, materiel, leadership & education, personnel and facilities) analysis to determine whether a Materiel solution is the best way to meet the warfighter's requirement. A Capabilities-based Assessment will determine if a Materiel solution is best. If so, a Materiel Determination Decision (MDD) will be made and will initiate the Initial Capabilities Document (ICD).

The ICD documents the need for a materiel approach, or an approach that is a combination of materiel and non-materiel, to satisfy specific capability gap(s). The ICD defines the gap in terms of the functional area; the relevant range of military operations; desired effects; time and Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities (DOTMLPF); and policy implications and constraints. The ICD summarizes the results of the DOTMLPF analysis and describes why non-materiel changes alone have been judged inadequate in fully providing the capability. The outcome of an ICD could be one or more DOTMLPF Change Recommendations (DCRs) or Capability Development Documents.

The ICD identifies a capability gap or other deficiency in terms of the functional area, the relevant range of military operations, and the timeframe. The ICD describes the evaluation of DOTMLPF approaches.

Key Performance Parameters (KPP) are not included in the ICD.

The ICD guides the Material Solution Analysis and Technology Development phases of the Defense Acquisition System and supports Analysis of Alternatives (AoA) and the Milestone A decision. Once approved, the ICD is not updated (i.e. the Capability Development Document (CDD) and Capability Production Document (CPD) are used to support the Engineering Manufacturing and Development (EMD) and Production and Deployment phases, respectively).

The ICD leaves enough room to allow operational capability to define system requirements and to encourage technological innovation.

Within the Joint Capabilities Integration & Development System (JCIDS) process, the sponsor is expected to lead the JCIDS Capability Based Assessment when developing the ICD, while engaging and collaborating with appropriate organizations. The sponsor should work closely with the appropriate Functional Capability Boards during the analysis process to ensure the analysis is truly joint.

1.2.2. Form the Product Support Management IPT

The formation of the Product Support Management IPT, which includes the user, will develop, implement, and manage product support for a weapon system throughout the life cycle. The IPT, led by the PSM, may consist of Government and private-sector functional experts and should include all appropriate stakeholders including Warfighter representatives. Before the IPT can be established, the PSM must establish the achievable goals of the IPT by knowing what must be accomplished.

1.2.3. Baseline the System

Baselining involves collecting the data that will be needed to assess and analyze product support decisions, including inputs from Supportability Analysis (e.g., Failure Modes Effects & Criticality Analysis (FMECA), Failure Reporting and Corrective Action System (FRACAS), Level of Repair Analysis (LORA), Maintenance Task Analysis (MTA), Reliability Centered Maintenance (RCM) analysis, and other key maintenance planning tasks), as well as Reliability, Availability and Maintainability (RAM) and Life Cycle Cost (LCC) analyses. The PSM will be involved with The Acquisition Program Baseline (APB), providing key cost, schedule, and performance thresholds and objectives for each major program milestone and configuration baselines, established for specific events and contribute to the performance portion of a program's APB.

1.2.4. Identify / Refine Performance Outcomes

The process of identifying and refining the Warfighter's critical product support performance and cost outcomes and the determination of how success will be measured which includes the application of OSD's specified top-level weapon system metrics reflected in the Materiel Availability KPP and the Reliability and Ownership Cost KSAs.

1.2.5. Business Case Analysis (BCA)

A Product Support BCA is an expanded cost/benefit analysis with the intent of determining a best value solution for product support. The BCA assesses each alternative and weighs total cost against total benefits to arrive at the optimum solution. The Product Support BCA process goes beyond cost/benefit or traditional economic analyses by documenting how each alternative fulfills the strategic objectives of the program; how it complies with product support performance measures; and the resulting impact on stakeholders. The Product Support BCA identifies which alternative product support options provide optimum mission performance given cost and other constraints, including qualitative or subjective factors. The Product Support BCA may result in a recommended product support strategy that is hybrid blend of both PBL and

transactional product support strategies broken out at the component, sub-system or system level, along with a best value mix of government and industry capabilities to deliver the 12 Integrated Product Support (IPS) Elements in an integrated product support package at affordable cost. A complete description and supporting documentation is found on the DAU community of practice website at https://acc.dau.mil/bca.

1.2.6. Product Support Value Analysis

A best value analysis, conducted as part of the Product Support BCA, to optimize long-term life cycle costs and benefits which includes consideration of the following: optimum level of support (system, sub-system or component level); assessment of the applicable IPS elements, supply chain management strategy, workload allocation strategy, data management strategy refinement, RAM, DMSMS, life cycle cost and risk mitigation.

1.2.7. Determine Support Method(s)

The determination whether product support will be acquired from the Product Support Providers using a PBL outcome-based, transactional based or best value hybrid mix of outcome-based and transactional based product support strategies. The method of product support, whether it is transactional, outcome based, or best value hybrid mix, does not alter the basic functions or tasks that comprise the product support, only in how that product support is acquired and provided.

1.2.8. Designate Product Support Integrator(s)

The Product Support Integrator (PSI) is an entity from government or industry performing as a formally bound agent charged with integrating all sources of support, public and private, defined within the scope of the product support arrangements (e.g., contract, Memorandum of Agreement (MOA), Memorandum of Understanding (MOU), Service Level Agreement [SLA]) to achieve the documented outcomes. The Product Support Manager (PSM) designates the Product Support Integrator(s) who will be delegated the responsibility to integrate the product support providers to deliver the specified outcomes assigned consistent with the scope of their delegated responsibility. The PSI has considerable flexibility and latitude in how the necessary support is provided, so long as the outcomes are accomplished.

1.2.9. Identify Product Support Providers

The identification and selection of the best value mix and blend of sources of support from both government and industry to perform the product support functions, based on capabilities, capacities, best value, and the qualitative efficiency and effectiveness of support, through the application of Product Support BCA value analysis as well as PSI discretionary decisions for lower tiered suppliers of support.

1.2.10. Identify / Refine Financial Enablers

The identification of the range, type and scope of financial incentives and remedies for inclusion in the product support agreement contract(s) for the purpose of motivating behavior needed to achieve performance and cost outcomes consistent with the terms, conditions, and objectives of the Product Support Arrangements Incentives include the following types: award fee, award term, incentive fee, shared savings and positive past performance ratings. Remedies include requiring the product support provider (i.e., contractor) to perform service at no additional cost;

reducing the price; reducing or eliminating the award fee, award term or incentive fee; option year not exercised or contract canceled; and negative past performance ratings.

1.2.11. Establish / Refine Product Support Agreements

The establishment and refinement of the implementing Product Support Arrangements (e.g., contract, Memorandum of Agreement (MOA), Memorandum of Understanding (MOU), and Service Level Agreements (SLA)) that assign and delineate the roles, responsibilities, resourcing, and reciprocal aspects of product support business relationships. Product Support Arrangements formalize the roles, responsibilities, relationships, and performance-based outcome commitments of the active participants in the product support strategy, including, at a minimum, the PM, PSM, Warfighter customer, resourcing Commands, PSIs, PSPs, and associated stakeholders or participants in product support. It is important that "flow down" provisions be applied to ensure performance-based outcome requirements are passed on to lower tiered product support providers.

1.2.12. Implement and Assess

The implementation, management and assessment of the product support,, including updates to the Life Cycle Sustainment Plan (LCSP), conducting and implementing recommendations from Logistics Assessments (LA), and the continuous, ongoing assessment of Product Support effectiveness through the use of established governance mechanisms that drive decisions and actions to review, modify, revise, or evolve product support strategies and product support arrangements. An example of a periodic assessment tool is the Sustainment Quad Chart which assesses the product support approach, sustainment schedule, metrics achievement and O&S Cost status at Program Reviews and in quarterly report submissions in DAMIRs to OSD for Major Defense Acquisition Program. https://acc.dau.mil/psm-guidebook.

1.3. Life Cycle Sustainment Plan (LCSP)

The LCSP addresses a program's approach for accomplishing the supportability objectives across the life cycle, including during the operations and support (O&S) phase. The LCSP is the key logistics acquisition deliverable required in the Defense Acquisition System.

USD(AT&L) September 14, 2010 memorandum, "Better Buying Power: Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending" directed a review of the documentation required by DoDI 5000.02 in support of the acquisition process.

According to the PDUSD(AT&L), "The … [LCSP] is designed to be a tool for programs to effectively and affordably satisfy life-cycle sustainment requirements. This plan articulates the product support strategy, and it must be kept relevant as the program evolves through the acquisition milestones and into sustainment. The LCSP outline emphasizes early-phase sustainment requirements development and planning, focuses on cross-functional integration - most critically with systems engineering, and highlights key sustainment contract development and management activities."

The Acquisition Strategy has recently been updated and now does not include the Life-cycle Sustainment Plan. Per PDUSD(AT&L) April 20, 2011 memorandum, "Document Streamlining - Program Strategies and Systems Engineering Plan," the LCSP has been separated from the

Acquisition Strategy. ***Every acquisition program shall develop a LCSP.*** The Assistant Secretary of Defense for Logistics and Materiel Readiness (ASD(L&MR)) shall approve LCSPs for all ACAT ID and USD(AT&L)-designated special interest programs for Milestone A or equivalent, each subsequent milestone, and Full-Rate Production decision. Following the system's initial operating capability, the component acquisition executive (CAE) or designee shall approve LCSP updates, in coordination with the ASD(L&MR). Approval for ACAT IC and below LCSPs is delegated to the CAE or Component designee.

1.4. Statutes, Policy and Guidance

Effective implementation of performance based life cycle product support is stated and defined through policy, statutes and guidance documents to include DoDD 5000.01, DoDI 5000.02, United States Code Title X, and numerous policy memorandums, manuals and guidebooks developed and maintained by the DoD and its Components including the DoD Product Support Manager (PSM) Guidebook, Product Support Business Case Analysis (BCA) Guidebook and Logistics Assessment (LA) Handbook.

1.5. Requirements

Requirements are needs that are determined to be obligatory to achieve a desired outcome. Requirements for weapons systems are defined during the Joint Capabilities Integration and Development System (JCIDS) process, implemented during the Defense Acquisition System management process and resourced through the Planning, Programming, Budgeting and Execution (PPBE) process.

1.5.1. Joint Capabilities Integration and Development System (JCIDS) Process

JCIDS are the procedures established to support the Chairman of the Joint Chiefs of Staff and the Joint Requirements Oversight Council (JROC) in identifying and assessing joint military capability needs. The primary manual is the "Manual for the Operation of the Joint Capabilities Integration and Development System" found at https://acc.dau.mil/CommunityBrowser.aspx?id=267116&lang=en-US.

1.5.2. Defense Acquisition System (DAS)

The Defense Acquisition System is the management process that guides all DoD acquisition programs. DoD Directive 5000.01, The Defense Acquisition System, provides the policies and principles that govern the defense acquisition system. DoD Instruction 5000.02, Operation of the Defense Acquisition System, in turn establishes the management framework that implements these policies and principles. The Defense Acquisition Management Framework provides an event-based process where acquisition programs proceed through a series of milestones associated with significant program phases. Details on the milestones and program phases are found in section 3 of the instruction. The instruction also identifies the specific statutory and regulatory reports and other information requirements for each milestone and decision point.

1.6. Product Support Business Model (PSBM)

The PSBM effectively describes the product support arrangement methodology by which DoD intends to ensure achievement of optimized product support through balancing maximum weapon system availability with the most affordable and predictable total ownership cost.

The PSBM provides a clearly delineated description of the roles, relationships, accountability, responsibility and business agreements among the managers, integrators, and providers of product support. Those roles and responsibilities are portrayed, consistent with their level of accountability and responsibility (https://acc.dau.mil/psm-guidebook)

1.6.1. PBL Government and Commercial Integrated Community

Sources-of-support decisions for PBL do not favor either organic or commercial providers. The decision is based upon a best-value determination of the provider's product support capabilities to meet set performance objectives.

1.6.1.1. Product Support Arrangements (PSA)

A PSA is a contract, task order, or any other type of contractual arrangement, or any type of agreement or non-contractual arrangement with or within the Federal government such as a Memorandum of Agreement, (MOA), Memorandum of Understanding (MOU), Service Level Agreement (SLA) or Commercial Services Agreement (CSA) for the performance of sustainment or product support required for major weapon systems, subsystems, or components. The Product Support Arrangement assigns and delineates the roles, responsibilities, resourcing, and reciprocal aspects of product support business relationships.

1.6.1.1.1. Memorandums of Agreement (MOA)

A memorandum of agreement (MOA) or cooperative agreement is a document written between parties to cooperatively work together on an agreed upon project or meet an agreed objective. The purpose of an MOA is to have a written understanding of the agreement between parties. In an MOA, there is a reciprocal relationship in which the actions of both parties are dependent on actions by the other party. An example is an MOA between the Program Manager and the Warfighter about the desired outcomes and the associated metrics for use in measuring the accomplishment of those outcomes.

1.6.1.1.2. Memorandums of Understanding (MOU)

A memorandum of understanding (MOU) is a document describing a bilateral or multilateral agreement between parties. It expresses a convergence of will between the parties, indicating an intended common line of action. It is often used in cases where parties either do not imply a legal commitment or in situations where the parties cannot create a legally enforceable agreement. In an MOU, there is no dependency on the other party, but recognition of their separate roles and responsibilities is required; example: an organic and commercial repair line is established in which one party accomplishes repair on one of the Shop Repairable Units (SRUs) on the end item while the other party accomplishes repair on another SRU. The MOU documents the understanding that both parties are working on the same end item, but have no dependency on each other beyond the understanding.

1.6.1.1.3. Service Level Agreements (SLA)

A service-level agreement is a part of a service contract where the level of service is formally defined. In practice, the term SLA is sometimes used to refer to the contracted delivery time (of the service) or performance. As an example, internet service providers will commonly include service level agreements within the terms of their contracts with customers to define the level(s) of service being sold in plain language terms. In this case the SLA will typically have a

technical definition and performance metrics in terms of mean time between failures (MTBF), mean time to repair or mean time to recovery (MTTR); various data rates or similar measurable outcomes. Service level agreements are often a component of the Commercial Services Agreement (CSA).

1.6.1.1.4. Commercial Services Agreements (CSA)

CSAs are agreements used to implement a Direct Sales Public-Private Partnership, in which the organic government agency (e.g., the depot) acts as a subcontractor to a commercial entity (i.e., a contractor) and authorizes the sale of goods or services from the government entity to the contractor. CSA's are legal and binding contracts.

1.6.1.1.5. Performance Based Agreements (PBA)

Performance Based Agreements are one of the key components of an effective product support strategy. (See DoDD 5000.01, para E1.16.) They establish the negotiated performance baseline and corresponding support necessary to achieve that performance, whether provided by commercial or organic support providers. The Program Manager, utilizing the performance objectives required by the Warfighter, negotiates the required level of support to achieve the desired performance at a cost consistent with available support funding. Once the performance, support, and cost are accepted by the stakeholders, the PM enters into a performance based agreement with the user. The agreement specifies the level of operational support and performance required. The PM then enters into performance-based agreements with the support providers, specifying the performance parameters that will meet the requirements of the Warfighter.

1.6.1.2. Public Private Partnership (PPP)

Public–private partnership (PPP) describes a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies. Because funding is involved, PPP's almost always require a formal contract between a public sector authority and a private party, in which the private party provides a public service or project and assumes financial, technical and operational risk in the project. In some types of PPP, the cost of using the service is borne by the users of the service and not by the taxpayer. The term PPP is used generically and does not define what types of contracts or specific relationships are to be used in this arrangement.

The primary intent of public-private partnerships or the depot maintenance partnership initiative is to enhance depot support to the Warfighter by enabling and empowering the DoD organic depots to develop appropriate partnerships with the commercial sector, while recognizing the legitimate national security need for DoD to retain Core depot maintenance capability.

Partnering is essentially a philosophy that focuses on a cooperative agreement between the following:

- Program Manager;
- System Support Manager;
- Depot Maintenance Manager;
- Private Sector Supplier of Sustainment and Modernization. The Service Secretaries are required to designate Centers of Industrial & Technical Excellence (CITE) and the head

of a CITE has authority to enter into partnerships. The CITE designation provides an exemption from 50-50 limit (10 USC 2466) provided:

- Depot has been designated a CITE;
- Work must be performed on the depot by industry personnel;
- Work must be pursuant to a partnership.

The objectives of public-private partnerships are to:
•Maximize the utilization of maintenance depot capability;
•Reduce or eliminate the cost of ownership by the DoD in such area as operations and maintenance;
•Reduce the cost of products and services to the DoD;
•Include the use of public sector facilities and employees to perform work or produce goods for the private sector;
•Private sector use of public sector equipment and facilities to perform work for the public sector; and
•Promote work-sharing arrangements using both public and private sector facilities and/or employees.

1.6.1.2.1. Direct Sales

"Direct sales" is an arrangement, currently authorized primarily for depot maintenance activities designated as Centers of Industrial and Technical Excellence (CITE), and other working capital funded industrial facilities under specified circumstances, whereby military and commercial entities enter into a contractual relationship for the sale of depot maintenance articles and/or services to an outside (non-government) entity, usually a contractor.

A direct sale agreement begins with a government contract that funds a commercial activity. In turn, after development of a commercial relationship with an appropriate implementing agreement, the contractor pays an organic depot maintenance activity (or other industrial funded activity as authorized) for goods and services provided to the contractor. Depending on the legal authority applied, the funds may be paid to the U.S. Treasury or directly to the depot's working capital fund. The contractor may also supply materiel to the depots in support of the partnership. The purchase of articles and/or services by the commercial entity establishes a quasi-subcontractor relationship for the depot, permitting (as authorized by law) the depot to be held accountable for willful misconduct or gross negligence, or from the failure of the government to comply with cost, schedule or cost performance requirements in the contract agreement to provide articles or services.

Primary legal authority for CITEs is 10U.S.C. §2474, which authorizes the payment from non-government entities to the working capital fund for articles and services produced.
Additional authority for "sale of articles and services" is in 10U.S.C. §2208(j), 2563, 4543, 4544, 7300, and 22U.S.C. §2770 for specified circumstances.

1.6.1.2.2. Work Share

Work share refers to a partnership in which a government buying activity, in collaboration with a contractor and a depot maintenance activity determines the best mix of work capitalizing on each partner's capabilities. The workload is then shared between the contractor and the organic

activity. The contractor is funded through a contract, and the organic activity is funded through a project or work order (in the case of depot maintenance). The partnering agreement between the contractor and organic activity focuses on the roles and responsibilities of each partner. The partners work jointly to accomplish the overall requirement. Funding is not exchanged between the partners under a work share agreement, and therefore work shares exist without specific legal authority.

1.6.1.2.3. Leasing

Leasing is an arrangement that allows a private sector entity to have access to, and beneficial use of, facilities or equipment located at an organic depot designated as a Center of Industrial and Technical Excellence. Facilities and equipment may be made available for lease so long as the arrangement does not preclude the depot maintenance activity from performing its mission. The goal is to make government- owned facilities more efficient through better utilization. Lease payments may be made as monetary payments from the contractor to the depot maintenance activity, or as full-value "in-kind" consideration (e.g., provision of property maintenance, protection, alternation, repair, improvement, restoration; construction of new facilities; provision of facilities; and provision or payment of utility services). 10U.S.C. §2667 and 2474 are the primary authorities for lease of non-excess real property.

1.6.2. Product Support Business Model Framework

The PSBM framework denotes the relationship of the Product Support Manager to the Program Manager, the Product Support Integrator (PSI) and the Product Support Providers (PSPs). This framework is described in detail in the PSM Guidebook found at https://acc.dau.mil/psm-guidebook.

1.6.2.1. Role of the Program Manager (PM)

The Program Manager (PM) is the designated individual with responsibility for and authority to accomplish program objectives for development, production, and sustainment to meet the user's operational needs. The PM shall be accountable for credible cost, schedule, and performance reporting to the MDA. (DoD 5000.01)

The role of the program manager is to direct the development, production, and initial deployment (as a minimum) of a new defense system. This must be done within limits of cost, schedule, and performance, as approved by the program manager's acquisition executive. The program manager's role, then, is to be the agent of the military service or defense agency in the defense acquisition system to ensure the Warfighter's modernization requirements are met efficiently and effectively in the shortest possible time.

1.6.2.2. Product Support Manager (PSM)

The PSM, a key leadership position created under Public Law 1138, Section 805, is responsible to the PM for developing and implementing a comprehensive product support strategy and for adjusting performance requirements and resource allocations across Product Support Integrators (PSIs) and Product Support Providers (PSPs) as needed to implement this strategy by fielding.

1.6.2.3. Product Support Integrator (PSI)

The Product Support Integrator (PSI) is an entity from government or industry performing as a formally bound agent charged with integrating all sources of support, public and private, defined within the scope of the product support arrangements (e.g., Performance Based Agreement (PBA), contract, Memorandum of Agreement (MOA), Memorandum of Understanding (MOU), Service Level Agreement [SLA]) to achieve the documented outcomes. The Product Support Manager (PSM) designates the Product Support Integrator(s) who will be delegated the responsibility to integrate the product support providers to deliver the specified outcomes assigned consistent with the scope of their delegated responsibility. The PSI has considerable flexibility and latitude in how the necessary support is provided, so long as the outcomes are accomplished.

1.6.2.4. Product Support Provider (PSP)

The Product Support Providers are assigned responsibilities to perform and accomplish the functions represented by the Integrated Product Support (IPS) elements or work packages within a Work Breakdown Structure (WBS) which, per the DoD Product Support Business Case Analysis (BCA) process and consistent with statute and policy, comprise the range of best value or statutorily assigned workloads that achieve the Warfighter support outcomes. This can be done at the component, subsystem, system, program, or enterprise level.

1.6.3. International and Cooperative Programs

An international cooperative program is any acquisition program or technology project that includes participation by one or more foreign nations, through an international agreement, during any phase of a system's life cycle. Cooperative logistics refers to cooperation between the U.S. and allied or friendly nations or international organizations in the logistical support of defense systems and equipment.

Cooperative logistics is part of the acquisition process, but as a substantial part of military operations, much of the implementation process involves Security Assistance processes and procedures.

Cooperative logistics support includes:

- Logistics Cooperation international agreements (IAs), used to improve sharing of logistics support information and standards, and to monitor accomplishment of specific cooperative logistics programs;
- Acquisition and Cross-Servicing Agreements;
- Host Nation Support;
- Cooperative Logistics Supply Support Arrangements;
- Cooperative Military Airlift Agreements;
- War Reserve Stocks for Allies;
- Agreements for acceptance and use of real property or services;
- Standardization of procedures under American/British/Canadian/Australian/New Zealand auspices;
- International Standardization Agreements developed in conjunction with member nations of the North Atlantic Treaty Organization and other allies and coalition partners, as described in DoD 4120.24-M, "Defense Standardization Program (DSP) Policies and

Procedures" and as listed in the Acquisition Streamlining and Standardization Information System (ASSIST) database (login required);

- Consideration of the interoperability implications of these agreements when constructing Work Breakdown Structures.

Each participant or party involved in cooperative logistics agreements should benefit from the agreement. Benefits could be tangible, such as the U.S. Receiving support for its naval vessels when in a foreign port; or intangible, such as the foreign nation receiving the implied benefit of a visible, U.S. Naval presence in the region. Other cases are more obviously quid-pro-quo: cross-servicing agreements, for example. In a cross-servicing agreement, each party receives the equivalent of the materiel or services provided to the other party. Besides the obvious material benefits, such agreements have the collateral effects of opening dialog and creating relationships between the parties. Such dialog and relationships may serve to strengthen political bonds. While not a program manager responsibility, DoD acquisition personnel should be aware of the international consequences of their activities and appropriately support such efforts.

Per DAG Chapter 2, the acquisition strategy shall discuss the potential for increasing, enhancing, and improving the conventional forces of the North Atlantic Treaty Organization (NATO) and the United States, including reciprocal defense trade and cooperation, and international cooperative research, development, production, and logistic support. The acquisition strategy shall also consider the possible sale of military equipment. The discussion shall identify similar projects under development or in production by a U.S. ally.

The acquisition strategy shall assess whether the similar project could satisfy U.S. Requirements, and if so, recommend designating the program an International Cooperative Program. The MDA shall review and approve the acquisition strategy for all programs at each acquisition program decision in accordance with 10 U.S.C. 2350a (reference (aq)), paragraph (e). All international considerations shall remain consistent with the maintenance of a strong national technology and industrial base and mobilization capability. Restricted foreign competition for the program, due to industrial base considerations, shall require prior USD(AT&L) approval. Results of T&E of systems using approved International Test Operating procedures may be accepted without repeating the testing.

All international cooperative programs shall fully comply with foreign disclosure and program protection requirements. Programs containing classified information shall have a Delegation of Disclosure Authority Letter or other written authorization issued by the DoD Component's cognizant foreign disclosure office prior to entering discussions with potential foreign partners.

Title 10 of the United States Code provides two legal authorities for foreign logistic support, supplies, and services: an Acquisition-only Authority, and a Cross-Servicing Authority, which includes an acquisition authority and a transfer authority.

1.6.3.1. Security Assistance

Security Assistance is a group of programs, authorized by law, which allows the transfer of military articles and services to friendly foreign Governments.

Security Assistance transfers may be carried out via sales, grants, leases, or loans and are authorized under the premise that if these transfers are essential to the security and economic well-being of allied Governments and international organizations, they are equally vital to the security and economic well-being of the United States (U.S.). Security Assistance programs support U.S. National security and foreign policy objectives. They increase the ability of our friends and allies to deter and defend against possible aggression, promote the sharing of common defense burdens, and help foster regional stability. Security Assistance can be the delivery of defense weapon systems to foreign Governments; U.S. Service schools training international students; U.S. Personnel advising other Governments on ways to improve their internal defense capabilities; U.S. Personnel providing guidance and assistance in establishing infrastructures and economic bases to achieve and maintain regional stability; etc.

The table below outlines some of the major types of Security Assistance and identifies the department (Department of Defense or Department of State (DoS)) that administers the program.

Type of Security Assistance		Program Administered by:
1	Foreign Military Sales (FMS)	DoD
2	Foreign Military Construction Services (FMCS)	DoD
3	Foreign Military Sales Credit (FMSCR)	DoD
4	Leases	DoD
5	Military Assistance Program (MAP)	DoD
6	International Military Education and Training (IMET)	DoD
7	Drawdown	DoD
8	Economic Support Fund	DoS
9	Peace Keeping Operations (PKO)	DoS
10	International Narcotics Control and Law Enforcement	DoS
11	Nonproliferation, Anti-Terrorism, Demining, and Related Programs (NADR)	DoS
12	Commercial Export Sales Licensed Under the Arms Export Control Act (AECA) of 1976, as amended (reference (c))	DoS

1.6.3.2. Joint Logistics

Joint logistics delivers sustained logistic readiness for the Combatant Commander (CCDR) and subordinate Joint Force Commanders (JFCs) through the integration of national, multinational, Service, and Combat Support Agency (CSA) capabilities. The integration of these capabilities ensures forces are physically available and properly equipped, at the right place and time, to support the joint force.

The Department of Defense actively seeks to include allies and friendly foreign countries as partners in the Research, Development, Test and Evaluation (RDT&E); production; and support of defense systems. The Department of Defense encourages early involvement with allied and friendly foreign partners. Such cooperative foreign government partnerships should begin at the requirements definition phase, whenever possible. Successful execution of cooperative programs will promote the desirable objectives of standardization, commonality, and interoperability. The U.S. Government and its foreign government partners in these endeavors will benefit from

shared development costs, reduced costs realized from economies of scale, and strengthened domestic industrial bases. Similarly, the Department of Defense plays a key role in the execution of security cooperation programs that ultimately support national security objectives and foreign policy goals. U.S. Defense system sales are a major aspect of security cooperation.

Joint programs provide opportunities to reduce acquisition and logistic support costs and to improve interoperability of equipment in Joint operations. The Defense Acquisition Guidebook states in para. 5.1.3.2, "Joint strategies are a top priority where more than one DoD Component is the user of the respective major weapon system or variant of the system. Likewise, product support strategies should address a programs product support interrelationship with other programs in their respective portfolio and joint infrastructure, similar to what is performed for operational interdependencies."

Sustainment is the provision of logistics and personnel services necessary to maintain and prolong operations until successful mission completion. Sustainment in joint operations provides the Joint Forces Command (JFC) flexibility, endurance, and the ability to extend operational reach. Effective sustainment determines the depth to which the joint force can conduct decisive operations, allowing the JFC to seize, retain, and exploit the initiative. Sustainment is primarily the responsibility of the supported CCDR and subordinate Service component commanders in close cooperation with the Services, CSAs, and supporting commands.

The key global providers in the Joint Logistics Environment (JLE) are the Services, the Defense Logistics Agency (DLA), United States Joint Forces Command (USJFCOM) and United States Transportation Command (USTRANSCOM). Global providers manage end-to-end processes that provide capabilities to the supported CCDR, and are challenged to link the CCDR requirements to the outcomes of those processes.

Services lie in the heart of this collaborative network and their logistic organizations form the foundation of the Joint Logistics Environment (JLE) and are responsible to maintain systems life-cycle readiness. DLA and the Services share responsibilities as suppliers to the joint force since both "manage" supplies in support of readiness requirements. In this shared role, they support the components of the joint force with equipment and supplies needed for sustained logistic readiness. USJFCOM is the primary conventional force provider to CCDRs, which includes serving as the Department of Defense (DOD) Joint Deployment Process Owner (JDPO). USTRANSCOM is responsible for providing common user and commercial air, land, and sea transportation, terminal management, and aerial refueling to support the global deployment, employment, sustainment, and redeployment of US forces. [JP 4.0]

The integration of national, multinational, Service, and Combat Support Agency (CSA) capabilities ensures forces are physically available and properly equipped, at the right place and time, to support the joint force.

1.6.3.3. Foreign Military Sales (FMS) and International Partners

FMS is a non-appropriated program through which eligible foreign governments purchase defense articles, services, and training from the U.S. Government.

The Foreign Military Sales (FMS) Program is that part of Security Assistance authorized by the Arms Export Control Act (AECA) and conducted using formal contracts or agreements between the United States Government (USG) and an authorized foreign purchaser. These contracts, called Letters of Offer and Acceptance (LOAs), are signed by both the USG and the purchasing Government or international organization; and provide for the sale of defense articles and/or defense services (to include training) usually from Department of Defense (DoD) stocks or through purchase under DoD-managed contracts. As with all Security Assistance, the FMS program supports United States (U.S.) foreign policy and national security.

Under foreign military sales, the purchasing government pays all costs that may be associated with a sale. In essence, there is a signed government-to-government agreement, normally documented in a Letter of Offer and Acceptance (LOA). Each LOA is commonly referred to as a "case" and is assigned a unique identifier for accounting purposes. Under FMS, military articles and services, including training, may be provided from DoD stocks or from new procurement.

Cooperative Logistics Supply Support Arrangements (CLSSAs) are FMS agreements for the furnishing of secondary items from the U.S. Logistics system to a country in support of specific major end items/systems. DoD considers the CLSSA to be one of the most effective means to replenish the in-country stocks of spares and repair parts that were initially furnished with end items of equipment. FMS CLSSA agreements set out terms under which DoD provides supply support for a common weapon system to a foreign government or international organization on a basis equal to that provided to U.S. Forces. Availability of such support is of paramount importance in promoting interoperability as well as in marketing U.S. Manufactured weapon systems. Department of Defense manual (DoD-M) 5105.38M) provides guidance for CLSSAs.

For further information, please see DAU's International Acquisition Career Path (IACP) Training which consists of entry level (I), intermediate level (II), and advanced level (III) IACP resident and on-line courses offered at the Defense Acquisition University. For a description of IACP program, read the "New Career Path Recognizes Global Scope of Acquisition - International Acquisition Career Path" article in the Defense AT&L Magazine, Jan-Feb 2009.

An international cooperative program is any acquisition program or technology project that includes participation by one or more foreign nations, through an international agreement, during any phase of a system's life cycle. The key objectives of international cooperative programs are to reduce weapons system acquisition costs through cooperative development, production, and support; and to enhance interoperability with coalition partners.

An analysis of potential opportunities for international cooperation for all Acquisition Category I programs before the first milestone or decision point. DoD Directive 5000.01, Enclosure 1 , and DoD Instruction 5000.02, Enclosure 10, paragraph 5 ,specify the requirements for international considerations; amplifying guidance and information appears in the Defense Acquisition Guidebook. DoD Directive 5000.01 requires International Armaments Cooperation; requires interoperability with U.S. Coalition partners; and establishes the preference for a cooperative development program with one or more Allied nations over a new, joint, or DoD Component-unique development program.

During the development of the Technology Development Strategy (TDS) for Milestone A or the initial Acquisition Strategy for Milestone B for a new program, the potential for international cooperative research, development, production, and logistic support should be addressed, and thereafter, the potential for international cooperation should be considered in every phase of the acquisition process. DoD Components should periodically review their programs to determine the potential for international cooperation. Milestone Decision Authorities may recommend forming international cooperative programs based on the TDS or acquisition strategy considerations; DoD Component Heads may also recommend forming international cooperative programs.

The Milestone Decision Authority should make the decision to establish an international cooperative program as early as possible in the Defense Acquisition Management System. The Milestone Decision Authority, with the advice and counsel of the DoD Components and the Joint Requirements Oversight Council, makes the decision to pursue an international cooperative program. The decision process should consider the following:

- Demonstrated best business practices, including a plan for effective, economical, and efficient management of the international cooperative program;
- Demonstrated DoD Component willingness to fully fund their share of international cooperative program needs;
- The long-term interoperability and political-military benefits that may accrue from international cooperation; and
- The international program's management structure as documented in the international agreement.

The designated program manager (U.S. or foreign) is fully responsible and accountable for the cost, schedule, and performance of the resulting system. The DoD Component remains responsible for preparation and approval of most statutory, regulatory, and contracting reports and milestone requirements, as listed in DoD Instruction 5000.02, Enclosure 4. Documentation for decision reviews and periodic reports flow through the DoD Component acquisition chain, supported by the participating nation(s).

International cooperation can add stability to the program. DoD Instruction 5000.02 prevents DoD Components from terminating or substantially reducing participation in international cooperative programs under signed international agreements without Milestone Decision Authority notification, and in some cases, Milestone Decision Authority approval. Additional information may be found in the Director, International Cooperation, and International Armaments Cooperation Handbook.

For armaments, DoDD 5000.01 directs that PMs shall pursue international armaments cooperation to the maximum extent feasible, consistent with sound business practice and with the overall political, economic, technological, and national security goals of the United States. International agreements for international armaments cooperation programs shall complete the interagency consultation and Congressional notification requirements contained in 10 U.S.C. 2350a (reference (f)), section 2751 of the Arms Export Control Act (reference (g)), and 10 U.S.C. 2531 (reference (h)).

1.6.3.3.1. Defense Security Cooperation Agency (DSCA)

DSCA is the central agency that synchronizes global security cooperation programs, funding and efforts across OSD, Joint Staff, State Department, COCOMS, the services and U.S. Industry. DSCA is responsible for the effective policy, processes, training, and financial management necessary to execute security cooperation within the DoD. DSCA mission areas include: Foreign Military Sales, Foreign Military Financing, International Military Education and Training, Humanitarian Assistance, Disaster Relief & Mine Action, and Regional Centers.

The Department of Defense established DSCA as a separate agency to direct, administer, and supervise security assistance programs. DSCA receives policy direction, as well as staff supervision, from the Assistant Secretary of Defense for International Security Affairs, which in turn is directed and supervised by the Under Secretary of Defense for Policy.

DSCA administers programs in the Arms Export Control Act (P.L. 90-269, or the AECA) and part II of the Foreign Assistance Act of 1961 (P.L. 87-195, or the "FAA"). These include:

- Sales of defense articles, training and services under the Foreign Military Sales (FMS) program (Section 524 FAA; Sections 21-40A, AECA)*;*
- Drawdown of defense articles, training and services *(*Section 506 FAA)*;*
- Grants and sales of Excess Defense Articles (EDA*)* (Section 516 FAA)*;*
- Leases of defense articles (Sections 61-64 AECA)*;*
- Funding of FMS purchases through the Foreign Military Financing (FMF) program (Section 23 AECA)*;*
- Funding of training through the International Military Education and Training (IMET) program (Sections 541-546 FAA).

1.6.3.3.2. International Traffic in Arms Regulations (ITAR)

International Traffic in Arms Regulations (ITAR) is a set of United States government regulations that control the export and import of defense-related articles and services on the United States Munitions List. These regulations implement the provisions of the Arms Export Control Act, and are described in Title 22 (Foreign Relations), Chapter I (Department of State), and sub-chapter M of the Code of Federal Regulations.

ITAR regulations dictate that information and material pertaining to defense and military related technologies may only be shared with "US Persons" unless approval from the Department of State is received. By definition, a "US Person" can be a US citizen; a permanent legal resident (green-card holder), or a corporation, business, organization, or group that is incorporated in the United States under US law.

1.6.3.3.3. State Department and Case Management

Case management tracks the investigation and adjudication of security clearance applications and suitability determinations for Department of State employees, prospective employees, and contractors; provides a means of recording individual Case files and Security files; provides a means of reporting based on criteria pre-defined by the user; provides a centralized repository for reference and tracking of background investigations for clearances.

1.6.3.3.4. Cooperative Logistic Supply Support Arrangement (CLSSA)

Cooperative logistics refers to cooperation between the U.S. and allied or friendly nations or international organizations in the logistical support of defense systems and equipment. Cooperative Logistics Supply Support Arrangements (CLSSAs) are FMS agreements for the furnishing of secondary items from the U.S. Logistics systems to a country in support of specific major end items/systems. DoD considers the CLSSA to be one of the most effective means to replenish the in-country stocks of spares and repair parts that were initially furnished with end items of equipment. FMS CLSSA agreements set out terms under which DoD provides supply support for a common weapon system to a foreign government or international organization on a basis equal to that provided to U.S. Forces. Availability of such support is of paramount importance in promoting interoperability as well as in marketing U.S. Manufactured weapon systems. Department of Defense manual (DoD-M) 5105.38M) provides guidance for CLSSAs.

1.7. Product Support Budgeting and Funding

The budgeting and funding of life cycle costs for product support strategy development and implementation beginning with program initiation and at each subsequent acquisition decision milestone. O&S cost estimates play a major role in budgeting and funding many different types of product support analyses and reviews during sustainment.

1.7.1. Planning, Programming, Budgeting and Execution (PPBE) Process

The PPBE is a cyclic process that allocates resources within the DoD using four distinct but overlapping phases: planning, programming, budgeting and execution. In the PPBE process, the Secretary of Defense establishes policies, strategy, and prioritized goals for the Department, which are subsequently used to guide resource allocation decisions that balance the guidance with fiscal constraints The Planning phase takes requirements from the Strategic Planning Guidance document provided by the Office of the Secretary of Defense and Joint Chiefs of Staff and refines these requirements into the Joint Planning Guidance which assists the Army, Navy, Marines, etc., to draft a Program Objective Memorandum (POM). This is done during the next phase which is called the Programming Phase. The POM is complemented with the Budget Estimate Submission (BES) which identifies cost. The POM/BES is submitted every two years...on the even years (or better known as the ON year). The POM/BES is authenticated by analyst who then forward the completed document (Program Budget Decision) to the Secretary of Defense (SECDEF) who in turn forward to the President of the United States for inclusion into the Presidential Budget (PRESBUD) and is then presented to CONGRESS for funding.

1.7.2. DoD Working Capital Fund (DWCF)

The DWCF is a revolving fund account which enables long term partnerships between government and industry support organizations under an outcome based product support arrangement. It consists of a dedicated, integrated, DoD-owned and operated worldwide supply, transportation, and maintenance system. The DWCF operations are unique in that unlike other DoD organizations, it sells its products and services to its customers much like a private business and, with a few exceptions, it does not receive a direct appropriation. Placing work with a DWCF activity such as NAVSUP Weapon Systems Support (WSS), formerly known as Naval Inventory Control Point (NAVICP), is fairly straightforward and since the transaction is internal to DoD, Federal procurement rules do not apply.

1.7.3. Challenges to Product Support Budgeting and Funding

This area consists of the challenges, trade-offs and issues which must be addressed when budgeting for sustainment product support strategies such as traditional transactional support, outcome based product support or a best mix blend of both. The PSM and the PSIs are thus challenged to manage funds both in line with the law and to optimize availability against minimum total ownership costs.

1.8. Cost Management

Cost information is an essential component of any well-managed, cost effective organization. Managerial cost accounting can assist both the Military Services and Defense Agencies as they strive to achieve cost effective mission performance. An operational manager's success depends on a thorough understanding of the organization's mission and the steps needed to accomplish it. This includes knowledge of alternate methods of performing the mission and the costs and impact on output associated with those alternatives. Further, cost information is essential to the Department's compliance with the Government Performance and Results Act (GPRA) of 1993 as cost accounting information coupled with performance measures are essential in evaluating and reporting on efficiency and effectiveness of DoD missions and functions.

The objective of managerial cost accounting is to accumulate and record all the elements of cost incurred to accomplish a cost object; i.e., to carry out an activity or operation, or to complete a unit of work with a specific output. The cost object, defined in SFFAS 4 as "an activity or item whose cost is to be measured", must be discrete enough and described in writing to such a level of detail to form a basis to establish cost centers and define output quality requirements. Establishing cost objects is a management decision; however, operations, activities and functions significant to enterprise performance should be included to support organization management and reporting. To assure cost information collection efficiency, managers may aggregate multiple similar outputs for which costs are collected. To support internal management, there may be a series of intermediate cost objects which, when combined, equal the final cost object. For example, a final cost object may be the cost to overhaul a piece of military equipment – a tank, aircraft or ship – while an intermediate cost object might be the cost of the engine overhaul, weapons system upgrade, and so forth. Certain costs are assigned as direct costs – costs directly related to accomplishing the cost object - while others are grouped as indirect costs and then allocated to various benefiting cost objects. Cost objects may vary from large programs or activities to smaller specific cost objects, such as work orders, manufactured products, or parts of a construction project. The Standard Financial Information Structure (SFIS) provides examples of cost oriented data elements types for the DoD. Reference is the DoD Financial Management Regulation, Vol 4, Ch 19, May 2010.

1.8.1. Better Buying Power / Affordability

On 14 September, 2010, the Undersecretary of Defense for Acquisition, Technology & Logistics, Dr. Ashton Carter issued sweeping acquisition Guidance through a "Memorandum for Acquisition Professionals" and signed out directive memoranda to his key staff elements. This memo follows Dr. Carter's June 28th memo describing a mandate to deliver better value to the taxpayer and Warfighter by improving the way the Department does business; and contains specific Guidance for achieving the June 28 mandate. Dr. Carter's June 28th memo, entitled

"Better Buying Power: Mandate for Restoring Affordability and Productivity in Defense Spending", reiterated the department's commitment to supporting our forces at war and reforming the acquisition system, including continued implementation of the 2009 Weapon Systems Acquisition Reform Act, and goes on to outline direction on another important departmental priority, namely "delivering better value to the taxpayer and improving the way the Department does business."

"Mandate affordability as a requirement" is the first initiative in the first area of the Better Buying Power initiatives "target affordability and control cost growth". Better Buying Power defines affordability as getting more warfighting capability without spending more money. Affordability means to manage programs for weapons or information systems without exceeding our available resources. Those resources include funding, schedule, and manpower.

Initial metrics for affordability include unit costs pertaining to both acquisition and operations & support (O&S):

- Average acquisition unit cost
- Average annual O&S unit cost

However, Affordability will not be a KPP.

The Better Buying Power initiatives expand on the DoDI 5000.02 definition of affordability. Now affordability means not only to stay within budget, but also to be able to buy increasing levels of capability within an almost static budget. The five affordability initiatives seek to reduce non-value added overhead in programs and devote the savings to procuring increased capability for our warfighters. The affordability initiatives seek to do this by 1) implementing affordability requirements at milestone reviews, 2) imposing affordability constraints on new starts, 3) making affordability analysis a part of the DAB planning process, and 4) introducing these requirements into programs further along in development or production.

At Milestone A, programs must establish an affordability target, or program cost. This target will be the functional equivalent of a Key Performance Parameter, such as speed, power or data rate. That is, the affordability target is a design parameter not to be sacrificed with the specific authority of the USD(AT&L). The initial metrics for setting and tracking the target will be the average unit acquisition cost and the average annual unit operations and support cost. This target will serve as the basis for pre-milestone B decision making and tradeoff analysis. This analysis will show the results of capability excursions around expected design performance points to highlight elements suitable to establish the cost and schedule trade space. This analysis will also be in the context of the portfolio or mission area. In the case of new programs, the analysis must show the adjustments necessary to absorb the new program within the portfolio.

At Milestone B, programs must present a systems engineering tradeoff analysis showing how cost varies in relation to design and schedule parameters. This analysis will pay due attention to spiral upgrades. As part of this analysis, programs must provide cost tradeoff curves, or trade space around major affordability drivers, to show how the program has established a cost-effective design point for these affordability drivers.

At Milestone C, the USD(AT&L) will approve a schedule for production based on economical production rates. To enforce adherence to the schedule, the USD(AT&L) will revoke the program's milestone if the program deviates from the schedule without express approval.

ASA(AL&T) issued an implementing directive to the Army acquisition workforce on 10 Jun 2011. This directive primarily addresses "will cost / should cost", but it does contain limited guidance on the affordability initiative. In addition to Dr. Carter's directions, this memo requires Army program offices to use the Defense Acquisition Board (DAB) template for milestone reviews and other important decision points.

On 24 Aug 2011, Dr. Carter released a memo to explain the differences between should-cost and affordability. The primary difference between the two relates to the product life cycle. Prior to Milestone B, the emphasis should be on defining and achieving the affordability target. Program offices need to set targets in terms of two metrics: the average unit acquisition cost and the average annual unit operations and support cost.

<u>10 Ingredients of Should-Cost Mgt from 22 Apr USD(AT&L) Implementation Memo</u>
1. Scrutinize each contributing ingredient of program cost and justify it. How and why is it reported or negotiated? What reasonable measures might reduce it?
2. Particularly challenge the basis for indirect costs in contractor proposals.
3. Track recent program cost, schedule, and performance trends and identify ways to reverse negative trend(s).
4. Benchmark against similar DoD programs and commercial analogues (where possible), and against other programs performed by the same contractor or in the same facilities.
5. Promote Supply Chain Management to encourage competition and incentivize cost performance at lower tiers.
6. Reconstruct the program (government and contractor) team to be more streamlined and efficient.
7. Identify opportunities to breakout Government-Furnished Equipment versus prime contractor-provided items.
8. Identify items or services contracted through a second or third party vehicle. Eliminate unnecessary pass-through costs by considering other contracting options.
9. In the area of test:
a. Take full advantage of integrated Developmental and Operational Testing to reduce overall cost of testing;
b. Integrate modeling and simulation into the test construct to reduce overall costs and ensure optimal use of National test facilities and ranges.
10. Identify an alternative technology/material that can potentially reduce development or life cycle costs for a program. Ensure the prime product contract includes the development of this technology/material at the right time.

Don't confuse the current "should cost" initiative with the older DFAR-defined "should cost" review. The DFAR review is typically undertaken when a program is entering production. This review was a manpower-intensive, in-depth review of contractor production processes and costs. A large team of engineers, production specialists, logisticians, and program managers performed the in-depth analysis. A BBP "should cost" management approach should be used throughout the

program life cycle. It is particularly focused on up-front planning and exploring engineering trades to ensure successful outcomes at every milestone. By creating cost-conscious technical and schedule baselines, identifying cost saving engineering trade-offs, and then aggressively managing areas identified for cost savings, efficiencies can be gained through-out the program. Productivity improvements might include investing in new technologies that reduce out-year costs, finding alternative sources or technologies for high-cost components, combining developmental and operational testing, and maximizing modeling and simulation. There are no silver bullets; each PM must find solutions that fit his or her specific program.

Contributing Factors to Achieving Stable and Economical Production Rates:

- Focus on production planning with an emphasis on Joint Supply Chain Architecture;
- Funding stability;
- Contracting approach (e.g., Multi-year, advance procurement, options, dual sourcing);
- Operational Requirements;
- Contractor capacity (e.g., Personnel, tooling, shifts);
- Accurate estimating;
- Requirements stability;
- Use of process improvement methodologies, such as Continuous Process Improvement, Lean/Six Sigma, and Total Ownership Cost;
- Support and sustainment requirements.

Important note is that the focus is on lowering cost, not on lowering profit. It is OK to pay more in profit in parallel with reducing overall cost.

- Cost reductions are not mandated in profit per se since in most instances profit should be used to incentivize /reward risk management and performance that reduces overall cost
- If profit policy is effectively used to incentivize reduction in program cost, the overall price to the taxpayer (cost plus profit) should be less
- Example: [(C): cost; (P): profit; (TPC): total program cost]
    - (before cost reduction): 90 (C) + 10 (P) = 100 (TPC)
    - (after cost reduction): 81 (C) + 11 (P) = 92 (TPC)

Profit increases even with a total cost reduction. Profit on subcontracted work is meant to compensate the prime for taking on the burden of managing subcontractor risk and delivering subcontractor value. If this is not happening, then “breaking out” the “body of work” for direct government management should be strongly considered

- Need to identify ways to remove costs from programs – challenge the status quo;
- Focus your use of incentives in schedule, technical and cost areas, tailored to your specific program, to achieve cost reduction;
- Review the full spectrum of available techniques - don’t stick to what’s been routinely done in the past.

Better buying power seeks to reward contractors for successful supply chain and indirect expense management with the following guidelines:

- Incentivize prime to aggressively manage high-risk subcontract, and higher profit will be given when prime succeeds in driving down subcontractor costs every year;
- Profit levels should be reexamined each time procurement is planned (including follow on procurements);
- Overhead: Included in this category are indirect labor costs (such as management, quality control, material handling), facility rent and utilities, depreciation, training not directly billable to a specific contract, travel for non-contract activities, morale and welfare. These costs are reflected in the overhead rate;
- Take the time to investigate and understand what cost elements are contained in overhead, and are they reasonable? If not, challenge their continuation in the contract;
- Smaller overhead does not always equate to higher efficiency. Evaluate each situation on its specific merits/demerits. You should be able to calculate an accurate overhead rate for any of your contracts…if you cannot, you need to learn how to do so;
- Although certain expenses may be chargeable to overhead, most companies constantly work to minimize these costs to keep their rates competitive in the marketplace;
- Additionally, the components of overhead and the way costs are collected and grouped can vary by company. For example, in one company, contracting officers and supply chain personnel may be handled as indirect labor (overhead), while in another the same people are direct (base labor). This may be a way to find savings;
- Buying outcomes instead of parts or man hours means reducing costs, decreasing cycle times, improving performance and accurately predicting demand;
- Properly structured, Materiel Availability increases, Logistics Response Time decreases, depot efficiency increases. Repair Turn Around Time, Awaiting Parts, Work in Process, Mean Time Between failures all improve;
- All managers of ACAT ID programs are now required to provide USD/ATL, as part of their acquisition strategy, the reward and incentive strategy behind their profit policy, including consideration of breakout alternatives where appropriate.

1.8.2. Total Ownership Cost (TOC) and Life Cycle Cost (LCC)

Total ownership cost includes the elements of a program's life-cycle cost, as well as other related infrastructure or business processes costs not exclusively attributed to the program in the context of the defense acquisition system.

Life-cycle cost can be defined as the sum of four major cost categories, where each category is associated with sequential but overlapping phases of the program life cycle. Life-cycle cost consists of:

- research and development costs associated with the Materiel Solution Analysis phase, the Technology Development phase, and the Engineering and Manufacturing Development phase;
- investment costs associated with the Production and Deployment phase;
- operating and support costs associated with the sustainment phase; and
- disposal costs which occur throughout the life cycle, disposal occurs for any material or product which is removed from useful service to include non-functional and “throw-away” parts; liquids such as oil and lubricants; components and systems that have no remaining useful service and cannot be repaired, replaced or overhauled.

1.8.3. Life Cycle Cost Estimating (LCCE)

Note that the DoDI 5000.02, dated Dec 8, 2008, references the "CAIG" which is a designation for the Cost Analysis Improvement Group (CAIG) which has been superseded by the Weapon Systems Acquisition Reform Act of 2009, establishing the Director of Cost Assessment and Program Evaluation and transfer of the staff of PA&E over to the Cost Assessment and Program Evaluation (CAPE) Directorate. Additional role and responsibility changes have been formalized in DTM-09-027 Implementation of the Weapon Systems Acquisition Reform Act of 2009. The text below will use the term "CAIG" as used in the current DoDI 5000.02. The PM/PSM should check with their respective organizations for accurate compliance with current policy and directives.

The life cycle cost estimate addresses as much of the program, including known future increments, as can be defined at the time of the initial (Increment 1) milestone review. Any exclusion (for portions of the program that cannot be defined at that time) should be clearly identified. The application of life cycle cost categories and program phases (as described in the DAG, section 3.1.2) may need to be modified to account for the evolutionary acquisition strategy. Per DoDI 5000.02, on ACAT I programs, the sustainment contracts or organic Inter-/Intra-Service agreements (such as Memorandums of Understanding) shall provide tailored cost reporting that can facilitate future cost estimating and price analysis. If the logistics support falls under a performance-based life cycle product support strategy, the contracts or organic agreements shall also include an agreed-to set of performance metrics that can be used to monitor performance.

Program cost estimates that are supporting the defense acquisition system normally are focused on life cycle cost or elements of life cycle cost. Examples of such cases where cost estimates support the acquisition system include Affordability Assessments, establishment of program cost goals for Acquisition Program Baselines, Independent Cost Estimates, or estimates of budgetary resources. However, for programs in Pre-Systems Acquisition or the Engineering and Manufacturing Development Phase, cost estimates that are used within the program office to support system trade-off analyses such as evaluations of design changes, or assessments of energy efficiency, reliability, maintainability, and other supportability considerations need to be broader in scope than traditional life cycle cost estimates to support the purpose of the analyses being conducted.

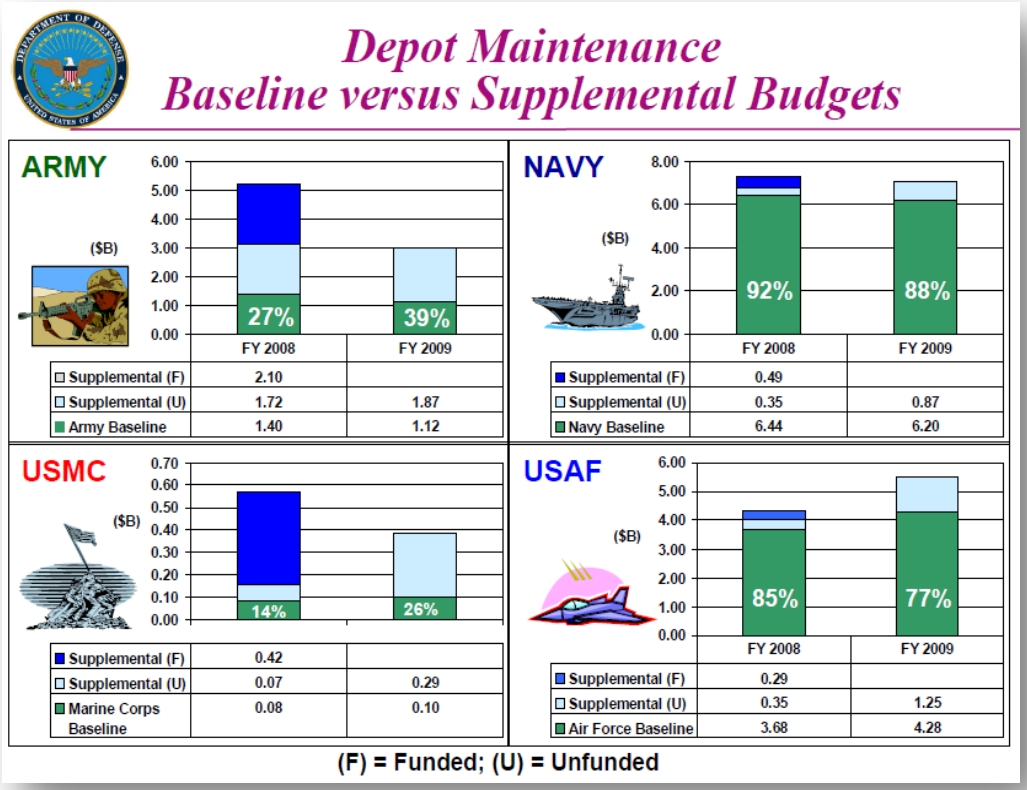


Figure 1.3.7.F1 Example of Depot Maintenance Baseline versus Supplemental Budgets

Moreover, for mature programs (in transition from production and deployment to sustainment), cost estimates in many cases may need to be expanded in scope to embrace total ownership cost concepts in order to support broad logistics or management studies. Section 3.4.3 of the DAG is primarily focused on procedures associated with life cycle cost estimates, which are subject to review by the Office of Cost Assessment & Program Evaluation, for major defense acquisition programs.

The estimate is prepared in support of major milestone or other program reviews held by the Defense Acquisition Board. This section describes a recommended analytic approach for planning, conducting, and documenting a life cycle cost estimate for a defense acquisition program (whether or not the estimate is subject to Office of Cost Assessment review).

DoD instructions require that both a Life Cycle Cost Estimate (LCCE) and a DoD Component Cost Analysis (CCA) estimate be prepared in support of acquisition milestone reviews for Major Defense Acquisition Programs (MDAP) and for Major Automated Information Systems (MAIS). The LCCE is also called the Program Office Estimate (POE) and is used by decision makers in assessing the affordability of the program. As part of this requirement, the program office will establish, as a basis for cost-estimating, a description of the salient features of the program and of

the system being acquired. This information is presented in a Cost Analysis Requirements Description (CARD) discussed below.

Per the DoDI 5000.02, Encl. 7, the OSD CAIG shall prepare independent LCCEs per section 2434 of Reference (k). The CAIG shall provide the MDA with an independent LCCE at major decision points as specified in statute, and when directed by the MDA. The MDA shall consider the independent LCCE before approving entry into the EMD Phase or the Production and Deployment Phase. The CAIG shall also prepare an ICE for ACAT IC programs at the request of the USD(AT&L). A CAIG Initial Cost Estimate (ICE) is not required for ACAT IA programs. (DoD Directive 5000.04 (Reference (bc))).

More information can be found in the Defense Acquisition Guidebook at https://acc.dau.mil/CommunityBrowser.aspx?id=314773, and at is completely described in DoD 5000.4 M, "DoD Cost Analysis Guidance and Procedures," Section1.

1.9. Contract Development and Management

From a sustainment perspective, contracts are structured and managed to balance three major objectives throughout the life cycle of the system: delivering sustained materiel readiness; minimizing the requirement for logistics support through technology insertion and refreshment; and continuously improving the cost-effectiveness of logistics products and services. Defense Acquisition University has a community of practice dedicated to the area of Contracting and is found at https://acc.dau.mil/cm

MIL-HDBK 502, Section 8.3, provides a compelling discussion on why The Product Support Manager should be thoroughly knowledgeable of the entire contract. Since product support needs are spread throughout the solicitation /contract, The Product Support Manager is concerned with the entire document. As product support needs are defined, it is extremely important to keep the solicitation parts consistent. They must complement each other, and not contradict each other, to express requirements clearly to potential offerors and to establish enforceable contracts.

1.9.1. Performance Specifications

Performance specifications translate operational requirements into more technical language that tells the manufacturer: 1) what the government will consider an acceptable product, and 2) how the government will determine if the product is acceptable.

Performance specifications communicate the user's requirements to the manufacturer. They translate operational requirements into more technical language that tells the manufacturer: 1) what we will consider an acceptable product, and 2) how we will determine if the product is acceptable. To the extent that any specification does these two things, it is good. The problem arises when we use specifications to tell the manufacturer how to make the product.

A performance specification states requirements in terms of the required results and provides criteria for verifying compliance, but it does not state methods for achieving results. It defines

the functional requirements for the product, the environment in which it must operate, and the interface and interchangeability requirements.

The following are examples of performance specifications:

Example #1: The circuit breaker shall not trip when subjected to the class 1, type A, shock test specified in MIL-S-901.
Purpose: States required results.

Example #2: The detector shall not contain foreign matter—such as dust, dirt, fingerprints, or moisture—that can be detected by visual examination.
Purpose: Provides criteria for verifying compliance. (Assuming that foreign matter affects detector performance)

Example #3: The equipment shall withstand, without damage, temperatures ranging from -46°C to +71°C.
Purpose: Defines operational environment.

There are five general classifications of performance specifications:

- Non-government Standards (performance type): A standardization document developed by a private sector association, organization, or technical society that plans, develops, establishes, or coordinates standard specifications, handbooks, or related documents. This term does not include standards of individual companies;
- Commercial Item Descriptions: An indexed, simplified product description prepared by the Government that describes, by performance characteristics, an available, acceptable commercial product that will satisfy the Government's needs. The content and format requirements for this specification are provided in the GSA Standardization Manual (Chapter 6), DoD 4120.3-M, and DoD 5000.37-H;
- Standard Performance Specifications: This type of specification establishes requirements for military-unique items used in multiple programs or applications;
- Guide Specifications: This type of specification identifies standard, recurring requirements that must be addressed when developing new systems, subsystems, equipments, and assemblies. Its structure forces appropriate tailoring to meet user needs. The content and format requirements for this specification are covered by DoD 4120.3-M, "Defense Standardization Program Policies and Procedures." It is a type of performance specification;
- Program-unique Specifications: This type of specification, also called a system specification, establishes requirements for items used for a particular weapon system or program. Little potential exists for the use of the document in other programs or applications. It should be written as a performance specification, but it may include a blend of performance and detail design type requirements.

In general, performance specifications leave out unnecessary "how to" or detail and give the manufacturer latitude to determine how to best meet our stated needs. The word "unnecessary"

should be emphasized because some detail requirements are necessary in a performance specification. Almost always the need for detail is generated by interface requirements.

The DoD uses performance specifications (i.e., DoD performance specifications, commercial item descriptions, and performance-based non-Government standards) when purchasing new systems, major modifications, upgrades to current systems, and commercial and non-developmental items for programs in all acquisition categories. The Department emphasizes conversion to performance specifications for re-procurements of existing systems at the subsystems level; and for components, spares, and services, where supported by a business case analysis; for programs in all acquisition categories.

When implementing performance specifications, the following is a guideline:

- If performance specifications are not practicable, the Department shall use non-Government standards. The following additional policy shall apply:
    - If no acceptable non-Governmental standards exist, or if using performance specifications or non-Government standards is not cost effective, not practical, or does not meet the users' needs, over a product's life cycle, the Department may define an exact design solution with military specifications and standards, as last resort, with MDA-approved waiver.
    - The CAE, or designee, may grant waivers for military specifications or standards across all programs.
    - Waiver authorities may grant waivers for military specifications or standards for all or for a portion of the life of the system.
- Military specifications and standards contained in contracts and product configuration technical data packages for re-procurement of items already in inventory should comply with the following:
    - Be streamlined to remove non-value-added management, process, and oversight specifications and standards;
    - Be replaced by Single Process Initiatives to improve product affordability;
    - When justified as economically beneficial over the remaining product life cycle by a business case analysis, convert to performance-based acquisition and form, fit, function, and interface specifications to support programs in on-going procurement, future re-procurement, and post-production support.

1.9.2. Request for Proposal (RFP)

A Request for Proposal (RFP) is a solicitation used in negotiated acquisition to communicate government requirements to prospective contractors and to solicit proposals.

Federal Government RFP format and composition is mandated by the Federal Acquisition Regulation (FAR). They are typically broken down into sections that are identified by letter. Below is a list of what is typically in each section:

Section A. Information to Offerors or Quoters
Identifies the title of the procurement, procurement number, Point of Contact (POC), how to acknowledge amendments and how to indicate "No Response" if the potential contractor decides not to bid. Section A often appears as a one page form.

Section B. Supplies or Services and Price/Costs
This is where the potential contractor provides pricing. It defines the type of contract, identifies Contract Line Items (CLINs), and Subcontract Line Items (SLINs) that identify billable items, describes the period of performance, identifies option periods (if any), and provides cost and pricing guidelines. This section is often presented and responded to in tabular form.

Section C. Statement of Work (SOW)
Describes what the Government requires. Outside of pricing, most of the proposal will be responding to this section, describing how the contractor will deliver products and services.

Note that the term SOW is often used interchangeably with the Performance Work Statement (PWS). The PWS is a statement of work for performance-based acquisitions that describes the required results in clear, specific and objective terms with measurable outcomes. (FAR subpart 2.1). Also, a Statement of Objectives may be included. A SOO provides the basic, top level objectives of the acquisition, 'what they want.' and eliminates the 'how to' instructions to accomplish the required effort normally contained in the SOW the Government provides to prospective offerors. The SOO is provided in the RFP in lieu of a Government written SOW. This approach provides potential offerors the flexibility to develop cost effective solutions and the opportunity to propose innovative alternatives meeting the stated objectives. It also presents the Government with an opportunity to assess the offeror's understanding of all aspects of the effort to be performed. (MIL HDBK 245D which references FAR subpart 2.1)

Section D. Packages and Marking
Defines how all contract deliverables such as reports and material will be packaged and shipped. This information is important as these instructions may affect costs and raise logistics issues.

Section E. Inspection and Acceptance
Describes the process by which the Government will officially accept deliverables and what to do if the contractor work is not accepted.

Section F. Deliveries or Performance
Defines how the Government Contracting Officer will control the work performed and how the contractor will deliver certain contract items.

Section G. Contract Administrative Data
Describes how the Government Contracting Officer and the contractor will interact and how information will be exchanged in administration of the contract to ensure both performance and prompt payment.

Section H. Special Contract Requirements
Contains a range of special contract requirements important to this particular procurement, such as procedures for managing changes to the original terms of the contract, Government Furnished Equipment (GFE) requirements, and Government Furnished Property (GFP) requirements.

Section I. Contract Clauses/General Provisions
Identifies the contract clauses incorporated by reference in the RFP. These clauses will be incorporated into the contract. While it doesn't require a separate response, these terms will be binding.

Section J. Attachments, Exhibits
Lists the appendices to the RFP. These attachments can cover a wide range of subjects ranging from technical specifications through lists of GFE. It generally is used to provide data you need in order to respond to the Statement of Work.

Section K. Representations/Certifications and Statements of Offerors
Identifies what the potential contractor must certify to bid on this contract. Examples include certification of acting according to procurement integrity regulations, taxpayer identification, the status of personnel, ownership of the firm, type of business organization, authorized negotiators, qualification as a small business, disadvantaged business, and/or women owned business, etc.

Section L. Proposal Preparation Instructions and Other
Provides instructions for preparing the proposal. These include any formatting requirements, how the material should be organized / outlined, how to submit questions regarding the RFP or procurement, how the proposal is to be delivered, and sometimes notices, conditions, or other instructions.

Section M. Evaluation Criteria
Defines the factor, sub-factors, and elements used to "grade" the proposal. Proposals are graded and then cost is considered to determine who wins the award and gets the contract.

1.9.3. Contract Deliverables

A contract deliverable is anything that can be physically delivered, but may include non-manufactured things such as meeting minutes or reports. Data deliverables are reflected in the contract's Contract Data Requirements List (CDRL) and described via a Data Item Description (DID). A DID is a completed document that defines the data required of a contractor. The document specifically defines the data content, format, and intended use. Deliverables and reporting requirements are tailored to each acquisition. Examples of reports and other deliverables frequently seen in product support contracts are below:

- Technical progress reports—technical monitoring tools that provide summaries of technical information and progress on a contract;
- Invention reports—disclosure of inventions conceived or first reduced to practice through work under a contract;
- Federal financial reports—business monitoring tools that provide financial status of a contract; necessary for monitoring, avoiding, or anticipating cost overruns and enabling contracting officer's technical representatives to match costs incurred with technical progress;
- Data—deliverables identified in a contract that can include data files, computer programs, source codes, and any written documentation;
- Summary of salient results or outcomes —summary of results achieved during performance of a contract;

- Final report—includes specific work performed and results obtained for an entire contract period;
- Special reports— reports or analyses as required by a statement of work or a contracting officer's technical representative. These may include tables, text, graphs, and diagrams presented at meetings or professional conferences, and other special reports concerning study findings;
- Study status reports—site-specific performance reports including accrual and retention of study participants, timeliness of data submission, and adherence to protocol specifications;
- SOPs—standard operating procedures for actions relevant to contract performance, quality assurance, and quality control plans;
- Training resources —training materials used, developed, or maintained under a contract.

1.9.4. Incentives

Incentives are a method of motivating the contractor to achieve the desired behavior in terms of measurable performance outcomes. Contract incentives include award fee, incentive fee, award term, and cost sharing.

Sustainment contracts should produce measurable performance outcomes that cumulatively contribute to the sustainment of system KPP/KSAs, to their threshold or objective levels. To motivate the contractor to achieve the desired behavior, appropriate contract incentives (including award fee, incentive fee, award term, and cost sharing) need to be developed to promote and facilitate contractor performance.

Incentives are unique to every contract and should be tied to metrics tailored to reflect the DoD Component's specific definitions and reporting processes. Award and incentive contracts should include tailored cost reporting to enable appropriate contract management and to facilitate future cost estimating and price analysis.

Sustainment contracts should strive to specify a fixed cost per outcome (e.g., operating hour (e.g., hour, mile, cycle) or event (e.g., launch)) vice a cost plus contract. However, lack of data on systems performance or maintenance costs or other pricing risk factors may necessitate cost type contracts until sufficient data is collected to understand the risks. Full access to DoD demand data should be incorporated into any contracts.

1.9.5. Earned Value Management System (EVMS)

An Earned Value Management System (EVMS) supports program management by integrating the program work scope with cost and schedule elements for optimum planning and control. EVM policy applies to contracts with industry and to intra-government activities.

EVMS is used throughout the life cycle subject to certain thresholds. Upon award of contract, the EVM system is used by the contractor to plan and control contract work. The Government relies on the contractor’s system and should not impose duplicative systems. Contractors maintain and improve the system, coordinating changes with the customer. Refer to appropriate DFARS clauses for further guidance.

The Product Support Manager needs to be training in EVMS and have the knowledge and skills to review cost performance reports for work progress versus cost expenditures and schedule for all 12 IPS Elements in an outcome based environment.

The PM shall require contractors to use internal management control systems that accomplish the following guidelines:

- Produce data that indicate work progress;
- Properly relate cost, schedule, and technical accomplishment;
- Are valid, timely and able to be audited; and
- Provide DoD PMs with information at a practical level of summarization.
- Unless waived by the MDA, the PM shall require that contractor's management information systems used in planning and controlling contract performance meet the Earned Value Management Systems (EVMS) guidelines set forth in American National Standards Institute (ANSI)/EIA 748-98, Chapter 2 (reference (av)). (See Appendix 4.) This standard is available through the ANSI Electronic Standards Store located at http://www.ansi.org/public/std info.html.
- The PM shall not require a contractor to change its system provided it meets these guidelines, nor shall the PM impose a single system or specific method of management control;
- These guidelines shall not be used as a basis for reimbursing costs or making progress payments;
- The PM shall apply EVMS guidelines on applicable contracts within acquisition, upgrade, modification, or materiel maintenance programs, including highly sensitive classified programs, major construction programs, and other transaction agreements. EVMS guidelines shall apply to contracts executed with foreign governments, project work performed in Government facilities, and contracts by specialized organizations such as the Defense Advanced Research Projects Agency.

EVMS guidelines shall apply to research, development, test, and evaluation contracts, subcontracts, other transaction agreements, and intra-Government work agreements with a value of $73 million or more (in FY 2000 constant dollars), or procurement or operations and maintenance contracts, subcontracts, other transaction agreements, and intra-Government work agreements with a value of $315 million or more (in FY 2000 constant dollars). Use DFARS Clauses 252.234-7000 (reference (aw)) and 252.234-7001 (reference (ax)) to place EVMS requirements in solicitations and contracts.

The requirement for EVM applies to cost or incentive contracts, subcontracts, intra-government work agreements, and other agreements that meet the dollar thresholds prescribed in DoD Instruction 5000.02. The application thresholds (total contract value including planned options in then-year dollars) are summarized below:

- $20 million but less than $50 million EVM implementation compliant with the guidelines in ANSI/EIA-748 (available for purchase) is required. No formal Earned Value Management System (EVMS) validation is required;

- $50 million or greater EVM implementation compliant with the guidelines in ANSI/EIA-748 is required. An EVMS that has been formally validated and accepted by the cognizant contracting officer is required.

There are many criteria for using, or not using, EVMS systems. Reference to the Defense Acquisition Guidebook, chapter 11.3.1 is highly recommended.

At some level of detail appropriate for the degree of technical, schedule, and cost risk of a program, a target value (i.e., a budget) is established for each scheduled element of work. As these elements of work are completed, their target values are "earned". Work progress is quantified and the earned value is now a metric against which to measure what was spent to perform the work and what was scheduled to have been accomplished.

Schedule variances are isolated and quantified. Cost variances are true variances that are not distorted by schedule performance. Results are early identification of performance trends and variances from the management plan, allowing decision making while there is adequate time to implement corrective actions.

The Defense Acquisition University (DAU) identifies five independent Earned Value Management (EVM) variables: BCWS, BCWP, ACWP, BAC, and EAC. All earned value metrics are derived from these five variables. The chart in Figure 1 can be used to visually represent EAC and its relationship with the other independent variables and two key EVM metrics derived from these variables.

Under EVM industry standard ANSI/EIA-748**,** companies are expected to plan and organize their work efforts into small work packages, typically 30 to 60 days in duration. These work packages are related to each other by an Integrated Master Schedule (IMS). For each work package, the contractor determines a budgeted cost for completing that work and sets a date for starting and completing the work package.

When arrayed over the period of performance for the contract, the budgeted work packages combine to form a time-phased Performance Measurement Baseline (PMB) curve. As shown on the chart, at the end of the contract, the PMB terminates at the Budget at Completion. At any point in time during the period of performance of the contract, this curve represents the cumulative total of the Budgeted Cost for Work Scheduled (BCWS) for the contract.

A contractor will not budget the entire amount of the contract cost, or the Total Allocated Budget (TAB)**,** but will reserve some budget as Management Reserve for tasks that may need to be added later (i.e., realized risks/unknowns within the currently authorized specific scope of work in the contract). In other words, Management Reserve is not part of the PMB until it is used, and thereby, applied to the PMB. The principle of earned value is that at any time during the performance of the contract, say Time Now, the actual performance (of the contractor) can be compared to the plan (the Performance Measurement Baseline), and a conclusion drawn about the contractor's performance with respect to cost and schedule.

The contractor reports the budgeted cost for all work packages completed for the contract to time now. This is the cumulative Budgeted Cost for Work Performed (BCWP**),** or earned value. If the contractor has not completed all the scheduled work packages to time now, then the BCWP will be less than the BCWS, representing a "monetized" indication that the contractor is behind schedule, known as Schedule Variance (SV). It is important to understand that we cannot infer from EVM data alone the actual time that the contractor is behind schedule. We would have to use other analysis tools (e.g., network techniques such as Critical Path Method (CPM) in conjunction with the IMS to forecast when the contractor will be complete.

In addition to reporting the BCWP, the contractor also reports the cumulative Actual Cost of Work Performed (ACWP) for the work packages that have been completed. The difference between the BCWP and the ACWP is the Cost Variance (CV**).** If the actual costs at time now (i.e., ACWP) are higher than the earned value at time now (i.e., BCWP), we know that the contractor is currently over running cost and that the contractor's Estimate at Completion (EAC) may be higher than the BAC.

There are tools available that can be used to predict the Estimate at Completion (EAC) based upon the past history of contractor performance on the contract (e.g., cost and schedule efficiencies). These EAC predictions are very useful to a program manager assessing whether sufficient funds are available to cover the cost of the contract at completion.

See the DAU website at https://acc.dau.mil/CommunityBrowser.aspx?id=240347 for more information.

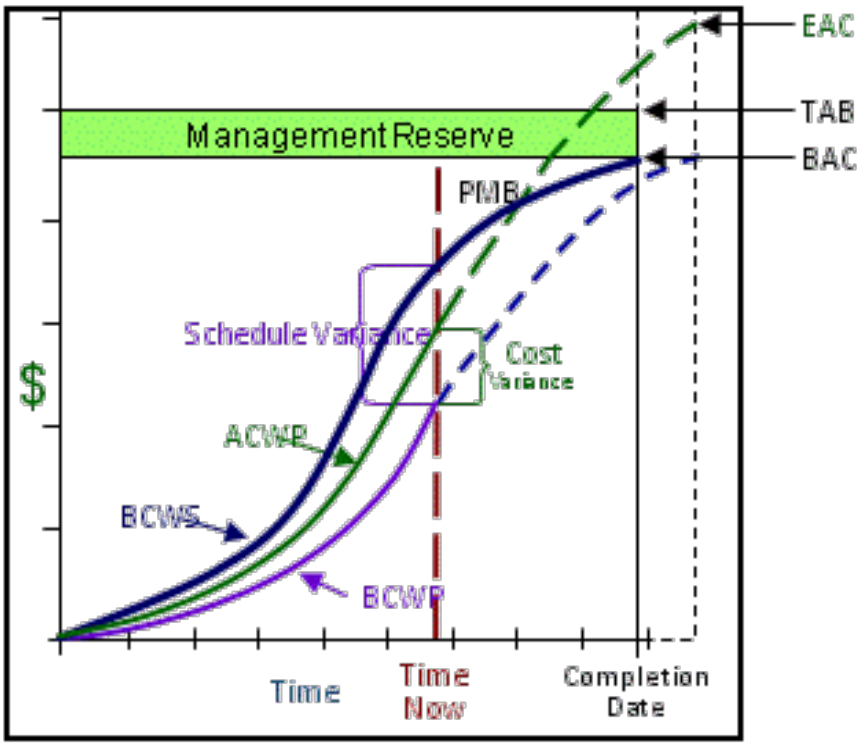


Figure 1.3.10.4.F1. Relationships of EVMS Metrics

VARIANCES

Favorable is Positive, Unfavorable is Negative

Cost Variance (CV)

CV = BCWP - ACWP

CV % = (CV / BCWP) * 100

Schedule Variance (SV)

SV = BCWP - BCWS

SV % = (SV / BCWS) * 100

Variance at Completion (VAC)

VAC = BAC – EAC

OVERALL STATUS

% Schedule = ($BCWS_{CUM}$ / $_{BAC}$) * 100

% Complete = ($BCWP_{CUM}$ / BAC) * 100

% Spent = ($ACWP_{CUM}$ / BAC) * 100

DoD TRIPWIRE METRICS

Favorable is > 1.0, Unfavorable is < 1.0

Cost Efficiency	CPI	=	BCWP / ACWP
Schedule Efficiency	SPI	=	BCWP / BCWS

The program manager should use Defense Federal Acquisition Regulation Supplement (DFARS) clauses 252.234-7001 and 252.234-7002 to place the Earned Value Management System (EVMS) requirement in solicitations and contracts. The EVMS FAR clauses will not be applied to DoD contracts. The DFARS clauses, which have been deemed "substantially the same" as the FAR clauses, will be used instead of the FAR clauses (see DFARS 234.203). See the EVM Contract Requirements Checklist found at http://www.acq.osd.mil/pm/.

The contract should not specify requirements in special provisions and/or statements of work that are not consistent with the EVM policy and EVMS guidelines (required by imposition of DFARS 252.234-7002). Consult the Defense Contract Management Agency (DCMA) for guidance on compliance of the contractor's EVMS. Their website is at http://www.dcma.mil/.

1.9.6. Warranties

A warranty is an express or implied promise from the seller that certain facts about the items or services being sold are true. It provides a buyer with legal assurance that the seller is providing an item or service that will perform as represented before the purchase transaction was complete. The concept of "warranty" also refers to certain promises, made by the Government, of future events or conditions (such as availability of a construction work site) needed for the supplier to perform the contract. There are two broad categories of warranties*:* express warranties and implied warranties. *A*ccording to the Uniform Commercial Code, "Any affirmation of fact or promise made by the seller to the buyer which relates to the goods and becomes part of the basis of the bargain creates an express warranty that the goods shall conform to the affirmation or promise." The other type of warranty is the implied warranty. This type of warranty revolves around the concepts of fitness for use and merchantability. Implied warranties become part of commercial contracts even though they are not written, unless specifically excluded.

Typically, warranties are on system or component reliability. The procedures for processing warranties should minimize impact on the user, particularly at the organizational level. Warranty provisions should enable the user to make warranty claims without delaying essential maintenance needed to restore system availability. For example, the Navy has in the past established warranties that allow Navy personnel to perform needed maintenance and then recover the cost incurred from the contractor.

1.9.7. Business Transparency

The word "transparent" can be used to describe high-quality information and business financial statements. The goal is to provide enough information to buyers and investors to allow for accountability and allow for monitoring of transactions.

1.10 Planning Management

DoD Directive 5000.01 requires programs to "implement performance-based logistic strategies that optimize total system availability while minimizing cost and logistics footprint". These strategies are articulated in the Life-Cycle Sustainment Plan (LCSP), documenting the Program Manager's plan for implementing and managing these strategies throughout the life of the program.

1.10.1 Integrated Product and Process Development (IPPD)

Integrated product and process development (IPPD) is a management process that integrates all activities from product concept through production/field support. It uses a multi-functional team to optimize the product and its manufacturing and sustainment processes simultaneously to meet cost and performance objectives. IPPD evolved from concurrent engineering and the philosophies of quality management. It is a system engineering process integrated with sound business practices and common sense decision making.

The PM should employ IPPD to the maximum extent practicable. IPPD considers and integrates program activities throughout the entire program life cycle, including systems management, development, manufacturing, testing, deployment, operations, support, training, and eventual disposal. Using IPPD, multi-disciplined IPTs shall simultaneously optimize the product, product manufacturing, and supportability to meet system cost and performance objectives.

Although there are common factors in all known successful IPPD implementations, IPPD has no single solution or implementation strategy. Its implementation is product and process dependent.

Basic elements of the iterative process are:

- Requirements;
- Disciplined Approach to include Tools, Teams and Development Processes;
- Product and Associated Processes;
- Customer.

The key tenets of IPPD as described in the "DoD Guide to IPPD", found at https://www.acquisition.gov/sevensteps/library/dod-guide-to-integrated.pdf, include:

- Customer focus;
- Concurrent development of products and processes;
- Early and continuous life cycle planning;
- Maximum flexibility to optimize contractor approaches;
- Robust design and improved process capability;
- Event-driven scheduling;
- Multi-disciplinary teamwork;
- Empowerment;
- Seamless management tools;
- Proactive identification and management of risk.

1.10.2 Overarching Integrated Product Team (OIPT)

OIPTs are not decision-making organizations. They are intended to provide a mechanism to coordinate and conduct staff preparation for DAE program decisions and to help execute those decisions. See OSD AT&L memo (Jul 11, 2011) at https://acc.dau.mil/adl/en-US/457957/file/58867/OIPT%20Roles%20memo_20%20Jul%2011.pdf.

All Acquisition Category (ACAT) ID and IAM programs will have an OIPT to provide assistance, oversight, and review as the program proceeds through its acquisition life cycle. An appropriate official within OSD, typically the Director, Portfolio Systems Acquisition, the Deputy Assistant Secretary of Defense (DASD) for Command, Control, Communications, Intelligence, Surveillance and Reconnaissance and Information Technology (C3ISR & IT) Acquisition, or the Director, Space and Intelligence Capabilities, will lead the OIPT for ACAT ID programs. The DASD(C3ISR and IT Acquisition) also leads the OIPT for ACAT IAM programs. The OIPT for ACAT IAM programs is called the NII OIPT. OIPTs should include the Program Manager, Program Executive Officer, DoD Component Staff, Joint Staff, and OSD staff involved in oversight and review of the particular ACAT ID or IAM program. Other OIPTs, such as Chem Bio, will be led by similar executives.

The OIPT should form upon departmental intention to start an acquisition program. The OIPT charters the IIPT and WIPT(s). The OIPT should consider the recommendations of the IIPT regarding the appropriate milestone for program initiation and the minimum information needed for the program initiation milestone review. OIPTs should meet thereafter, as necessary, over the life of the program. The OIPT leader should act to resolve issues when requested by any member of the OIPT, or when so directed by the Milestone Decision Authority. The goal is to resolve as many issues and concerns at the lowest level possible, and to expeditiously escalate issues that need resolution at a higher level. The OIPT should bring only the highest-level issues to the Milestone Decision Authority for decision.

1.10.3 Integrated Master Schedule (IMS)

The Integrated Master Schedule (IMS) is a time-based schedule containing the networked, detailed tasks necessary to ensure successful program/contract execution. The IMS is traceable to the integrated master plan, the contract Work Breakdown Structure, and the statement of work.

The IMS is used to verify attainability of contract objectives, to evaluate progress toward meeting program objectives, and to integrate the program schedule activities with all related components.

The program manager obtains an IMS on all cost or incentive contracts, subcontracts, intra-government work agreements, and other agreements valued at or greater than $20 million. The IMS is applicable to development, major modification, and low rate initial production efforts; it is not typically applied to full rate production efforts. It is also not normally required for contracts valued at less than $20 million, contracts less than 12 months in duration, or Firm-Fixed Price contracts for production efforts.

The DoD Earned Value Management Implementation Guide (EVMIG) discusses some circumstances where the IMS may be appropriate for contracts in these categories. Data Item Description DI-MGMT-81650 (current version at time of award) is used to obtain the IMS. The contracting officer and contractor should negotiate reporting provisions in the contract, including level of detail, submission dates, and frequency of the schedule risk analysis. The program manager should tailor the IMS to the minimum data necessary for effective management control on contracts valued at less than $50 million. See the DoD EVMIG for additional guidance on tailoring IMS reporting.

1.10.4 Decisions, Program Reviews and Independent Assessments

1.10.4.1 Program Decisions

The Defense Acquisition Management Framework provides an event-based process where acquisition programs proceed through a series of milestones associated with significant program phases. Details on the milestones and program phases are found in section 3 of the DoDI 5000.02 instruction. The instruction also identifies the specific statutory and regulatory reports and other information requirements for each milestone and decision point. Program decisions occur regularly throughout the acquisition cycle and are formalized during specific reviews and assessments.

1.10.4.1.1 Milestone Decisions

Milestone Decision Reviews authorize entry into a new program acquisition phase.

The Defense Acquisition Management System is an event-based process. DoD Instruction 5000.02, Operation of the Defense Acquisition System, establishes the management framework that implements these policies and principles. Acquisition programs proceed through a series of milestone reviews and other decision points that may authorize entry into a significant new program phase. Details of the reviews, decision points, and program phases are found beginning with in paragraph 3 of Enclosure 2 of the Instruction. The Instruction also identifies the specific statutory and regulatory information requirements for each milestone and decision point.

The DAU website, https://dag.dau.mil/Pages/Default.aspx, contains a listing of each deliverable for each Milestone Decision Review and a discussion of what are The Product Support Manager responsibilities for each deliverable.

1.10.4.1.2 Exit Criteria

"Milestone decision authorities use exit criteria to establish goals for an acquisition program during a particular phase. Exit criteria are phase-specific tasks selected to track progress in important technical, schedule, or risk management areas. They act as "gates," which when successfully passed, demonstrate that the program is on track to achieve its final goals. Examples of appropriate exit criteria are achieving a level of performance (e.g., engine thrust, or missile range) or successful accomplishment of a task (e.g., first flight). Exit criteria are documented in the Acquisition Decision Memorandum issued by the MDA upon completion of a milestone review. (Intro. Def. Acq. Mgmt)

At each milestone decision point and at each decision review, the program manager, in collaboration with the IPT, will develop and propose exit criteria appropriate to the next phase or effort of the program. The OIPT will review the proposed exit criteria and make a recommendation to the Milestone Decision Authority. Exit criteria approved by the Milestone Decision Authority will be published in the ADM. (DAG)

1.10.4.2 Executive Reviews

Executive reviews are DoD assessment reviews associated with major decision points as listed below.

1.10.4.2.1 Defense Acquisition Board (DAB)

The DAB is the Department's senior-level forum for advising the Under Secretary of Defense (Acquisition, Technology and Logistics) (USD(AT&L)) on critical decisions concerning Acquisition Category (ACAT) ID programs, and selected ACAT IAM programs that meet major defense acquisition program dollar thresholds. The DAB is composed of the Department's senior executives. The Board is chaired by the USD(AT&L). Other executive members of the Board include:

- Vice Chairman, Joint Chiefs of Staff;
- Under Secretary of Defense (Comptroller) (USD(C));
- Under Secretary of Defense (Policy) (USD(P);
- Under Secretary of Defense (Personnel and Readiness (USD(P&R));
- Assistant Secretary of Defense for Networks and Information Integration (ASD(NII));
- Director of Operational Test and Evaluation (DOT&E);
- Director, Cost Assessment and Program Evaluation (also executive secretary);
- Secretary of the Army;
- Secretary of the Navy;
- Secretary of the Air Force.

1.10.4.2.2 Information Technology Acquisition Board (ITAB)

The ITAB is the Office of the Secretary of Defense (OSD) oversight and review body for Major Automated Information System (MAIS) (Acquisition Category (ACAT) IA) acquisition programs. The ITAB performs review function for MAIS programs in support of the Under Secretary of Defense (Acquisition, Technology and Logistics)(USD(AT&L) similar to that performed by the Defense Acquisition Board (DAB) for Major Defense Acquisition Programs

(MDAPs). May be delegated to the Assistant Secretary of Defense (Networks and Information Integration) (ASD(NII)) or other designee by the USD(AT&L).

1.10.4.2.3 Joint Requirements Oversight Council (JROC)

The Joint Requirements Oversight Council (JROC) is an advisory council to the Chairman of the Joint Chiefs of Staff with the responsibility to: identify and assess the priority of joint military requirements; consider alternatives to acquisition programs; and assign priority among military programs, ensuring priorities reflect resource levels.

1.10.4.2.4 Program Support Reviews

Program Support Reviews (PSRs) are a means to inform an MDA and Program Office of the status of technical planning and management processes by identifying cost, schedule, and performance risks and the recommendations to mitigate those risks.

1.10.4.2.5 Independent Program Management Reviews (PMR)

A PMR is regularly conducted at defined intervals (monthly or quarterly) by the Program Manager for the purpose of determining the status of an assigned system.

1.10.4.2.6 DoD Component Program Technical Reviews

Technical reviews of program progress shall be event-driven and conducted when the system under development meets the review entrance criteria as documented in the SEP. They shall include participation by subject matter experts who are independent of the program (i.e., peer review), unless specifically waived by the SEP approval authority as documented in the SEP.

1.10.4.2.6.1 Initial Technical Review (ITR)

The ITR is a multi-disciplined technical review to support a program's initial Program Objective Memorandum submission. This review ensures a program's technical baseline is sufficiently rigorous to support a valid cost estimate (with acceptable cost risk) and enable an independent assessment of that estimate by cost, technical, and program management subject matter experts (SMEs). The ITR assesses the capability needs and Materiel solution approach of a proposed program and verifies that the requisite research, development, test and evaluation, engineering, logistics, and programmatic bases for the program reflect the complete spectrum of technical challenges and risks. Additionally, the ITR ensures the historical and prospective drivers of system life-cycle cost have been quantified to the maximum extent and that the range of uncertainty in these parameters has been captured and reflected in the program cost estimates.

1.10.4.2.6.2 Alternative Systems Review

The ASR is a multi-disciplined technical review to ensure the resulting set of requirements agrees with the customers' needs and expectations and the system under review can proceed into the Technology Development phase. The ASR should be completed prior to, and provide information for Milestone A. Generally, this review assesses the preliminary materiel solutions that have been evaluated during the Materiel Solution Analysis phase, and ensures that the one or more proposed materiel solution(s) have the best potential to be cost effective, affordable, operationally effective and suitable, and can be developed to provide a timely solution to a need at an acceptable level of risk. Of critical importance to this review is the understanding of available system concepts to meet the capabilities described in the Initial Capabilities Document

(ICD) and to meet the affordability, operational effectiveness, technology risk, and suitability goals inherent in each alternative concept.

1.10.4.2.6.3 System Requirements Review (SRR)

The SRR is a multi-disciplined technical review to ensure that the system under review can proceed into initial systems development, and that all system requirements and performance requirements derived from the Initial Capabilities Document or draft Capability Development Document are defined and testable, and are consistent with cost, schedule, risk, technology readiness, and other system constraints. Generally this review assesses the system requirements as captured in the system specification, and ensures that the system requirements are consistent with the approved materiel solution (including its support concept) as well as available technologies resulting from the prototyping effort. Of critical importance to this review is an understanding of the program technical risk inherent in the system specification and in the Engineering and Manufacturing Development (EMD) phase Systems Engineering Plan (SEP). Determining an acceptable level of risk is essential to a successful review.

1.10.4.2.6.4 Technology Readiness Assessment (TRA)

Per DoD Instruction 5000.02, Enclosure 4 the TRA is a regulatory information requirement for all acquisition programs. The TRA is a systematic, metrics-based process that assesses the maturity of critical technology elements (CTEs), including sustainment drivers. The TRA should be conducted concurrently with other Technical Reviews, specifically the Alternative Systems Review (ASR), System Requirements Review (SRR), or the Production Readiness Review (PRR). If a platform or system depends on specific technologies to meet system operational threshold requirements in development, production, or operation, and if the technology or its application is either new or novel, then that technology is considered a CTE. The TRA should be considered not as a risk assessment, but as a tool for assessing program risk and the adequacy of technology maturation planning. The TRA scores the current readiness level of selected system elements, using defined Technology Readiness Levels (TRLs). The TRA highlights critical technologies (including critical manufacturing-related technologies) and other potential technology risk areas that require program manager attention. The TRA essentially "draws a line in the sand" on the day of the event for making an assessment of technology readiness for critical technologies integrated at some elemental level.

1.10.4.2.6.5 Integrated Baseline Review (IBR)

An Integrated Baseline Review (IBR) is a joint assessment conducted by the government program manager and the contractor to establish the Performance Measurement Baseline (PMB). The IBR is not a one-time event. IBRs should be scheduled as early as practicable and the timing of the IBRs should take into consideration the contract period of performance. The process should be initiated not later than 180 calendar days (6 months) after: (1) contract award, (2) the exercise of significant contract options, and (3) the incorporation of major modifications.

1.10.4.2.6.6 System Functional Review (SFR)

The SFR is a multi-disciplined technical review to ensure that the system's functional baseline is established and has a reasonable expectation of satisfying the requirements of the Initial Capabilities Document or draft Capability Development Document within the currently allocated budget and schedule. It completes the process of defining the items or elements below system

level. This review assesses the decomposition of the system specification to system functional specifications, ideally derived from use case analysis. A critical component of this review is the development of representative operational use cases for the system. System performance and the anticipated functional requirements for operations maintenance, and sustainment are assigned to sub-systems, hardware, software, or support after detailed analysis of the architecture and the environment in which it will be employed. The SFR determines whether the system's functional definition is fully decomposed to its lower level, and that Integrated Product Teams (IPTs) are prepared to start preliminary design.

1.10.4.2.6.7 Preliminary Design Review (PDR)

The PDR is a technical assessment establishing the physically allocated baseline to ensure that the system under review has a reasonable expectation of being judged operationally effective and suitable. This review assesses the allocated design documented in subsystem product specifications for each configuration item in the system and ensures that each function, in the functional baseline, has been allocated to one or more system configuration items. The PDR establishes the allocated baseline (hardware, software, human/support systems) and underlying architectures to ensure that the system under review has a reasonable expectation of satisfying the requirements within the currently allocated budget and schedule.

1.10.4.2.6.8 Critical Design Review (CDR)

The CDR is a key point within the Engineering and Manufacturing Development (EMD) phase. The CDR is a multi-disciplined technical review establishing the initial product baseline to ensure that the system under review has a reasonable expectation of satisfying the requirements of the Capability Development Document within the currently allocated budget and schedule. Incremental CDRs are held for each Configuration Item culminating with a system level CDR. This review assesses the final design as captured in product specifications for each Configuration Item in the system and ensures that each product specification has been captured in detailed design documentation. Configuration Items may consist of hardware and software elements, and include items such as airframe/hull, avionics, weapons, crew systems, engines, trainers/training, support equipment, etc. Product specifications for hardware enable the fabrication of configuration items, and include production drawings. Product specifications for software enable coding of the Computer Software Configuration Item. The CDR evaluates the proposed Baseline ("Build To" documentation) to determine if the system design documentation (Initial Product Baseline, including Item Detail Specs, Material Specs, Process Specs) is satisfactory to start initial manufacturing.

1.10.4.2.6.9 Test Readiness Review (TRR)

The TRR is a multi-disciplined technical review designed to ensure that the subsystem or system under review is ready to proceed into formal test. The TRR assesses test objectives, test methods and procedures, scope of tests, and safety and confirms that required test resources have been properly identified and coordinated to support planned tests. The TRR verifies the traceability of planned tests to program requirements and user needs. It determines the completeness of test procedures and their compliance with test plans and descriptions. The TRR also assesses the system under review for development maturity, cost/ schedule effectiveness, and risk to determine readiness to proceed to formal testing. In addition to adequate planning and

management, to be effective the program manager should follow-up with the outcomes of the TRR.

1.10.4.2.6.10 Flight Readiness Review (FRR)

The FRR is a sub-set of the Test Readiness Review, and is applicable only to aviation programs. It assesses the readiness to initiate and conduct flight tests or flight operations. Typically, FRR approval requires the aviation system to be under configuration management, a flight clearance issued by the technical authority, the flight test plan(s) approved, and discrepancy tracking and risk assessment processes in place.

The FRR risk assessment checklist is designed as a technical review preparation tool, and should be used as the primary guide for assessing risk during the review. This checklist is available on the Systems Engineering Community of Practice.

1.10.4.2.6.11 System Verification Review (SVR)

The SVR is a multi-disciplined product and process assessment to ensure the system under review can proceed into Low-Rate Initial Production and full-rate production within cost (program budget), schedule (program schedule), risk, and other system constraints. Generally this review is an audit trail from the System Functional Review. It assesses the system functionality, and determines if it meets the functional requirements (derived from the Capability Development Document and draft Capability Production Document) documented in the functional baseline. The SVR establishes and verifies final product performance. It provides inputs to the Capability Production Document. The SVR is often conducted concurrently with the Production Readiness Review.

1.10.4.2.6.12 Functional Configuration Audit (FCA)

A FCA may also be conducted concurrently with the System Verification Review. The FCA is the formal examination of the as tested characteristics of a configuration item (hardware and software) with the objective of verifying that actual performance complies with design and interface requirements in the functional baseline. It is essentially a review of the configuration item's test/analysis data, including software unit test results, to validate the intended function or performance stated in its specification is met. For the overall system, this would be the system performance specification. For large systems, audits may be conducted on lower level configuration items for specific functional areas and address non-adjudicated discrepancies as part of the FCA for the entire system. A successful FCA typically demonstrates that Engineering and Manufacturing Development product is sufficiently mature for entrance into Low-Rate Initial Production.

1.10.4.2.6.13 Production Readiness Review (PRR)

The PRR examines a program to determine if the design is ready for production and if the prime contractor and major subcontractors have accomplished adequate production planning without incurring unacceptable risks that will breach thresholds of schedule, performance, cost, or other established criteria. The review examines risk; it determines if production or production preparations identify unacceptable risks that might breach thresholds of schedule, performance, cost, or other established criteria. The review evaluates the full, production-configured system to determine if it correctly and completely implements all system requirements. The review

determines whether the traceability of final system requirements to the final production system is maintained.

1.10.4.2.6.14 Operational Test Readiness Review

The OTRR is a multi-disciplined product and process assessment to ensure that the production configuration system can proceed into Initial Operational Test and Evaluation (IOT&E) with a high probability of success. More than one OTRR may be conducted prior to IOT&E.

1.10.4.2.6.15 Physical Configuration Audit (PCA)

A Physical Configuration Audit (PCA) is used to examine the actual configuration of the CI that is representative of the product configuration in order to verify that the related design documentation matches the design of the deliverable CI. In performance based acquisition environment, the PCA addresses the accuracy of the documentation reflecting the production design. It is also used to validate many of the supporting processes that the contractor uses in the production of the CI. The PCA is also used to verify that any elements of the CI that were redesigned after the completion of the FCA also meet the requirements of the CI's performance specification. In cases where the Government does not plan to control the detail design, it is still essential that the contractor conduct an internal PCA to define the starting point for controlling the production design and to establish a product baseline.

1.10.4.2.6.16 In-Service Review (ISR)

An ISR is a formal review conducted to verify that is to characterize in-service technical and operational health of the deployed system by providing an assessment of risk, readiness, technical status, and trends, in a measurable form that will substantiate in-service support and budget priorities.

1.10.4.3 Independent Assessments (IAs)

Assessments, independent of the developer and the user, provide a different perspective of program status. However, requirements for independent assessments (for example, Program Support Reviews, Assessments of Operational Test Readiness, the independent cost estimate, or technology readiness assessment) must be consistent with statutory requirements, policy, and good management practice. Senior acquisition officials should consider these assessments when making acquisition decisions. Staff offices that provide independent assessments should support the orderly and timely progression of programs through the acquisition process. IPT access to independent assessments, to provide unbiased program perspectives, facilitates full and open discussion of issues.

1.10.4.3.1 Independent Cost Estimate (ICE)

Section 101 of Public Law 111-23, "Weapon Systems Acquisition Reform Act of 2009", May 22, 2009, requires the Director, Cost Assessment and Program Evaluation (DCAPE) to conduct independent cost estimates (ICEs) on Major Defense Acquisition Programs (MDAPs) for which the USD(AT&L) is the MDA, and also, in certain circumstances, for Major Automated Information Systems (MAIS) programs. The statute also requires DCAPE to review DoD Component cost estimates and cost analyses conducted in connection with Major Defense Acquisition Programs (MDAPS). Additionally, DCAPE is required to provide policies and

procedures for the conduct of all DoD cost estimates (and issues guidance relating to the full consideration of life-cycle management and sustainability costs).

1.10.4.3.2 Technology Maturity and Technology Readiness Assessment

Technology maturity is a measure of the degree to which proposed critical technology elements (CTEs) meet program objectives; and, is a principal element of program risk. A technology readiness assessment examines program concepts, technology requirements, and demonstrated technology capabilities in order to determine technological maturity. The program manager should identify critical technologies, using tools such as the Work Breakdown Structure. In order to provide useful technology maturity information to the acquisition review process, technology readiness assessments of CTEs and identification of critical program information (CPI) must be completed prior to Milestone Decision points B and C. P.L. 111-23, the Weapon Systems Acquisition Reform Act of 2009, requires the Director of Defense Research and Engineering (DDR&E) to develop knowledge-based standards against which to measure the technological maturity and integration risk of critical technologies at key stages in the acquisition process for the purpose of conducting the required reviews and assessments of MDAPs.

1.10.4.3.3 Post-Preliminary Design Review (Post-PDR) Assessment

PDR planning is reflected in the Acquisition Strategy and conducted consistent with the policies for the TD phase PDR. Following PDR, the PM submits a PDR report and the MDA conducts a formal Post-PDR Assessment. The PDR report reflects any requirements trades based upon the PM's assessment of cost, schedule, and performance risk. The MDA will consider the results of the PDR and the PM's assessment, and determine whether remedial action is necessary to achieve APB objectives. The results of the MDA's Post-PDR Assessment are documented in an ADM.

1.10.4.3.4 Post-Critical Design Review (Post-CDR) Assessment

The Post-CDR Assessment has been rescinded and is no longer required. Per USD(AT&L) memo, Feb 24, 2011, "Expected Business Practice: Post-Critical Design Review Reports and Assessments", the Office of the Deputy Assistant Secretary of Defense (Systems Engineering) (DASD(SE)) will participate in program CDRs and prepare a brief assessment of the program's design maturity and technical risks which may require Milestone Decision Authority (MDA) attention. Consequently, PMs of Major Defense Acquisition Programs shall be required to invite DASD(SE) engineers to their system-level CDRs and make available CDR artifacts. The draft CDR assessments will be coordinated with the PM prior to forwarding to the MDA. PMs shall continue to document CDRs in accordance with component best practices.

1.10.4.3.5 Post-Implementation Review

DoD Instruction 5000.02 requires that PIRs be conducted for MAIS and MDAP programs in order to collect and report outcome-based performance information.

1.10.4.3.6 Logistics Assessment

A Logistics Assessment (LA) is an analysis of a program's supportability planning. Preferably, it is conducted by an independent and impartial team of Subject Matter Experts (SMEs) not directly associated with the program being assessed. An LA is not a compliance audit, but an effective and valid assessment of the program office's product support strategy, as well as an

assessment of how this strategy leads to successfully operating a system at an affordable cost. As part of the LA, statutory, regulatory, and Component required documentation is reviewed and assessed for completeness and compliance prior to the milestone decision. The focus is on whether the program planning and methodology has a basis and can be successfully executed. Conducting the LA early in the program phase where the design can be influenced, and re-assessing the planning at each milestone and periodically thereafter as the design matures, is critical to fielding a sustainable system. It also provides senior decision makers critical information for making strategic trades within and across various programs, especially as today's Acquisition Category (ACAT) programs are becoming increasingly complex and integrated with other systems. Additional information on Logistics Assessments is also available in the CLL020 Independent Logistics Assessment continuous learning module and LOG 350 Enterprise Life Cycle Logistics Management course.

1.11 Configuration Management

Configuration Management is critical to Weapon System Life Cycle management it is a pre-requisite for systems engineering, product support (all elements depend on effective configuration management), operations, program management, T&E, all basic design activities, it is even instrumental in financial compliance due to the ability to trace needs to investments to capability. A product is something used or produced to satisfy a need; materiel or non-materiel (documents, facilities, firmware, hardware, processes, services, materials, software, systems).

Configuration management embodies two concepts: (1) the configuration management of items and their defining technical requirements and design documents, referred to herein as configuration documentation; and (2) the application of CM principles to digital data in general.

Configuration Management is defined as a process for establishing a product's functional (requirements), performance (test/readiness), and physical (design) attributes and maintaining the relationships between these elements at all times throughout the life cycle. Figure 1.3.19.F1 is a top-level activity model depicting the CM process showing:

- Inputs - Information needed to initiate and perform the process;
- Constraints - Factors or information that inhibits or puts limitations on the process;
- Mechanisms/Facilitators - Information, tools, methods, and technologies which enable or enhance the process;
- Outputs - Results that derive from the process or information that is provided by the process.

Configuration management is the application of sound program practices to establish and maintain consistency of a product's or system's attributes with its requirements and evolving technical baseline over its life. It involves interaction among government and contractor program functions such as systems engineering, hardware/software engineering, specialty engineering, logistics, contracting, and production in an Integrated Product Team environment. The program manager/PSM should use configuration management to establish and mature the technical baseline throughout the acquisition life cycle.

Programs should understand that the content of the R&M artifacts need to be consistent with the level of design knowledge that makes up each technical baseline.

• R&M Allocations – R&M requirements assigned to individual items to attain desired system level performance. Preliminary allocations are expected by SFR with final allocations completed by PDR.
• R&M Block Diagrams – The R&M block diagrams and math models prepared to reflect the equipment/system configuration. Preliminary block diagrams are expected by SFR with the final completed by PDR.
• R&M Predictions – The R&M predictions provide an evaluation of the proposed design or for comparison of alternative designs. Preliminary predictions are expected by PDR with the final by CDR.
•Failure Definition and Scoring Criteria – Failure definitions and scoring criteria to make assessments of R&M contract requirements.
• FMECA – Analyses performed to assess the severity of the effects of component/subsystem failures on system performance. Preliminary analyses are expected by PDR with the final by CDR.
• Maintainability and Built-In Test – Assessment of the quantitative and qualitative maintainability and Built-In test characteristics of the design.
• Reliability Growth Testing at the System and Subsystem Level – Reliability testing of development systems to identify failure modes, which if uncorrected could cause the equipment to exhibit unacceptable levels of reliability performance during operational usage.
• FRACAS – Engineering activity during development, production, and sustainment to provide management visibility and control for R&M improvement of hardware and associated software by timely and disciplined.

Government configuration control actually begins when the system is Type Classified Standard and further changes are approved by a PM led configuration control board.

DoD Instruction 5000.02, Enclosure 12, paragraph 5, directs the use of configuration management across the total system life cycle per the following extract:

The PM/PSM shall use a configuration management approach to establish and control product attributes and the technical baseline across the total system life cycle. This approach shall identify, document, audit, and control the functional and physical characteristics of the system design; track any changes; provide an audit trail of program design decisions and design modifications; and be integrated with the SEP and technical planning. At completion of the system level Critical Design Review, the PM/PSM shall assume control of the initial product baseline for all Class 1 configuration changes.

It is important for the PM/PSM to understand the differences between the two types of Engineering Change Proposal (ECP) classes. ECPs are identified as Class I or Class II.

Class I changes require government approval before changing the configuration. These changes can result from problems with the baseline requirement, safety, interfaces, operating/servicing capability, preset adjustments, human interface including skill level, or training. Class I changes can also be used to upgrade already delivered systems to the new configuration through use of retrofit, mod kits, and the like. Class I ECPs are also used to change contractual provisions that do not directly impact the configuration baseline; for example, changes affecting cost,

warranties, deliveries, or data requirements. Class I ECPs require program office approval, which is usually handled through a formal Configuration Control Board, chaired by the government program manager or delegated representative.

Class II changes correct minor conflicts, typos, and other "housekeeping" changes that basically correct the documentation to reflect the current configuration. Class II applies only if the configuration is “form, fit, and function” and not changed when the documentation is changed. Class II ECPs are usually handled by the in-plant government representative. Class II ECPs normally require only government concurrence to ensure the change is properly classified. Under an initiative by the Defense Contract Management Command (DCMC), contractors are increasingly delegated the authority to make ECP classification decisions.

The Product Support Manager should thoroughly review MIL-HDBK 61B, Configuration Management Guidance, for further direction and technical insight. This reference contains helpful templates for specific CM activities by Acquisition Phase (as of Feb 2001).

1.11.1 **Configuration Identification and Baseline Management**

The technical baseline includes user requirements, program and product information and related documentation for all configuration items (i.e., those system elements under configuration management). Configuration items can consist of the integrated master schedule, system requirements, specifications, hardware, software, and documentation (data). A configuration management process guides the system products, processes, and related documentation, and facilitates the development of open systems. Configuration management efforts result in a complete audit trail of requirements, plans, decisions, verifications, capability, and modifications.

Configuration identification is the process for establishing levels or boundaries for managing as independent entities, typically if there is a performance specification or detailed specification associated the product is identified as a configuration item. This process ensures a unique identifier is provided in which functional, performance, and design attributes can be assigned allowing for management of relationships between these attributes, the documentation that represents these attributes, and other configuration items.

Good configuration control procedures assure the continuous integrity of the configuration identification. The configuration identification process includes:

- Selecting configuration items at appropriate levels to facilitate: safety, system verification and life cycle support.
- Determining the types of configuration documentation required for each CI to define its performance, functional and physical attributes, including internal and external interfaces. Configuration documentation provides the basis to develop and procure software /parts/material, fabricate and assemble parts, inspect and test items, and maintain systems;
- Determining the appropriate configuration control authority for each configuration document consistent with product support planning for the associated CI;
- Issuing identifiers for the CIs and the configuration documentation;

- Maintaining the configuration identification of CIs to facilitate effective product support of items in service and effective management of the performance envelope of items in service;
- Releasing configuration documentation; and
- Establishing configuration baselines for the configuration control of CIs.

Effective configuration identification is a pre-requisite for the other configuration management activities (configuration control, status accounting, audit), which all use the products of configuration identification. If CIs and their associated configuration documentation are not properly identified, it is impossible to: (1) manage a systems performance envelope; (2) perform root cause analysis; (3) assess the impact of recommended changes to performance envelope inclusive of support profile; (4) validate achievement of functional requirements; and (5) validate physical item that achieved functional performance is what is documented. Inaccurate or incomplete configuration documentation may result in mishaps, degraded safety, degraded performance, defective products, schedule delays, and higher maintenance costs after delivery.

The basic principles of configuration identification are articulated in EIA Standard 649. It cites the following purposes and benefits of configuration identification:

- Determines the structure (hierarchy) of a product and the organization and relationships of its technical documentation and product information;
- Documents the performance, interface, and other attributes of a product;
- Determines the appropriate level of identification marking of product and documentation;
- Provides unique identity to a product or to a component part of a product;
- Provides unique identity to the technical documents describing a product;
- Modifies identification of product and documents to reflect incorporation of major changes;
- Maintains release control of documents for baseline management;
- Enables a user or a service person to distinguish between product versions;
- Enables a user or a service person to correlate a product to related operational or maintenance instructions;
- Facilitates management of information including that in digital format;
- Correlates individual product units to warranties and service life obligations;
- Enables correlation of document revision level to product version/configuration;
- Provides a reference point for defining changes and corrective actions.

The basic principles guide effective configuration identification practices by both Government and industry. They are independent of specific methods of acquisition practice. A particular method of acquisition practice, such as “Performance based acquisition,” influences the types of Government controlled documents selected to define systems or configuration items and the delegation of responsibilities for approving changes to specifications and detailed design documentation. It also offers contractors flexibility in choosing the methods of design definition.

However, it does not alter the necessity for both Government (the acquiring activity) and Contractors (the performing activity) to implement practices that employ the basic configuration identification principles.

The single process initiative enables a contractor to employ a common set of practices to all products and services they provide to the Government from a given facility. The Government's contractual requirements must respect the contractor's common process in order to realize significant acquisition cost savings. A "block change methodology" may be employed to transition from individual contract-based processes to a common set of practices.

The government should ensure the contractor practices principles of EIA 649 or MIL-HDBK-61, this includes imposing these practices on their lower tier suppliers. The government can use this as part of their source selection criteria and perform an assessment of the contractors CM program. This is highly recommended in a performance based acquisition environment.

1.11.2 Configuration Control

Configuration control is a systematic process that ensures that changes to released configuration documentation are properly identified, documented, evaluated for impact, approved by an appropriate level of authority, incorporated, and verified.

1.11.2.1 Configuration Control Board (CCB)

A configuration control board is composed of technical and administrative representatives who recommend approval or disapproval of proposed engineering changes to, and proposed deviations from, a CI's current approved configuration documentation.

1.11.2.2 Engineering Change Proposal (ECP)

The documentation by which a proposed engineering change is described, justified, and submitted to (a) the current document change authority for approval or disapproval of the design change in the documentation and (b) to the procuring activity for approval or disapproval of implementing the design change in units to be delivered or retrofit into assets already delivered.

NAVAIR uses Technical Directives to manage engineering changes. Per NAVAIR SWP6852-002, "Technical Directives System Process", 31 Aug 2010, Technical Directives are documents issued by Naval Air Systems Command (NAVAIRSYSCOM) to provide technical information necessary to properly and systematically inspect or alter the configuration of aircraft, engines, systems, weapons, or equipment. Engineering Changes (ECs) and one-time inspections are the methods used to sustain or improve safety and/or efficiency of aviation systems. Engineering changes are used to affect configuration changes that correct deficiencies, enhance safety, reduce life cycle costs, prevent production delays, and/or improve operational capabilities or material readiness. One-time inspections are used to verify existence of reported conditions and to initiate appropriate corrective maintenance actions.

1.11.2.3 Value Engineering Change Proposal (VECP)

A proposal submitted by a contractor under the Value Engineering (VE) provisions of the Federal Acquisition Regulation that, through a change in the contract, would lower the project's life-cycle cost to DoD.

1.11.3 Configuration Status Accounting

The configuration management activity concerning capture and storage of, and access to, configuration information needed to manage products and product information effectively.

1.11.4 Configuration Verification and Audit

Configuration Verification and Audit includes 1) configuration verification of the initial configuration of a CI, and the incorporation of approved engineering changes, to assure that the CI meets its required performance and documented configuration requirements; 2) validation that a development program has achieved its performance requirements and configuration documentation or the system/CI being audited is consistent with the product meeting the requirements.

1.12 Quality

The systematic monitoring and evaluation of the various aspects of a project, service or facility to maximize the probability that minimum standards of quality are being attained by the production process. QA cannot absolutely guarantee the production of quality products. GAO report, 10-49, "DoD Can Achieve Better Outcomes by Standardizing the Way Manufacturing Risks Are Managed", http://www.gao.gov/new.items/d10439.pdf, provides an excellent breakout of risk and quality assessment using MRL's and TRL's in Appendix III. The PSM and Life Cycle Logistician is also referred to the Defense Acquisition Guidebook (DAG), Sections 4.4.14, 5.1.6, 11.3.3 and others for additional guidance.

1.12.2 Quality in Contracting

Government Contract Quality Assurance (GCQA) is a joint responsibility between the program office and Defense Contract Management Agency (DCMA). Interdisciplinary skills (such as quality assurance, industrial specialist, engineering, and software) are needed. The program manager should establish open and effective communication with DCMA. DCMA uses Contract Data Package Recommendation/Deficiency Reports (DD Form 1716) for the following:

- To improve contract data packages;
- When essential information is required as a basis for inspection/acceptance or shipment is incorrect, incomplete, unclear or unavailable; or
- When there is a conflict, ambiguity, noncompliance or other problem area between the contractor and Government concerning contractual requirements.

The DD Form 1716 is an important avenue of communication for DCMA to resolve contractual issues with the Procuring Activity and to understand and meet expectations and needs of their customers. For item-managed contracts, Defense Logistics Agency ICPs issue Quality Assurance Letters of Instruction to DCMA to provide additional contractor past performance history and to request tailored or specialized surveillances during contract performance.

1.12.3 Quality in Design and Materiel Quality

Design engineering efforts that lead to a producible and testable product. Quality in design via design maturity and producibility is measured and assessed using the Technology Readiness Levels (TRLs) and Manufacturing Readiness Levels (MRLs).

Per joint regulation DLAR 4155.24, "Product Quality Deficiency Report Program", there shall be a cross-Component system that will feed back quality data to activities responsible for design, development, purchasing, production, supply, maintenance, contract administration, and other functions so that action can be initiated to correct and prevent product quality deficiencies.

Quality deficiency data will be reported across Component lines in a timely manner to ensure prompt determination of cause, corrective action, and prevention of recurring deficiencies are initiated.

Components will assure, as applicable, that contract clauses or quality assurance provisions are incorporated into contracts that provide for contractor and subcontractor participation in the deficiency reporting and investigation program.

Components will assure that all product quality deficiencies subject to the provisions of this regulation are reported. This includes deficiencies which may occur in major weapon systems, Government-owned products used during development/test, items supplied as Government-furnished property (GFP), or deficiencies in any other items not specifically excluded by paragraph ID, above.

Exceptions to the use of this reporting system shall be submitted through the respective Component headquarters. Agreement from all affected Components is necessary before approval is granted for any requested exception.

Submission of Product Quality Deficiency Reports (PQDRs) may also require reporting of quality deficient stock(s) under materiel returns or warranty programs for credit to be given. Submitters should check their applicable Service/Agency regulations and enclosure 2, paragraph III, for guidance.

Alternate material quality measures addressing manufacturing risks include using the Technology Readiness Levels (TRLs) and Manufacturing Readiness Levels (MRLs). Areas with material quality (defined by GAO as sub-threads) are maturity, availability, supply chain management and special handling. Note that there are other measures to determine quality both in materiel and data. http://www.gao.gov/new.items/d10439.pdf

1.12.4 Process Quality

Process quality that is measured by the reproducibility of the products created from the process, where reproducibility is defined by the extent of variation in characteristics among the products.

1.13 Test and Evaluation (T&E)

The fundamental purpose of T&E is to provide knowledge to assist in managing the risks involved in developing, producing, operating, and sustaining systems and capabilities. T&E measures progress in both system and capability development. T&E provides knowledge of system capabilities and limitations to the acquisition community for use in improving the system performance, and the user community for optimizing system use in operations.

1.13.1 Test and Evaluation Considerations for Product Support

Supportability of a system is demonstrated before deployment. DoDI 5000.02 states that OT&E shall be used to determine the operational effectiveness and suitability of a system under realistic operational conditions, including joint combat operations. Typical users shall operate and maintain the system or item under conditions simulating combat stress and peacetime conditions.

The NAVAIR "Logistics Systems Performance Assessment (LSPA) Supportability Test and Evaluation Development of the Statement of Work (SOW)" Standard Work Package, SWP 6744-004, 3 Mar 2011, provides specific guidelines to establish the tasks that contractors must perform. AIR 6.7.4.4's role during this process is to ensure the test & evaluation of the Integrated Logistics Support (ILS) elements deliver readiness of end-items for Development Test (DT) and Operational Test (OT) transition, ultimately assessing their readiness for fleet utilization. This includes identifying contractor requirements for verification during DT and validation during OT. The SOW should specify in clear, understandable terms the required work for developing or producing the weapon system to be performed by the contractor. The SOW defines all work (task) requirements for the contractor effort directly or through references to other documents. The SOW describes the essential and technical requirements for items, materials, or services and includes standards used to determine whether requirements have been met. The primary source document for writing the SOW is MIL-HDBK-245, "Handbook for Preparation of Statement of Work". Additional references regarding the preparation and use of SOWs include COMOPTEVFORINST 3980.1 and NAVAIRINST 4355.19D.

1.13.1.1 Maintainability Demonstration (M-Demo) or Logistics Demonstration (LD)

A maintainability demonstration (M-Demo) test would be implemented to verify by demonstration the actual maintainability characteristics of a system, against the maintainability requirements or objectives. An M-Demo test would establish what criteria will be tested based upon given parameters. These would include the verification of the many maintenance tasks, which are being proposed to be implemented on a system. In the implementation of each maintenance task (corrective and preventive), all the necessary resources to permit an effective repair or maintenance activity would be assessed to include all supporting elements, such as the systems diagnostics capabilities, the required tools (common and special), support equipment and even the skills of the maintainer.

Another goal of the M-Demo would be to identify potential problems in the implementation of specific maintenance tasks, hence find fixes prior to fielding the system. Note: these are typical products referred back to in the M-demo … Current references include: DI-MNTY-81600, Maintainability Program Plan; DI-MNTY-81601, Maintainability Status Report; DI-MNTY-81602, Maintainability Predications Report; DI-MNTY-81603, Maintainability / Testability Demonstration Test Report; DI-MNTY-81604, Maintainability / Testability Demonstration Test Plan; DI-SESS-81613, Reliability and Maintainability (R&M) Program Plan.

The M-Demo may also be referred to as a Logistics Demonstration (LD). Per Army Regulation 700-127, "Integrated Logistics Support", Logistics Demonstrations (LD) are used to evaluate the adequacy of the PM System Support Package (SSP) and ensure that the gaining unit has the logistical capability to achieve initial operational capability (IOC).

1.13.1.2 Product Support In Test & Evaluation Master Plan (TEMP)

Supportability Test and Evaluation (ST&E) is a test methodology, in which criteria and tools for evaluating, analyzing and reporting the product support elements are applied to the article under test. Within the TEMP, (a sample TEMP outline can be found at https://acc.dau.mil/CommunityBrowser.aspx?id=291159) the program manager is required to identify the Key Performance Parameters (KPPs) and Key System Attributes (KSAs) for the system and for each listed parameter, providing the threshold and objective values from the Capability Development Document (CDD) / Capability Production Document (CPD).

The following Planning Guidelines for Supportability T&E, are provided:

- Develop a test strategy for each logistics support-related objective. Ensure that DT&E, integrated testing and OT&E planning encompasses all IPS Elements. The general objectives shown in Figure 18-3 must be translated into detailed quantitative and qualitative requirements for each acquisition phase and each T&E program. The quantitative requirements are those stated as KPPs and key system attributes (KSAs) in the CDD/CPD while the qualitative requirements relate to the twelve IPS Elements;
- Incorporate logistics support testing requirements into the formal DT&E/OT&E/integrated testing plans;
- Identify logistics support T&E that will be performed outside of the normal DT&E and OT&E. Include subsystems that require off-system evaluation;
- Identify all required resources, including test articles and logistics support items for formal DT/OT/ integrated testing and separate logistic support testing (participate with test manager);
- Ensure establishment of an operationally realistic test environment, to include personnel representative of those who will eventually operate and maintain the fielded system. These personnel should be trained for the test using prototypes of the actual training courses and devices. They should be supplied with operationally representative[1] technical manuals and documentation that will be used with the fielded system;
- Ensure planned T&E will provide sufficient data on high-cost and high-maintenance burden items (e.g., for high-cost critical spares, early test results can be used to reevaluate selection);
- Participate early and effectively in the TEMP development process to ensure the TEMP includes critical logistics T&E designated test funds from program and budget documents;
- Identify the planned utilization of all data collected during the assessments to avoid mismatching of data collection and information requirements;
- Ensure key items (e.g., parameters to be measured, methods for measurement and time frames and any penalties/incentives associated with the achieved demonstrated performance) are well-defined in the procurement contract.

[1] Use of production representative test articles is required by Secretary of Defense Memo, Use of Production-Representative Test Articles for Initial Operational Test and Evaluation (IOT&E), dated October 18, 2010. (*http://www.dote.osd.mil/pub/reports/20101018UseofProd-RepTestArticlesforIOT&E.pdf)*

The PM/PSM must confirm adequacy of the proposed support concept programmed support resources prior to fielding. Evaluation of system supportability issues will be performed using data from contractor, Government testing, and other sources and comparing results of the evaluation analysis against criteria based on stated system requirements and goals. Careful planning and executing of the Logistics T&E (LOG T&E) process is necessary to ensure the reliability, maintainability and supportability objectives of the system are identified and achieved. LOG T&E planning is a disciplined, unified and iterative approach to the management and technical activities necessary to integrate support considerations into system and equipment designs.

Supportability testing is conducted in the controlled conditions of developmental T&E and in the representative field conditions of operational T&E. Supportability testing will stress use of Fleet Representative personnel skills, support equipment, technical manuals, tools, and TMDE, including embedded diagnostics, prognostics, instrumentation and Test Program Sets (TPSs) projected for the operational environment of the organization to which the system will be assigned.

Log T&E may consist of a series of logistics demonstrations (LOG DEMOs) and assessments that are usually conducted as part of system performance tests but may require dedicated T&E. Logistics support systems may also be coordinated and evaluated as part of R&M test events such as a maintenance demonstration (M DEMO). Special end-item equipment tests are rarely conducted solely for logistics parameter evaluation. ST&E and LOG DEMOs complement each other and, in a perfect world, would both be performed during evaluation of the support system and products. With LOG DEMOs, specific, high-interest components / systems can be targeted for evaluation while ST&E provides long-term, multi-maintenance technician perspectives on other areas of supportability. Both are useful and should be utilized in verifying / evaluating the twelve IPS Elements. The plan for implementing a Supportability Test Plan, supportability environmental issues, demilitarization and disposal requirements will also be included in the Test and Evaluation Master Plan (TEMP) and Life Cycle Sustainment Plan (LCSP).

The overall test and evaluation (T&E) strategy should be consistent with and complementary to the System Engineering Plan and acquisition strategy. The T&E team should work closely with the Program Manager (PM) and the system design team to facilitate this process. Rigorous component and sub-system DT&E enables performance capability and reliability improvements to be designed into the system early. DT&E events should advance to robust, system-level and system-of-systems level T&E, to ensure that the system has matured to a point where it can enter production, and ultimately meet operational employment requirements.

1.13.2 Developmental Test and Evaluation (DT&E)

Developmental Test (DT) provides the verification and validation of the systems engineering process and must provide confidence that the system design solution is on track to satisfy the desired capabilities.

Note: Each Service maintains an organization dedicated to Developmental Test and Evaluation. PSM's should check their respective Service's policy and guidelines for execution direction.

Additionally, DoDI 5000.02, Enclosure 6 contains detailed checklists for PM/PSM responsibilities during DT&E planning and execution.

Robust DT&E reduces technical risk and increases the probability of a successful program. During early DT&E, the prime contractor will focus testing on technical contract specifications. To ensure that the systems engineering verification and validation relates back to user required capabilities, it is appropriate for government testers to observe the contractor testing, conduct additional T&E, and, when appropriate, facilitate early user involvement and contribution in the design and test processes.

The PM's contract with industry must support an interface between government testers and users with the contractors' testing. The OSD "Incorporating Test and Evaluation into Department of Defense Acquisition Contracts" guidebook provides additional guidance on contract-related issues for the successful solicitation, award, and execution of T&E related aspects of acquisition contracts. Items such as commercial-off-the-shelf, non-developmental items, and Government-off-the-shelf products, regardless of the manner of procurement, must undergo DT&E to verify readiness to enter IOT&E, where operational effectiveness, suitability, and survivability for the intended military application are confirmed.

Programs should not enter IOT&E unless the DoD Components are confident the system is effective, suitable, and survivable. In addition, the government's DT&E results will be reported at each program milestone, to provide knowledge to reduce the risk in those acquisition decisions.

During DT&E, the materiel developer shall:

- Identify the technical capabilities and limitations of the alternative concepts and design options under consideration;
- Identify and describe design technical risks;
- Stress the system under test to at least the limits of the Operational Mode Summary/ Mission Profile, and, for some systems, beyond the normal operating limits to ensure the robustness of the design;
- Assess technical progress and maturity against critical technical parameters, to include interoperability, documented in the TEMP;
- Assess the safety of the system/item to ensure safety during OT and other troop-supported testing and to support success in meeting design safety criteria;
- Provide data and analytic support to the decision process to certify the system ready for IOT&E;
- Conduct information assurance testing on any system that collects, stores, transmits, or processes unclassified or classified information;
- In the case of IT systems, including National Security System (NSS), support the DoD Information Assurance Certification and Accreditation Process and Joint Interoperability Certification process;
- Prior to full-rate production, demonstrate the maturity of the production process through Production Qualification Testing of LRIP assets. [5000.02]

1.13.3 Initial Operational Test and Evaluation (IOT&E) / Operational Test and Evaluation (OT&E)

IOT&E is dedicated operational test and evaluation conducted on production, or production representative articles, to determine whether systems are operationally effective and suitable, and which supports the decision to proceed Beyond Low Rate Initial Production (LRIP). The IOT&E is conducted by an OT&E agency independent of the contractor, Program management office, or developing agency.

Operational test and evaluation is the actual or simulated employment, by typical users, of a system under realistic operational conditions.

According to 10 USC 139, the term "operational test and evaluation" means: (i) the field test, under realistic combat conditions, of any item of (or key component of) weapons, equipment, or munitions for the purpose of determining the effectiveness and suitability of the weapons, equipment, or munitions for use in combat by typical military users; and (ii) the evaluation of the results of such test. [10 USC 139]

The independent planning of dedicated Initial Operational Test and Evaluation (IOT&E), as required by law, and Follow-on Operational Test and Evaluation (FOT&E), if required, shall be the responsibility of the appropriate Operational Test Agency (OTA). A Director, Operational Test & Evaluation (DOT&E)-approved Live-Fire Test and Evaluation (LFT&E) strategy shall guide LFT&E activity.

Title 10 USC 2399 requires DoD to conduct an independent, initial operational test and evaluation on major programs (ACAT I & II) before entering full rate production. Lower ACAT programs may have the IOT&E delegated to another agency.

Note: Each Service maintains an organization dedicated to Operational Test and Evaluation. PSMs should check their respective Service's policy and guidelines for execution direction. Additionally, DoDI 5000.02, Enclosure 6 contains detailed checklists for PM/PSM responsibilities during OT&E planning and execution.

U.S. Navy Operational Test and Evaluation Force. The Navy's Operational Test and Evaluation Force provides an independent and objective evaluation of the operational effectiveness and suitability of naval aviation, surface, subsurface, expeditionary, C4I, cryptology, and space systems in support of Department of Defense and Navy acquisition and fleet introduction decisions. As the sole independent agent for Operational Test and Evaluation (OT&E) in the Navy's acquisition process, OPTEVFOR conducts OT&E in a realistic operational environment.

U.S. Army. Operational Test Command (OTC) has the mission to conduct realistic operational testing in the critical areas of equipment, doctrine, force design and training. The command conducts the operational tests, required by Public Law, which provides significant data to Army decision makers on key Army systems and concepts.

U.S. Air Force. The Air Force Operational Test and Evaluation Center (AFOTEC) tests and evaluates new weapon systems in realistic battlespace environments to provide decision makers a

range of accurate, balanced and timely assessments of effectiveness, suitability and mission capability.

U.S. Marine Corps. The Marine Corps Operational Test and Evaluation Activity (MCOTEA) is responsible for ensuring that all new equipment introduced into the Marine Corps team works properly, helping the Corps continue to be the elite fighting force it has always been. It is our goal to guarantee that the equipment in the hands of each Marine is the best it can be through "fair and objective operational test and evaluation."

During initial deployment of the system, the OT&E agency and/or the user may perform Follow-on Operational Test and Evaluation (FOT&E) to refine the effectiveness and suitability estimates made during earlier OT&E, assess performance not evaluated during IOT&E, evaluate new tactics and doctrine, and assess the impacts of system modifications or upgrades. The FOT&E is performed with production articles in operational organizations. It is normally funded with Operations and Maintenance (O&M) funds. The first FOT&E conducted during this phase may be used to:

- Ensure that the production system performs as well as reported at the Milestone III review;
- Demonstrate expected performance and reliability improvements;
- Ensure that the correction of deficiencies identified during earlier testing was completed;
- Evaluate performance not tested during IOT&E;
- Additional objectives of FOT&E are to validate the operational effectiveness and suitability of a modified system during an operational analysis of the system in new environments. The FOT&E may look at different platform applications, new tactical applications, or the impact of new threats.

1.13.4 Integrated Developmental Test with Operational Test

The goal of integrated testing is to conduct a seamless test program that produces credible qualitative and quantitative data useful to all evaluators, and to address developmental, sustainment, and operational issues. Integrated testing allows for the collaborative planning of test events, where a single test point or mission can provide data to satisfy multiple objectives, without compromising the test objectives of participating test organizations. Integrated testing focuses the entire test program (contractor test, Government DT, Live Fire Test, and OT) on designing, developing, and producing a comprehensive plan that coordinates all test activities to support evaluation results for decision makers at required decision reviews.

System designers, developmental testers, operational testers and user representatives must all be in agreement concerning the missions, tasks, and defined capabilities. It is important to ensure direct traceability and linkage of system characteristics, key performance parameters/key system attributes, specifications, and user requirements, to a mission or missions. Such a structured approach also ensures that all test activities are necessary, duplication is eliminated, and that no areas are missing in the overall T&E effort.

The traditional focus of T&E has been during the system development phase and early production. Policy issued in December 2007 jointly by OSD(AT&L) the Director, Operational Test & Evaluation (DOT&E) focused on bringing the T&E community to be involved earlier in the system life cycle, when requirements and concepts are first developed. The goals of this

early involvement are to establish better requirements that are more fully understood, and the ‘‘early identification of technical, operational, and system deficiencies, so that appropriate and timely corrective actions can be developed prior to fielding the system’’.

Effective Configuration Management will significantly enhance probability of a successful T&E program. Traceability between functional requirements and test requirements/results ensures adequate product verification but also supports integrated testing by managing when and to what degree a fix was implemented following a DT test event reducing both program cost and risk.

The focus on integrated developmental and operational testing is consistent with prior policy; however, now the role of T&E in the system life cycle is being expanded, so all testing should be as seamless as possible, with minimal or no stops and starts for different types of testing. This seamless T&E will require continued emphasis on the use of live, virtual, and constructive modeling and simulation (M&S), or as the policy memo puts it, ‘‘T&E will be conducted in a continuum of live, virtual, and constructive system and operational environments’’ . Another focus in making T&E integrated and more efficient is the policy that ‘‘evaluations shall take into account all available and relevant data from contractor and government sources’’.

Integrated Testing is intended to ensure that all stakeholders (Program Manager, developmental testers, operational testers, and evaluators) collaborate so that all can use the data from any test event to satisfy their needs. There are complicating factors, which make fully attaining this goal difficult; for example, Developmental Testing (DT) is characterized by the use of a ‘‘test-analyze-fix-test’’ process, which allows the system design to constantly be improved and refined; final Operational Testing (OT) is traditionally conducted with systems that are nearly fully mature and are ‘‘production representative.’’

Integrated Testing will never do away with the need for a dedicated Operational Test to confirm that systems will work in combat, and also, due to the fact there is a legal requirement for a dedicated operational test. In practice, the separation of developmental and operational testing has caused development process difficulties that have been documented by the Defense Science Board Task Force on Developmental Test and Evaluation. The lack of operational realism in early testing hides failure modes and performance limitations that become evident only at the end of a program, when fixing the problems is expensive, time-consuming, and, often, simply not possible.

Integrated Testing must be embedded in the Test and Evaluation (T&E) Strategy, although most of the effort takes place during the detailed planning and execution phases of a test program. It is critical that all stakeholders understand what evaluations are required to assess risks and the maturity of the system. The "end state" of what will be evaluated must be defined up front so all stakeholders are working toward the same goal. Once this is accomplished, an integrated test program can be developed that generates the data required to conduct the evaluations.

Early involvement of the T&E community has many potential benefits. This allows the Army Evaluation Center (AEC), for example, to provide the data requirements to testers early on, so they can structure test events to satisfy OT as well as DT evaluation requirements. Some benefits that the test community has already seen include the following:

- contributions in drafting the T&E portions of the system specifications;
- technical support for the source selection process;
- assistance in the development of more realistic requirements;
- improved contractor understanding of requirements;
- more informed and balanced assessment reports;
- problems identified earlier and fixed more economically;
- a much more timely developmental process.

The use of Design of Experiments (DOE) to achieve Integrated Testing was endorsed by DOT&E and OTA Commanders in May 2009. DOE is currently in use and provides the scientific and statistical methods needed to rigorously plan and execute tests and evaluate test results.

The DT&E and OT&E offices are working with the OTAs and Developmental Test Centers to integrate DOE within the Test & Evaluation Strategy. The October 19, 2010 OT&E Memorandum, "Guidance on the use of Design of Experiments (DOE) in Operational Test and Evaluation", provides further guidance to increase the use of scientific and statistical methods in developing rigorous, defensible test plans and in evaluating their results.

A few of the elements of experimental design that the OT&E looks for in Test and Evaluation Management Plans (TEMPs) and specific Test Plans include:

- The goal of the experiment. This should reflect evaluation of end-to-end mission effectiveness in an operationally realistic environment;
- Factors that affect those measures of effectiveness and suitability. Systematically, in a rigorous and structured way, develop a test plan that provides good breadth of coverage of those factors across the applicable levels of the factors, taking into account known information in order to concentrate on the factors of most interest;
- Statistical measures of merit (power and confidence) on the relevant response variables for which it makes sense. These statistical measures are important to understand "how much testing is enough?" and can be evaluated by decision makers on a quantitative basis so they can trade off test resources for desired confidence in results.

In summary, integrating DT and OT can strengthen Reliability, Availability, Maintainability and Supportability (RAMS) outcomes by establishing the parameters and requirements for data collection and data sufficiency early in the design process and by involving stakeholders throughout the process.

Most importantly, regarding RAMS data, there will be direct and continuous traceability and linkage of system characteristics, key performance parameters/key system attributes, specifications, and user requirements, to a mission or missions. Recent initiatives, including policy changes for the endorsement of the use of DOE and guidance for the development of T&E acquisition documents, strengthen and encourage the early and continuous involvement of the T&E community in weapon system acquisition. The goal of Integrated Testing is to ensure that all stakeholders (Program Manager [PM], developmental testers, operational testers, and evaluators) collaborate so that all can use the data from any test event to satisfy their needs.

Additional information on supportability test and evaluation can be found in the DAU Test and Evaluation Management Guide, Chapter 18, Logistics T&E, at the DAU website: http://www.dau.mil/pubscats/Lists/GuideBook/DispForm.aspx?ID=9 .

1.13.5 Prototyping

A prototype is an original or model on which a later system/item is formed or based. Early prototypes may be built and evaluated during the Technology Development Phase, or later in the Engineering and Manufacturing Development phase, or is the result of a Joint Capability Technology Demonstration (JCTD) or Advanced Technology Demonstration (ATD), and tested prior to Milestone C decision. Selected prototyping may continue after Milestone C, as required, to identify and resolve specific design or manufacturing risks, or in support of Evolutionary Acquisition (EA).

1.13.6 Acceptance Testing

Acceptance testing is a test conducted to determine if the requirements of a specification or contract are met. It may involve chemical tests, physical tests, or performance tests. Acceptance testing generally involves running a suite of tests on the completed system. The test environment is usually designed to be identical, or as close as possible, to the anticipated user's environment, including extremes of such. These test cases must each be accompanied by test case input data or a formal description of the operational activities (or both) to be performed and a formal description of the expected results. Mil-STD-1916, DoD Test Method Standard, provides DoD preferred methods for acceptance of products. The purpose of this standard is to encourage defense contractors and other commercial organizations supplying goods and services to the U.S. Government to submit efficient and effective process control (prevention) procedures in place of prescribed sampling requirements. The goal is to support the movement away from an AQL-based inspection (detection) strategy to implementation of an effective prevention-based strategy including a comprehensive quality system, continuous improvement and a partnership with the Government.

1.14 Production and Fielding

Production is the process to achieve an operational capability that satisfies the mission need. The system is produced at rate production and deployed to the field or fleet. This process involves a combination of multiple activities to include manufacturing, assembly, systems integration, final test and inspection prior to delivery. Deployment and fielding are generic terms used interchangeably, covering the activities known as fleet introduction in the Navy, site activation in the Air Force, materiel fielding in the Army, and fielding in the IT/AIS community.

1.14.1 Product Support in Manufacturing

Product support considerations that occur during manufacturing focus on ensuring all of the integrated product support elements are being considered, where there may be integration with, the manufacturing process. Examples include suppliers who should have long term arrangements to continue past manufacturing into sustainment, infrastructure which can be re-used for maintenance and supply functions; repair parts production lines to integrate and manage supply and demand as the system transitions into fielding and operations while manufacturing of new systems is still occurring; quality control; etc.

1.14.2 Post Production Support Plan

A post product support plan identifies the IPS Elements which are critical to post production support planning, detailed analysis including examination of all items for possible parts supportability problems such as obsolescence and other resource implications and problem correction.

Post Production Support (PPS) includes the management and support activities necessary to ensure continued attainment of readiness and supportability objectives with economical logistics support, after cessation of production for the acquisition or modification of a major system or equipment.

Post production evaluation is a subset of support planning. An initial Post Production Evaluation will be accomplished thru out course of production allowing WIPT to review and comment challenges and success to meet cost, schedule, and performance goals. Conducting a post production evaluation to analyze how a program ran and identify success and improvement areas, after reviewing with the WIPT, will be beneficial to identify need to develop an effective support plan. Especially beneficial to identify and evaluate each functional area process. Post production evaluation should occur after each system development and evaluate and analyze depot level maintenance performance/progress. This evaluation can be used as a tool to show challenges and success meeting cost, schedule and performance goals.

Post production support planning (PPSP) includes management and support activities necessary to ensure attainment of readiness and sustainability objectives with economical logistics support after cessation of the production phase for a system. Per AR 700–127, 17 July 2008, the following are specified [*Note that the SDD phase reference should read EMD*]:

- The PPSP will be based upon support requirements and concepts established during the materiel development or acquisition phase;
- The PPSP will be a joint effort involving Government and contractor agencies. Requirements for PPS planning must be placed in the SDD statement of work for the contractor to include PPS considerations in source selection tradeoff activities;
- An initial PPS plan documenting resources and management actions will be completed and included as an annex to the Life Cycle Sustainment Plan (LCSP) by milestone C;
- A final PPS plan will be completed prior to production phase-out and schedules will be established for reviewing and updating PPS planning throughout the life cycle;
- The PPS will commence prior to the beginning of the SDD phase. This planning will address software change distribution, downloading, installation, and training after system deployment. These considerations will be addressed in the PPS plan;
- Continuous Technology Refreshment will be addressed as part of the PPS strategy to provide a means to acquire technologically improved replacement parts and to reduce ownership costs.

The development of a post production support plan typically has three steps:

1. Identification of Integrated Product Support Elements critical to post production support planning, which includes reviewing requirements and available data, establishing a methodology, and preparing preliminary post production support plans;

2. Detailed analysis including examination of all items for possible parts supportability problems such as obsolescence and other resource implications. Trade studies and post production support analyses are conducted to identify impacts of prospective loss of tools, support equipment, contractor's expertise, and vendor base;

3. Problem correction occurs during this step which includes recommending solutions and alternatives. The post production support planning continues for the duration of the production contract, updated according to the frequency determined by the program office and continued up to actual equipment phase out. The updates from the study will be based on the contract data requirements list (CDRL).

More information on support plan development is found in Services' guidebooks such as the Joint Service Guide for Aviation Post Production Support Planning dtd OCT 97.

Post Production Support Summaries are used to analyze life cycle support requirements of a system or equipment before production lines are closed to ensure supportability over the system or equipment's remaining life. These summaries identify items within the system that will present potential problems due to inadequate sources of supply, or modification after shutdown of production lines. They also may identify alternative solutions for anticipated support difficulties during the remaining life of the system or equipment. General topics that may be addressed in this summary include, but are not limited to, manufacturing, repair centers, data modifications, supply management, configuration management, and other related areas.

1.14.3 Environmental / Hazardous Waste / Green Issues

This topic includes the activities required to minimize and contain the environmental effects, distribution, storage, use, handling, and transportation of hazardous materials and hazardous wastes, including radioactive items**.**

1.14.4 Deployment / Fielding Planning

Deployment and fielding are a generic terms, used interchangeably, covering the activities known as fleet introduction in the Navy, site activation in the Air Force, materiel fielding in the Army, and fielding in the IT/AIS community.

The deployment process is designed to turn over newly acquired or modified systems to users who are being and have been trained and equipped to operate and maintain the equipment. All organic or contractor-operated elements of logistics must be in place at appropriate levels at the time of deployment. Although it may seem a straightforward process, deployment is complex and can be costly if not properly managed. When properly planned and executed, deployment can make a major contribution toward mission achievement if planned levels of unit readiness are met, planned costs are not exceeded, and logistics turmoil is minimized.

Per DoDI 5000.02, Enclosure 2, for Milestone C, the PM shall prepare a program description as part of the Acquisition Strategy. Throughout Production and Deployment, the PM/PSM shall ensure that all deliverable equipment requiring capitalization is serially identified and valued at full cost; the full cost of each item of equipment is entered in the Item Unique Identification (IUID) registry (if it meets the IUID criteria, or other database specifically requiring serialized management unique to a specific weapon system); all solicitations, proposals, contracts, and/or orders for deliverable equipment are structured for proper segregation of each type of equipment based on its respective financial treatment; procedures are established to track all equipment items throughout their life cycle; and the status of items added, retired from operational use, or transferred from one DoD Component to another DoD Component are updated quarterly throughout their life.

Example for IUID registry requirement: according to the Small Arms Serialization Program (SASP), all small arms, as defined in DoD 4140.1-R, including those mounted on aircraft, vehicles, and vessels that are accounted for in unclassified property records, shall be reported to the DoD Registry. Security Risk Category I non-nuclear missiles and rockets shall only be included in the DoD SASP if the asset and its physical custodian are not recorded in the Service internal Supply Class V tracking systems. To ensure accurate tracking, the serial number of a missile and rocket, in the appropriate tracking system, cannot be changed, but may be modified with a suffix when the unit is in maintenance.

First unit Initial Operational Capability (IOC), a start date for deployment resources to be in place, may range from the first day of custody of the system hardware to some later date when unit training has been completed and a readiness inspection is satisfactorily passed. The type of deployment program may range from introduction of thousands of combat vehicles over a 10-year period to the staged delivery and acceptance of a single aircraft carrier.

Regardless of the number of items and the length of the deployment schedule, there must be a comprehensive, coordinated deployment plan. This plan must contain realistic lead times that are supported by adequate funds and staff and that have the potential for rigorous execution.

Deployment should not be thought of as simply delivering equipment. There is a need for consideration of manpower, personnel and training requirements, establishment of facilities, placement of system support, use of contractor support, data collection and feedback, scheduling, and identification of funds. Planning for deployment and using an Integrated Product Team (IPT), as appropriate, begins in the Materiel Solution Analysis phase as an integral part of the systems engineering process.

Reference is made to the logistics performance requirements stated in the Initial Capabilities Document (ICD). By Milestone A, a draft LCSP is recommended to address the long-term deployment considerations. Deployment planning intensifies through the Technology Development phase. By the Engineering and Manufacturing Development (EMD) phase, a detailed plan for deployment can be prepared. This plan must be updated and coordinated on an on-going basis to reflect program changes.

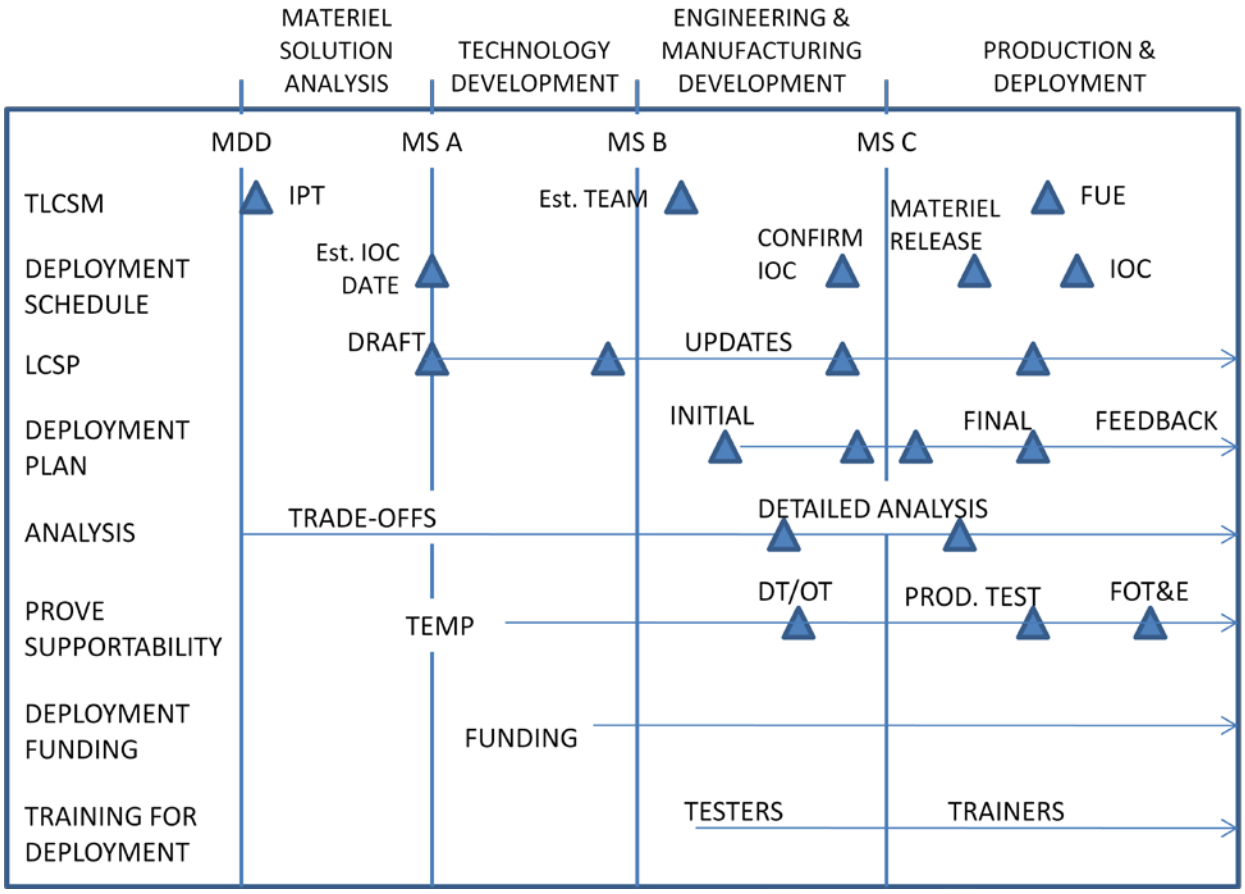


Figure 1.3.16.1.F2. Typical System Deployment / Fielding Activities Mapped by Life Cycle Acquisition Phase

Dissemination of information to all participants and IPTs is very important; each change must be coordinated as needed and passed on to every organization involved in the deployment process. Figure 1.3.16.1.F2 shows the relationship between deployment activities and major logistics activities. Changes in almost any aspect of the program (ranging from the very obvious, such as production schedule changes, to a less obvious change in unit manning requirements) can have an impact on deployment. Figure 1.3.16.1.F3 provides suggested generic topics for inclusion in the plan. The Product Support Manager must be actively involved in deployment planning.

SYSTEM SUPPORT DETAILS
A. Limitation of data
B. Logistics support concept
C. Deployment agreement and certification (LOA, MOU)*

SYSTEM/END ITEM DESCRIPTION
A. Functional configuration
B. Organizational and operational concepts
C. Deployment schedules

LOGISTICS SUPPORT AND COMMAND AND CONTROL
A. Command and control procedures
B. Logistics assistance
C. Materiel defects
D. Coordination

SUPPORT REQUIRED FROM USING COMMAND

OTHER CONSIDERATIONS
A. Key correspondence
B. Plans and agreements
C. Developers checklist
D. User command checklist
E. Classified information

* Letters of agreement, memorandum of understanding

Figure 1.3.16.1.F3. Recommended topics for inclusion in Fielding Plans.

1.15 Sustainment Logistics

The objective of this activity is the execution of a support program that meets operational support performance requirements and sustains the system in the most cost-effective manner over its total life cycle. When the system has reached the end of its useful life, it shall be disposed of in an appropriate manner. The Services, in conjunction with users, conduct continuing reviews of sustainment strategies, utilizing comparisons of performance expectation as defined in performance agreements against actual performance measures. PMs revise, correct, and improve sustainment strategies as necessary to meet performance requirements. Sustainment strategies evolve and are refined throughout the life cycle, particularly during development of subsequent increments of an evolutionary strategy, modifications, upgrades, and reprocurement. The PM ensures that a flexible, performance-oriented strategy is developed and executed to sustain fielded systems.

1.15.1 Implementing Key Performance Parameters and Key System Attributes

The four sustainment outcome metrics consist of the Materiel Availability KPP, the Materiel Reliability, and Ownership Cost KSAs, and Mean Down Time established by the JCIDS Manual

3170 and the 2007 OSD policy memorandum on Life Cycle Sustainment Outcome Metrics and which apply to all ACAT 1 Acquisition Programs and all major legacy programs.

1.15.2 Product Support Package

The major integrated product support elements and plan for acquiring and fielding them including the results of any Service conducted Logistics Assessments. While it varies by organization typically, the product support package (PSP) includes the logistics elements contained in figure 5.1.1.1.F1. They must be integrated because they impact each other and Materiel Availability. During the acquisition process the focus is on influencing the design for supportability and by fielding the support concept to satisfy user specified requirements for sustaining system performance at the lowest ownership cost. This applies to each increment of capability to be developed. Features include:

- Availability of support to meet Warfighter specified levels of combat and peacetime performance;
- Logistics support that sustains both short and long term readiness;
- Management of life-cycle cost (LCC) through analysis and decision prioritization;
- Maintenance concepts to integrate the logistics elements and optimize readiness while drawing upon both organic and industry sources;
- Data management and configuration management that facilitates cost-effective product support throughout the system life cycle;
- A diminishing manufacturing sources and material shortages management process that ensures effective, affordable, and operationally reliable systems;
- Operator and maintainer training to encompass the full capability of the system.

1.15.3 Services' Tailored PBL Checklists and Assessments

PBL checklists are detailed checklist of specific actions for the PM / PSM to consider when implementing PBL. It is included in AR 700-127 Appendix B. Material on BCA checklist is found in the DoD PSM Guidebook.

1.15.4 Continuous Process Improvement (CPI)

DoD CPI is a strategic approach for developing a culture of continuous improvement in the areas of reliability, process cycle times, costs in terms of less total resource consumption, quality, and productivity. In DoD, CPI comprises the application of a broad range of tools and methods, such as Lean, Six Sigma, and Theory of Constraints (TOC).

1.15.4.1 Lean Enterprise

Lean Enterprise is the application of the lean enterprise value concept constitutes the elimination of waste with the goal of creating value for all stakeholders. DAU has a community of practice site located at
http://www.dau.mil/educdept/mm_dept_resources/navbar/lean/enterprise_model.asp.

1.15.4.2 Six Sigma

Six Sigma is a quality control methodology that results in very few defects, given the complexity of the service or product.

1.15.4.3 Theory of Constraints

Theory of constraints is a concept that focuses on exploiting a system's constraint to get the most out of it without additional investment.

1.15.5 Value Stream Mapping

Value stream mapping is a technique that begins with the objective of identifying the waste in the current state of a production, repair, or other service process.

1.15.6 Contingency Logistics Considerations

Under 10 USC 101(a)(13), the term "contingency operation" means a military operation that is designated by the Secretary of Defense as an operation in which members of the armed forces are or may become involved in military actions, operations, or hostilities against an enemy of the United States or against an opposing military force; or results in the call or order to, or retention on, active duty of members of the uniformed services under section 688, 12301(a), 12302, 12304, 12305, or 12406 of this title, chapter 15 of this title, or any other provision of law during a war or during a national emergency declared by the President or Congress. In its contingency operations since the early 1990s, the Department of Defense (DoD) has relied extensively on logistics support contractors to provide many of the supplies and services needed by deployed U.S. Forces. The rapid pace of ramp up and then standing down personnel and material needs places high stresses on the logistics infrastructure. The PSM must review and plan against all 12 integrated product support elements in regards to supporting contingency logistics operations.

Contingency contracting is the process of obtaining goods, services, and construction from commercial sources in support of contingency operations. Emergency acquisition includes (i) contingency contracting (which includes disaster relief); (ii) facilitating the defense against or recovery from nuclear, biological, chemical, or radiological attack against the U.S.; and (iii) situations where the President issues an emergency declaration or major disaster declaration. There has been much attention on contingency contracting in both Iraq and Afghanistan. However, contingency contracting encompasses much more than the support for the military efforts in those two countries. Contingency contracting includes all contracting done in a contingency environment (declared and not declared), including stability operations, natural disasters, and other calamitous events.

1.16 Disposal

Disposal is the process of reutilizing, transferring, donating, selling, destroying, or other ultimate disposition of personal property.

1.16.1 Disposal Cost Considerations

Disposal costs associated with demilitarization and disposal of a military system at the end of its useful life need to be considered.

1.16.2 Recycling

All installations, worldwide, shall have recycling programs as required by Executive Order 12780. Pursuant to Public Law 97-214 (10 USC 2577), and DoD Instruction (DoDI) 4715.4, Pollution Prevention. Each installation and facility not on a military installation, worldwide, shall have, or be associated with, a Qualified Recycling Program (QRP) to service all tenant activities.

1.16.3 Transfer to Other Services and Agencies

The transfer of property between Government Agencies governed by the Unified Facilities Criteria (UFC) 1-300-08, dated 16 April 2009. Also see DLA Disposition Services.

1.16.4 FMS Excess

See Section 1.6.4.3 Cooperative Logistic Supply Support Arrangement (CLSSA).

1.16.5 Exchange of Equipment

The exchange, rather than the replacement, of eligible government, non-excess property occurs whenever exchange promotes economic and efficient program accomplishments which is encouraged by the Department of Defense.

1.16.6 DLA Disposition Services (formerly DRMO)

Their mission is to anticipate needs and deliver performance to customers through the reuse, transfer, donation, sale or disposal of excess property. AMARG, or the Aerospace Maintenance And Regeneration Group, is a joint service facility managed by the US Air Force Material 309th Aerospace Maintenance and Regeneration Group, under the 309th Maintenance Wing located at Hill Air Force Base, Utah.

1.16.7 Issues Related to Return and Reintegration

Each DoD Component has designated reclamation organizations to ensure necessary tests and inspections are performed prior to reintegration into the supply chain for all parts planned for reuse.

1.16.8 Deactivation and Stand Down of Operational Units

Deactivation of military units is the inactivation, redeployment to another operational area or the relocation within a major command. The deactivation process is often unique to the command and host installation.

1.16.9 Demilitarization

The act of eliminating the functional capabilities and inherent military design features from DoD personal property. Methods and degree range from removal and destruction of critical features to total destruction by cutting, crushing, shredding, melting, burning, etc. DEMIL is required to prevent property from being used for its originally intended purpose and to prevent the release of inherent design information that could be used against the United States. DEMIL applies to DoD personal property in both serviceable and unserviceable condition." See: http://www.dtic.mil/whs/directives/corres/pdf/416028p.pdf .

1.16.10 Munitions

Materiel that is designated by the OSD to require demilitarization, or that is related to articles on the U.S. Munitions List under 22 CFR 121 or the Commerce Control List under 15 CFR 774 and found by the DoD Components to have, directly or indirectly, a significant military utility or capacity, is controlled and/or demilitarized to the extent necessary to eliminate its functional or military capabilities.

40 CFR 260.10 defines munitions as "Military munitions means all ammunition products and components produced or used by or for the U.S. Department of Defense or the U.S. Armed Services for national defense and security, including military munitions under the control of the Department of Defense, the U.S. Coast Guard, the U.S. Department of Energy (DOE), and National Guard personnel. The term military munitions includes: confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries used by DoD components, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. Military munitions do not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components thereof. However, the term does include non-nuclear components of nuclear devices, managed under DOE's nuclear weapons program after all required sanitization operations under the Atomic Energy Act of 1954, as amended, have been completed." See: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=3909f46c7c885b999012f2966eec6766&rgn=div8&view=text&node=40:26.0.1.1.1.2.1.1&idno=40.

1.16.11 Retirement

Retirement is the point in time that marks the end of a piece of equipment's service life.

1.16.12 Disposal of Unusable Property

Unusable property is scrap or salvage materiel that is considered unusable.

1.16.13 Security and Destruction of Classified Items

The destruction of classified material should occur when that material is no longer required, including media, memory, and equipment. The NISP Operating Manual, DoD 5220.22-M, outlines requirements for getting rid of classified digital data. NISPOM paragraphs 5-704 and 5-705 set out requirements for the destruction of classified material that is no longer required, including media, memory, and equipment.

1.16.14 Precious Metal Items Management

The process of handling precious metal-bearing scrap, residual material or precious metals is administered by the Director, DLA in the DoD Precious Metals Recovery Program (PMRP).

1.16.15 Archiving and Record Retention of Historical Data

Historical data may be destroyed or sent to archiving and record retention repositories such as the Naval Historical Center, the National Archives, or a federal records center. For U.S. Navy records, before destroying or disposing of any records, commands should refer to SECNAV Manual 5210.1, Department of the Navy, Navy Records Management Program.

1.16.16 Benefiting Historical Collections

The loaning, giving, or exchange of documents, historical artifacts, and condemned or obsolete combat materiel to benefit the Department of Defense's historical collection and associated educational programs under 10 U.S.C. 2572. Other Surplus Property: Surplus personal property

that is made available to Military Service educational activities to foster and encourage the educational purposes of such activities.

1.16.17 End-Use Certificate

This document indicates the intended destination and disposition of sensitive, controlled items released from DoD control in accordance with the Export Administration Act.

1.17 Risk Management

The program manager and others in the acquisition process take an active role in identifying and understanding program uncertainties, whether they have a negative or positive impact on the program baseline. An assessment of cost, schedule, or performance against a program baseline is not credible or realistic if uncertainties are not recognized and in some manner incorporated into estimates and assessments in a transparent manner. The impact of uncertainty in particular areas of the program, on particular estimates and assessments, is analyzed and understood. Risk has three components: 1) A future root cause (yet to happen), which, if eliminated or corrected, would prevent a potential consequence from occurring, 2) A probability (or likelihood) assessed at the present time of that future root cause occurring, and 3) The consequence (or effect) of that future occurrence.

A future root cause is the most basic reason for the presence of a risk. Accordingly, risks should be linked to future root causes and their effects.

The risk management process includes the following key activities, performed on a continuous basis (See Defense Acquisition Guidebook, Figure 4.2.3.1.5.F1 Risk Management Process – Key Activities):

- Risk Identification;
- Risk Analysis;
- Risk Mitigation Planning;
- Risk Mitigation Plan Implementation; and
- Risk Tracking.

1.18 Tools and Processes

Analytical tools and related analytical processes can take many forms (analysis of alternatives, supportability analysis, sustainment business case analysis, and life cycle impact analysis) and are dependent upon the stage of the programs life cycle.

1.18.1 PSM Online Resources

The Defense Acquisition University (DAU) has developed many online resources available for the Defense Acquisition Workforce, industry partners, and other Federal, State, and Local government organizations. These online resources provide you with the ability to apply for a course, take a continuous learning module for continuous learning credit, research policy and other documents, link to related learning and knowledge content, ask a professor a question, contribute knowledge objects (such as lessons learned, best practices, templates, or samples), or collaborate with your peers on work issues. These online resources were developed in support of the Acquisition, Technology, and Logistics Performance Learning Model (PLM): A Net-Centric Approach to Engaged Learning. The PLM represents a complete learning environment, 24/7,

whenever and wherever you need it to improve your performance. Learn more at http://www.dau.mil/documents/virtual_tour/index.html .

1.18.2 Sustainment Maturity Levels (SMLs)

Each major program phase has a unique set of activities that should be performed to achieve increasing levels of program product support maturity and readiness. Each SML represents a discrete assessment with associated criteria and describe the expected level of maturity and summarize key documents and capabilities of the sustainment program at a given point in the weapon system life cycle. The PSM Guidebook, Appendix H, contains a detailed discussion of Sustainment Maturity Levels.

1.18.3 Logistics Assessments

Note: this topic is covered in the IPS Element Guidebook section 1.10.4.3.6 above but also listed here as a designated tool in the PSM Guidebook's Tools and Processes. The PSM is encouraged to use the criteria in the Logistics Assessment (LA) Guidebook as a step-by-step guide to maximize the likelihood that the product support organization will achieve the Warfighter-required outcomes. Each row of the criteria is phrased as a leading statement to inspire further thought and investigation and is not intended to simply be a compliance statement.

1.18.4 Enterprise Synergies across IPS Elements

Enterprise synergies refer to the ability to leverage the efforts of other programs or portfolio of programs. The PSM's challenge varies throughout the life cycle and grows more complex over time as fleet configurations change due to varying ages, blocks, and modifications of the systems being managed. Other systems and functional organizations are also evolving in parallel with the PSM's, providing opportunities for the PSM to identify and take advantage of synergistic relationships across the enterprise. For example, the PSM of a legacy bomber might take advantage of another heavy aircraft's avionics modernization program to upgrade a cockpit without investing separately in a stand-alone, bomber-unique cockpit upgrade. This would create economies of scale in procurement of the system upgrade, consolidate and add efficiency to spending for supply chain management, and accelerate the learning curve for installation and maintenance. Each of these benefits would result in improvements to the Warfighter and minimized life cycle costs.

1.18.5 Business and Variance Analysis

PSMs should base decisions on empirical facts and proven analytical techniques to ensure they are made as objectively as possible and should use that analyzed data to support informed opinions. All major decisions regarding product support strategy development, including assignment of workloads and responsibility for integration of those workloads (PSI delegation) should be informed by unbiased BCAs that account for all applicable cost assessed equitably across all alternatives to meet Warfighter requirements. Likewise, the PSM should understand the cause of variances between predicted and actual product support cost and performance. The level of analysis depends on the life cycle phase, purpose of the BCA, and scope of the BCA.

Product Support Management in the Life Cycle

A. Purpose

This Product Support Management Integrated Product Support Element will, through the Product Support Manager, provide continuous product support leadership throughout the weapon system's life cycle, reporting to senior leadership of status of program key metrics and product support activities, and providing senior program subject matter expertise in all areas of life cycle product support.

a. Why the New Product Support Management Element Is Important

Per USD(AT&L) DTM 10-015, the Product Support Manager will be an integral part of the program management team and will report directly to the PM. The Product Support Manager will need to understand requirements development, all Acquisition Phases and have a good working knowledge of other functional areas for planning and implementation activities, to include contracting, finance, configuration management, outcome based strategy development, etc. For total life cycle product support of the weapon system being fielded.

b. Summary of Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because the Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

It is important to understand that the Product Support Manager, or the pre-Milestone B "PSM", is in a leadership role. The PSM's are leading the development of the initial product support strategy, developing product support cost estimates for incorporation in the LCCE, and participation in the source selection process, i.e., development of strategy, performance spec, SOW, SOO, SSP, and evaluation. This leadership must start at the earliest phases and continue throughout the life of the program.

Note that the Logistics Analysis (LA), also known as an independent logistics analysis, is part of each Milestone Decision Package and is a requirement for type classification.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below are 12 tables for each IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. This first table, Product Support Management IPS Element, includes in the left column a listing of all deliverables to support **requirements for Milestone/Decision Reviews**, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. *The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase.*

The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	PSM Element Activities
User Need / Technology Opportunities & Resources Requirements for Materiel Development Decision (MDD): • Acquisition Decision Memorandum (ADM) • Analysis of Alternatives (AoA) Study Guidance • Initial Capabilities Document (ICD)	Performance-based life-cycle product support implementation begins in the JCIDS process with the exploration of capabilities. Every system is acquired to provide a particular set of capabilities in a specific concept of operations, sustained to an optimal level of readiness. Understanding user needs in terms of performance is an essential initial step in developing a meaningful product support strategy because changes to the CONOPS or the sustainment approach may impact the effectiveness, suitability, or cost of the system. The Product Support Manager, although not formally designated until MS B, must be able to understand and forecast requirements to actual product support sustainment activities and outcomes. The PSM should be collaborating with program requirement analysts and engineers to identify known technologies that are expected to reside in the materiel solution and any unique support requirements associated with the particular technologies. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Key Products: • Requirements and Metrics Development • Product Support Strategy
Materiel Solution Analysis Requirements for MS A: • Acquisition Decision Memorandum • Acquisition Information Assurance Strategy • AoA • CCA Compliance & CIO Confirmation • Component Cost Estimate • Consideration of Technology Issues • Cooperative Opportunities • Data Management Strategy	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. The AoA requires, at minimum, full consideration of possible trade-offs among cost, schedule, and performance objectives for each alternative considered. While not officially designated until Milestone B, the outcomes of a PSM perspective should be introduced at this point. The outcomes will drive the design of KPPs, KSAs and subordinate metrics. The initial Life Cycle Sustainment Plan (LCSP) will include appropriate trade-off studies to validate and forecast product support sustainment outcomes. The intended sustainment footprint should encompass all twelve integrated product support (IPS) elements. The ICD documents the system's capability requirements. Refer to the Defense Acquisition Guidebook (DAG), Chapters 3.3 and 5 for more information.

• Economic Analysis • Exit Criteria • Independent Cost Estimate • Initial Capabilities Document • Item Unique Identification Plan • Life Cycle Signature Support Plan • Life Cycle Sustainment Plan • Market Research • MDA Certification • Net-Centric Data Strategy • Program Protection Plan • Systems Engineering Plan • Technology Development Strategy • Test & Evaluation Strategy	The Product Support Manager will use the Sustainment Chart (described in The Product Support Manager Guidebook) to summarize current Life Cycle Product Support status. Specific analysis focuses on the approach for achieving the required enabling sustainment technologies to implement the product support strategy and achieve the sustainment metrics. Risks to achieving the necessary support structure for the time frame of the program by Initial Operating Capability (IOC) should be identified and a mitigation strategy outlined. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of Milestone Decision Review required documents. Key Product • Life Cycle Support Plan (LCSP) strategic outline • System Safety Analysis • Life Cycle Cost Estimate • Supportability Test and Evaluation inputs to the ICD (see NAVAIR Standard Work Package 6744-002 for more info)
Technology Development Requirements for MS B: • Acquisition Decision Memorandum • Acquisition Program Baseline • Acquisition Strategy • Acquisition Information Assurance Strategy • Affordability Assessment • Alternate Live Fire T&E Plan • AoA • Benefit Analysis & Determination • Capability Development Document • CCA Compliance & CIO Confirmation	The primary document incorporating Life Cycle Product Support plans and outcomes is the Life Cycle Sustainment Plan (LCSP). After Milestone A, the LCSP evolves from a strategic outline to a management plan describing the sustainment efforts in the system design and acquisition processes to achieve the required performance and sustainment outcomes necessary to ensure required Warfighter capabilities. A detailed outline for the LCSP can be found in the Defense Acquisition Guidebook, Chapter 5.1.2.2. and at the DAU community of practice at https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3303/USA005157-11_SignedLCSPMemo_14Sep2011.pdf. By Milestone B, the LCSP has evolved into a detailed execution plan for how the product support package is to be designed, acquired, sustained, and how sustainment will be applied, measured, managed, assessed, modified, and reported from system fielding through disposal. The LCSP is submitted as a separate deliverable. The Product Support Manager is required to also provide information on many other acquisition documents. Information can be found summarized below under deliverables, described in the DAG, and also found on the DAU website,

• Competition Analysis • Component Cost Estimate • Consideration of Technology Issues • Cooperative Opportunities • Core Logistics/Source of Repair Analysis • Corrosion Prevention Control Plan • Cost Analysis Requirements Description • Data Management Strategy • Economic Analysis • Exit Criteria • Industrial Base Capabilities • Independent Cost Estimate • Independent Technology Readiness Assessment • Information Support Plan • Initial Capabilities Document • Item Unique Identification Plan • Life Cycle Signature Support Plan • Life Cycle Sustainment Plan • LRIP Quantities • Manpower Estimate • Market Research • MDA Certification • MDA Assessment of Survivability • Net-Centric Data Strategy • OTA Report of OT&E Result • Preliminary Design Review • Program Protection Plan • PESHE • Replaced System Sustainment Plan • Spectrum Supportability Determination • System Threat Assessment • Systems Engineering Plan • Technology Development Strategy	https://dag.dau.mil/Pages/Default.aspx. Key Products: • Updated LCSP • Initial Logistics Assessment (LA) • Initial Business Case Analysis (BCA) • Memorandum of Agreement between the PM/PSM and the Warfighter • Supportability Test and Evaluation inputs to the TEMP (see NAVAIR Standard Work Package 6744-0003 for more info)

• Technology Readiness Assessment • Test & Evaluation Plan	
Engineering & Manufacturing Development Requirements for MS C: • Acquisition Decision Memorandum • Acquisition Program Baseline • Acquisition Strategy • Acquisition Information Assurance Strategy • Affordability Assessment • AoA • Capability Production Document • CCA Compliance & CIO Confirmation • Consideration of Technology Issues • Cooperative Opportunities • Core Logistics/Source of Repair Analysis • Corrosion Prevention and Control Plan • Cost Analysis Requirements Description • Data Management Strategy • Exit Criteria • Industrial Base Capabilities • Independent Cost Estimate • Independent Technology Readiness Assessment • Information Support Plan • Initial Capabilities Document • Item Unique Identification Plan • Life Cycle Signature Support Plan • Life Cycle Sustainment Plan • Manpower Estimate • MDA Certification	During this phase, the Product Support Management goal is to establish a product support package to achieve the sustainment KPP and KSAs at minimum life cycle cost. Supportability requirements designed earlier in the acquisition process should be validated and those that were not defined are assessed for impact, i.e., a particular depot level repair capability to be utilized so as not to incur new facilities, equipment, tools, training, etc., requires validation if the requirements can been achieved. The Product Support Management element activities during this phase include: development/update of the Configuration Management Plan, Business Case Analysis, Product Support Plan, and Total Ownership Cost Reduction Plan. By Milestone C, the Life Cycle Sustainment Plan (LCSP) describes the content and implementation status of the product support package (including any sustainment related contracts, e.g., Interim Contractor Support, Contractor Logistics Support) to achieve the Sustainment Key Performance Parameter (KPP) / Key System Attribute (KSAs). In addition to sustaining the system performance capability threshold criteria and meeting any evolving user readiness needs, the LCSP details how the program will manage O&S costs and reduce the logistics footprint. Key Products: • Updates to CM plan • Life Cycle Sustainment Plan • Updated LCSP • Updated LA • Updated BCA • Threat assessment inputs

• MDA Assessment of Survivability • Military Equipment Validation • Net-Centric Data Strategy • OTA Report of OT&E Result • Program Protection Plan • PESHE • Spectrum Supportability Determination • System Threat Assessment • Systems Engineering Plan • Technology Development Strategy • Technology Readiness Assessment • Test & Evaluation Plan	
Production & Deployment Requirements for Full Rate Production: • Acquisition Decision Memorandum • Acquisition Program Baseline • Acquisition Strategy • Acquisition Information Assurance Strategy • AoA • Beyond LRIP Report • CCA Compliance & CIO Confirmation • Component Cost Estimate • Consideration of Technology Issues • Cost Analysis Requirements Description • Data Management Strategy (replaced by Technical Data Rights Strategy) • Economic Analysis • Exit Criteria • Independent Cost Estimate • IOT&E	During this phase the Product Support Manager, using the system performance metrics from IOT&E and other test/evaluation events, develops a detailed plan to track, forecast, monitor, maintain and improve system performance during operations and support phase. PSM activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, taking part in planning activities that may be on-going already for product improvement, and developing long term plans for improvements for both the system and its support infrastructure. After the Full Rate Production Decision Review (FRPDR) update, the LCSP describes the plans for sustaining affordable materiel availability as well as accommodating modifications, upgrades, and re-procurement. Fielding occurs during this phase and proof of early planning is now being validated as the system deploys to the operational site. Initial operating capability is executed. As the program matures, the LCSP is updated to reflect increasing levels of detail as they become available. The detail and focus will vary depending on the life-cycle phase but in all cases the information should be in sufficient depth to ensure the acquisition, design, sustainment, and user communities have an early common understanding of the sustainment requirements, approach, and associated risks. Key Products: • Product Support Arrangements • Updated LCSP

• Joint Interoperability Test Certification • Life Cycle Sustainment Plan • Manpower Estimate • Military Equipment Validation • OTA Report of OT&E Result • Post Implementation Review • PESHE • Test & Evaluation Plan	• Updated Logistics Assessment for LRIP/IOT&E • Updated BCA for Full Operating Capability (FOC) • Finalized Product Support Package
Operations & Support	The Product Support Manager's responsibility is to continue reviewing system performance while looking for opportunities to improve both the system itself and the support infrastructure to optimize cost versus availability. The LCSP should be updated for any Post-IOC Sustainment Reviews and, looking into the future, shall be updated, at a minimum every 5 years or when subsequent increments are approved and funded to reflect how the product support strategy will evolve to support multiple configurations. Significant changes may be required to the product support package to achieve the objective sustainment metrics including changes to support providers. Key Products: • Product Support Full Implementation • LCSP Updates • Logistics Assessment Updates • BCA Updates • Service Life Extension Plans • End of Life Plans

Table 1.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DI-ADMN-80222, Classified Processing Equipment Inventory
DI-ADMN-80426, Competitive Subcontracts Report (CSR)
DI-ADMN-80447A, Contract Summary Report
DI-ADMN-81401B, Contract Change Proposals (CCPS)

DI-ALSS-80728A, Depot Maintenance Production Report
DI-ALSS-81220A, End Item (EI) Production and Component Item (C/I) Consumption Repair
DI-ALSS-81529, Logistics Management Information (LMI) Data Product
DI-ALSS-81530, Logistics Management Information (LMI) Summaries
DI-ATTS-80041A, Test Requirements Document (TRD)
DI-ATTS-80281A, Test Program Set (TPS) Integration Logbook
DI-ATTS-80282B, TEST Program Set (TPS) and Operational Test Program Set (OTPS) Acceptance Test Procedures (ATPS)
DI-ATTS-80283B, Test Program Set (TPS) Acceptance Test Report (ATR)
DI-ATTS-80284B, Test Program Set Documentation (TPSD)
DI-ATTS-81268, Electronic Test Equipment Capability Requirements Summary
DI-ATTS-81270, Testability Program Plan
DI-ATTS-81271, Testability Requirements Analysis Report
DI-ATTS-81272, Inherent Testability Design and Assessment Report
DI-ATTS-81273, Test Design and Assessment Report
DI-EMCS-81777, Electromagnetic Interference Survey (EMIS) Test Report
DI-EMCS-81782, Electromagnetic Interference Survey (EMIS) Test Procedures
DI-FNCL-80448, Life Cycle Cost (LCC) and Independent Schedule Assessment (ISA) Report
DI-FNCL-80449, Design-To-Cost / Life Cycle Cost and Variance Analysis Report
DI-CMAN-80639C, Engineering Change Proposal (ECP)
DI-CMAN-80640C, Request for Deviation (RFD)
DI-CMAN-80642C, Notice of Revision (NOR)
DI-CMAN-80789, Quality Assurance Provisions
DI-CMAN-80858B, Contractor's Configuration Management Plan
DI-CMAN-80874, Configuration Data Lists (CDLS)
DI-CMAN-81022C, Configuration Audit Summary Report
DI-CMAN-81121, Baseline Description Document
DI-CMAN-81253A, Configuration Status Accounting Information
DI-CMAN-81293, Configuration Item (CI) Documentation Recommendation
DI-CMAN-81516, As Built Configuration List (ABCL)
DI-FACR-80810A, Test Facility Requirements Document (TFRD)
DI-FNCL-80165A, Cost Breakdown Structure Summary Report
DI-FNCL-80166C, Program Cost and Technical Data Reports
DI-FNCL-80342, Performance and Cost Allocation Reporting for Contractor Logistics Support (CLS) of Training Devices
DI-FNCL-80448, Life Cycle Cost (LCC) and Independent Schedule Assessment (ISA) Report
DI-FNCL-80449, Design-To-Cost / Life Cycle Cost and Variance Analysis Report
DI-FNCL-80462, Depot Maintenance Cost Report
DI-FNCL-80753A, Rework / Repair and Scrap Cost Report
DI-FNCL-80912, Performance and Cost Report
DI-FNCL-81116, Man-hour Estimate, Technical Cost Proposals
DI-FNCL-81565B, Cost Data Summary Report
DI-FNCL-81765A, Contractor Business Data Report (DD Form 1921-3)
DI-FNCL-81787, Contract Cost Report for Avails 12 Weeks or Less
DI-FNCL-81788, Contract Cost Report for Avails Greater Than 12 Weeks
DI-FNCL-81789, Cost Contract Continuous Maintenance and Emergent Work

DI-FNCL-81811, Technical Manual Cost Report
DI-HFAC-80743B, Human Engineering Test Plan
DI-HFAC-80744B, Human Engineering Test Report
DI-ILSS-80095, Integrated Logistics Support Plan
DI-ILSS-80134A, Proposed Spare Parts List
DI-ILSS-80191D, Contractor Device Performance Report
DI-ILSS-80483, Spare Parts Usage Report
DI-ILSS-80525, Logistic Support Status Report
DI-ILSS-80620, Government Furnished Equipment Repair Status Report
DI-ILSS-80806, Test, Measurement and Diagnostic Equipment Data Sheets
DI-ILSS-80833, Damaged Retrograde Screening Report
DI-ILSS-80834, Consumable Parts Bondroom / Inventory and Parts Usage Report
DI-ILSS-80835, Commercially Reworked End Items, Monthly Status Report
DI-ILSS-80868, Special Equipment Tools and Test Equipment List
DI-ILSS-80869, Special Equipment Other Provisioning Parts List
DI-ILSS-80954, Contractor Furnished (CF) Operating Space Item (OSI) Requirements Report
DI-ILSS-81042, Contractor Data Collection (CDC) Code Manual
DI-ILSS-81043, Contractor Data Collection (CDC) Program Documentation
DI-ILSS-81226, Interim Contractor Support (ICS) Parts Usage and Maintenance Data Collection Report
DI-IPSC-81316, Information Processing Equipment (IPE) Functional Configuration Audit (FCA) Plan
DI-MGMT-80227, Contractor's Progress, Status and Management Report
DI-MGMT-80368A, Status Report
DI-MGMT-80465, Due-in-From Maintenance (DIFM) Status Report
DI-MGMT-80501, Contractor's Corrective Action Plan
DI-MGMT-80606A, Contract Simulator Instruction (CSI) Summary Report
DI-MGMT-80688, Engineer Design Test Plan
DI-MGMT-80899, Hazardous Waste (HW) Report
DI-MGMT-80921, Parts Reclamation Procedures (PRP)
DI-MGMT-80933, Repair/Modification/Overhaul Status Report
DI-MGMT-80937, Coordinated Test Plan
DI-MGMT-81255, Production Status Report
DI-MGMT-81238, Contract Field Service Report
DI-MGMT-81334C, Contract Work Breakdown Structure
DI-MGMT-81398A, Hazardous Materials Management Program (HMMP) Plan
DI-MGMT-81466, “Contract Performance Report (CPR)”
DI-MGMT-81468, Contract Funds Status Report (CFSR)
DI-MGMT-81543, Government Owned Material (GOM) Status Report
DI-MGMT-81580, Contractor's Standard Operating Procedures
DI-MGMT-81596, Contractor Roster
DI-MGMT-81642, Small Business Sub-Contractor Report
DI-MGMT-81649, Preservation Team Services (PTS) Contract Cost and Hour Status Report
DI-MGMT-81650, Integrated Master Schedule (IMS) (Replaces DI-MISC-81183)
DI-MGMT-81651, Contract Invoicing and Payment Report
DI-MGMT-81793, Request Contract Change (RCC) Report

DI-MGMT-81808, Contractor's Risk Management Plan
DI-MGMT-81809, Risk Management Status Report
DI-MISC-80071E, Parts Approval Requests
DI-MISC-80072D, Program Parts Selection List (PPSL)
DI-MISC-80093, DoD Property Record (Partial)
DI-MISC-80344, Acquisition Streamlining Cost Benefit Assessment Report
DI-MISC-80759A, Contractor Validation Plan
DI-MISC-80761, Test Scheduling Report
DI-MISC-80915, Status Report for Contractor Receipt/Shipment of Foreign Military Sales (FMS) Repair/Return Assets
DI-MGMT-80920, List of Items Delivered During the Term of a CONTRACT
DI-MISC-80060, Ammunition Test Expenditure Report
DI-MISC-80591, Fire Hazard / Deficiency Inspection Report
DI-MISC-81258A, Value Engineering Program Plan
DI-MISC-81259A, Value Engineering Study Proposal
DI-MISC-81260A, Value Engineering Program Status Report
DI-MISC-81276, As-designed Parts, Materials, and Processes List (ASPMPL)
DI-MISC-81277, Parts, Materials, and Processes Selection List (PMPSL)
DI-MISC-81360, Contract Shipment Report
DI-MISC-81362, Cost Avoidance Report
DI-MISC-81364, Security Requirements List
DI-MISC-81392, Contractor Operation and Maintenance of Simulators/Equipment Management Status Report
DI-MISC-81397A, Hazardous Materials Management Program (HMMP) Report
DI-MISC-81539B, Special Test Equipment (STE) Report for Electronic Tooling Information Management System (ETIMS)
DI-MISC-81562, Temporary Non-Standard Modification Documentation and Marking Requirements for Test Equipment in Aerospace Vehicles and Related Ground Support Equipment
DI-MISC-81622, Test Problem Report (TPR)
DI-MNTY-80873, Test Program Documentation (TPD)
DI-MNTY-80993, Planned Maintenance System (PMS) Quality Assurance Check Sheet
DI-MNTY-81603, Maintainability / Testability Demonstration Test Report
DI-MNTY-81604, Maintainability / Testability Demonstration Test Plan
DI-NDTI-80566A, Test Plan
DI-NDTI-80603A, Test Procedure
DI-NDTI-80809B, Test / Inspection Report
DI-NDTI-81284, Test and Evaluation Program Plan (TEPP)
DI-NDTI-81585A, Reliability Test Plan
DI-PACK-80456, Packaging Test Plan
DI-PACK-80457, Packaging Test Report
DI-PACK-80458, Packaging Cost Analysis
DI-PACK-81059, Performance Oriented Packaging Test Report
DI-QCIC-80154A, Installation and Acceptance Test Plan (IATP)
DI-QCIC-80204, Test Elements List
DI-QCIC-80205, Ship Test Outline

DI-QCIC-80553A, Acceptance Test Plan
DI-QCIC-80736, Quality Deficiency Report
DI-QCIC-80756, Quality Engineering Inspection Requirements and Equipment List
DI-QCIC-81009, Technical Data Package Quality Control Program Plan
DI-QCIC-81110, Inspection and Test Plan
DI-QCIC-81187, Quality Assessment Report
DI-QCIC-81379, Quality System Plan
DI-QCIC-81536, Test Information Sheet (TIS)
DI-QCIC-81708, Non-Standard Part Qualification / Quality Conformance Test Plan
DI-QCIC-81722, Quality Program Plan (QPP)
DI-QCIC-81794 Quality Assurance Program Plan
DI-QCIC-81795, Software Quality Assurance Report
DI-RELI-80322, Quality Conformance Inspection and Test Procedures
DI-RELI-80670A, Reporting Results of Electrostatic Discharge (ESD) Sensitivity Tests of Electrical and Electronic Parts Assemblies and Equipment
DI-RELI-81500, Survivability Cost Effectiveness Tradeoff Studies Report
DI-SAFT-80101B, System Safety Hazard Analysis Report (SSHA)
DI-SAFT-80106B, Health Hazard Assessment Report (HHAR)
DI-SAFT-80184A, Radiation Hazard Control Procedures (RHCP)
DI-SAFT-80402, Operating Procedures for Hazardous Materials
DI-SAFT-80931B, Explosive Ordnance Disposal Data
DI-SAFT-81125, Hazard Assessment Test Report
DI-SAFT-81299B, Explosive Hazard Classification Data
DI-SAFT-81300A, Mishap Risk Assessment Report (MRAR)
DI-SAFT-81640, Ammunition Demilitarization and Disposition Plan
DI-SDMP-81748, Parts Management Plan
DI-SESS-80294B, Maintenance Test and Support Equipment Requirements List
DI-SESS-81309A, Internal Contractor Technical Data Report
DI-SESS-81359B, Parts List
DI-SESS-81625, Contractor Integrated Technical Information System Implementation Plan (CITIS-IP)
DI-SESS-81628, Reliability Development Growth Test Report
DI-SESS-81629, Reliability Development Growth Test Procedures
DI-SESS-81646, Configuration Audit Plan
DI-SESS-81704, Test Plans / Test Procedures
DI-SESS-81712, Provisioning Parts List Index (PPLI)
DI-SESS-81715, Provisioning Parts List (PPLs)
DI-SESS-81721, Part Configuration Analysis Report
DI-SESS-81734, Electronics Parts / Circuits Tolerance Analysis Report
DI-SESS-81744, Special Tooling/Special TEST Equipment (ST/STE) Information for the Air Force Equipment Management System (AFEMS)
DI-SESS-81758, Logistics Product Data
DI-SESS-81759, Logistics Product Data Summaries
DI-SESS-81771, Reuse Management Report (ReMR)
DI-TMSS-80007, Test Program Manual
DI-TMSS-81586A, Reliability Test Reports

DI-TMSS-81670A, Contractor Evaluation of Technical Publications and Recommended Changes
DI-TMSS-81711A, Automatic Test Equipment (ATE) Interface Hardware Manual
DI-TMSS-81760, Operational Test Program Instruction / Test Program Instruction (OTPI/TPI)
DI-TMSS-81805, Data Module Requirements List S1000D
DI-TMSS-81812, Technical Manual Schedule and Status Report
DI-TMSS-81817, Technical Manual Quality Assurance (TMQA) Program Plan

C. OSD Policy, Regulations and U.S. Statutes

a. U.S. Statutes
b. DoD Directives
c. DoD Instructions
d. DoD Manuals
e. Directive-Type Memorandums
f. OSD Policy Memorandums
g. Selected DoD Handbooks and Guidebooks

Note: please see the References at the end of this section for a more complete list of relevant materials.

a. U.S. Statutes

Congress has enacted a number of statutes known as United States Code (USC) to ensure availability of a ready and controlled (i.e., government owned) source of technical competence and resources for effective and timely response to a national defense contingency requirement (10 USC 2464) and that there is a balance between the private and the public sector industrial base (10 USC 2466 and 10 USC 2474). The product support strategy must ensure compliance with all statutory and regulatory requirements. There are additional important references to USC that are identified throughout this Guidebook. These legislative and statutory issues must be considered as an integral and evolving aspect of all Life-Cycle Management decisions.

- 10 U.S.C. 2399, Operational Test and Evaluation of Defense Acquisition Programs
- 10 U.S.C. 139, “Director of Operational Test and Evaluation”
- 10 U.S.C. 153, “Chairman: functions”
- 10 U.S.C. 163, “Role of Chairman of Joint Chiefs of Staff”
- 10 U.S.C. 167, “Unified Combatant Command for Joint Warfighting Experimentation: Acquisition Authority”
- 10 U.S.C. 181, “Joint Requirements Oversight Council”
- 10 U.S.C. 2244, “Equipment Scheduled for Retirement or Disposal: Limitation on Expenditures for Modifications”
- 10 U.S.C. 2320, “Rights in Technical Data”
- 10 U.S.C. 2399, “Operational Test and Evaluation of Defense Acquisition Programs”
- 10 U.S.C. 2460, “Definition of Depot-level Maintenance and Repair”
- 10 U.S.C. 2464, “Core Logistics Capabilities”

- 10 U.S.C. 2466, "Limitations on the Performance of Depot-level Maintenance of Materiel"
- 10 U.S.C. 2474, "Centers of Industrial and Technical Excellence: Designation; Public-private Partnerships"
- 10 U.S.C. 2572, "Documents, Historical Artifacts, and Condemned or Obsolete Combat Materiel: Loan, Gift, or Exchange"
- 10 U.S.C. 2576, "Excess Personal Property: Sale or Donation to Assist Firefighting Agencies"
- 15 U.S.C. 3710(i), "Utilization of Federal Technology"
- 15 CFR 774, "Commerce Control List"
- 22 CFR 121, "U.S. Munitions List"
- 40 U.S.C. 484(j)(2), "Disposal and Utilization of Surplus Federal Real Property for Educational Purposes"
- 40 U.S.C. 512(a), "Foreign Excess Property"
- 41 U.S.C. 432, "VE Procedures and Processes"
- P.L. 106–580, Dec. 29, 2000, "Federal Property and Administrative Services Act of 1949"
- P.L. 108-136, National Defense Authorization Act for FY04, Section 802, "Quality Control in the Procurement of Aviation Critical Safety Items and Related Services"
- P.L. 110-417, Section 814, "
- P.L. 111-84 National Defense Authorization Act for Fiscal Year 2010

b. DoD Directives

DoD Directive 5000.01, The Defense Acquisition System, defines the management process by which the Department of Defense provides effective, affordable, and supportable systems to the users in a timely manner. Its policy includes implementation of a Total Systems Approach as discussed in E1.1.29. Total Systems Approach for accomplishing program objectives for total life-cycle systems management, including sustainment, and implementing performance-based strategies throughout the product life cycle, as discussed in E1.1.17, Performance-Based Logistics.

c. DoD Instructions

DoD Instruction 5000.02, Operation of the Defense Acquisition System, establishes the management framework for translating capability needs and technology opportunities, based on approved capability needs, into stable, affordable, and well-managed acquisition programs. DoD Instruction 5000.02, Table E3.T1, refers to The Government Performance and Results Act (GPRA) that requires Federal Agencies acquiring Information Technology and National Security Systems to compare actual program results with established performance objectives, and the Clinger-Cohen Act requires that Federal Agencies ensure that performance measurements are prescribed for the information technology (IT) to be acquired, that these performance measurements measure how well the IT supports the programs of the Agency. As a result, a Post Deployment Performance Review (PDPR) is required for MAIS and MDAP acquisition programs at the Full-Rate Production Decision Review. An appropriately conducted PDPR can satisfy both GPRA and CCA requirements for a post deployment evaluation. This information is

also discussed in Defense Acquisition Guidebook Chapter 7 – Acquiring Information Technology and National Security Systems

d. DoD Manuals

- Department of Defense "Reliability, Availability, Maintainability, and Cost Rationale Report" Manual of 1 June 2009

e. Directive-Type Memorandums

- DTM 08-048, "Supply Chain Risk Management (SCRM) to Improve the Integrity of Components Used in DoD Systems.
- DTM 10-015 – Requirements for Life Cycle Management and Product Support, 6 Oct 10. This DTM 10-015 establishes policy to implement and institutionalize the requirements of Section 805 of the FY10 National Defense Authorization Act (Public Law 111-84), which directed a number of changes to DoD policies designed to improve weapon systems life cycle management and product support by establishing new requirements that directly impact acquisition, fielding, and sustainment decisions. The DTM states that "it is DoD policy that a mandatory Product Support Manager (PSM) position shall be identified and assigned for each ACAT I and ACAT II system and filled by a properly qualified Military Service member or full-time employee of the Department of Defense."

f. OSD Policy Memorandums

- DOT&E Memorandum, "Guidance on the use of Design of Experiments (DOE) in Operational Test and Evaluation", 19 Oct 10
- USD AT&L Policy Memo "Strengthened Sustainment Governance for Acquisition Program Reviews", 5 Apr 10
- DoD Weapon System Acquisition Reform (WSAR) Product Support Assessment (PSA), Nov 09
- USD(AT&L) Memorandum**,** "Implementing a Life Cycle Management Framework", 31 Jul 08, identified Implementing a Life Cycle Management Framework as a top priority for the DoD. This memo establishes a strategy and provides direction to achieve the following: (1) reinforce the implementation of mandatory life cycle sustainment metrics; (2) align resources to achieve readiness levels; (3) track performance throughout the life cycle; and (4) implement performance-based life cycle product support strategies;
- DUSD(L&MR) and DARA Memorandum, "Implementation of Life Cycle Sustainment Outcome Metrics Data Reporting", 11 Dec 08
- USD(AT&L) Memorandum, "Reliability, Availability, and Maintainability Policy", 21 Jul 08
- USD(AT&L) and DOT&E Memorandum, "Definition of Integrated Testing", 25 Apr 2008
- USD(AT&L) and DOT&E Memorandum, "Reliability Improvement Working Group", 15 Feb 08
- USD(AT&L) Memorandum, "Prototyping and Competition", 19 Sep 07

- USD(AT&L) and DOT&E Memorandum, "Test and Evaluation Policy Revisions", *22* Dec 07
- DUSD (L&MR) Policy Memo, "Life Cycle Sustainment Outcome Metrics", 10 Mar 07 establishes four sustainment outcome metrics for all ACAT (Acquisition Category) 1 Acquisition Programs, as well as all major legacy programs currently included in the Defense Readiness Reporting System (DRRS). The four metrics are Materiel Availability, Materiel Readiness, Ownership Cost, and Mean Down Time. In addition, Materiel Availability is also a JROC-established Key Performance Parameter (KPP) requirement; Materiel Readiness and Ownership Cost are JROC-established Key System Attribute (KSA) requirements for new acquisitions. Specific definitions of each of these four metrics are contained in the memorandum, as well as fourteen "Life Cycle Sustainment Enablers".
- OSD(AT&L) and DOT&E Memorandum, "Policy for Assessing Technical Risk of Entry into Initial Operational Test and Evaluation", 21 May 07
- DUSD(L&MR) Memo, "Resetting the Force (RESET) and Depot Maintenance Capacity and Utilization", 26 Jan 2007
- Joint Requirements Oversight Council (JROC) Memorandum 161-06, "Key Performance Parameter (KPP) Study Recommendations and Implementation", 17 Aug 06
- ASA(ALT) Memorandum, "Performance Based Logistics (PBL) for Army Working Capital Fund (AWCF) Secondary Items", 2 May 06
- USD(AT&L) Memorandum, "Performance Based Logistics (PBL) Business Case Analysis (BCA)", 23 Jan 2004
- Acting USD(AT&L) Memorandum, "Performance Based Logistics; Purchasing Using Performance Based Criteria", 16 Aug 2004
- USD(AT&L) Memorandum, "TLCSM Executive Council Meeting Report; Oct 6, 2005", 24 Oct 2005
- USD(AT&L) Memorandum, "Product Support Boundaries", 23 Sep 04
- DSD Memorandum, "Implementation of Defense Business Practice Board Recommendations on Continued Progress on Performance Based Logistics", 14 Feb 04
- USD(AT&L) Memorandum, "Transformation Through Reduction of Total Ownership Cost (R-TOC)", 16 Dec 2003
- USD(AT&L) Memorandum, "Total Life Cycle Systems Management and Performance Based Logistics", 24 Oct 03
- USD(AT&L) Total Life Cycle Systems Management and PBL Memo, 7 MAR 03 This policy memo contains a template on major actions for The Product Support Manager regarding a PBL contract development.
- USD(AT&L) Memorandum, "Performance Based Logistics", 13 Feb 02

g. Selected DoD Guidebooks and Handbooks

- Cost Analysis Improvement Group, "Operating and Support Cost-Estimating Guide", Oct 07
- Department of the Navy, "Total Ownership Cost (TOC) Guidebook", Feb 10
- Mil-HDBK-61A, "Configuration Management Guidance", 2001. Note this document is about to be cancelled and superseded

- MIL-HDBK-502, “DoD Acquisition Logistics Handbook (ALH)”, May 97

D. Who Develops, Delivers and Manages Product Support Management

Per USD(AT&L) DTM 10-015, it is DoD policy that a mandatory Product Support Manager (PSM) position shall be identified and assigned for each ACAT I and ACAT II system and filled by a properly qualified Military Service member or full-time employee of the Department of Defense.

The principal duties of The Product Support Manager are to:
a. Provide weapon systems product support subject matter expertise to the PM for the execution of the PM's duties as the Total Life Cycle Systems Manager, in accordance with DoD Directive 5000.01 (Reference (g));
b. Develop and implement a comprehensive, outcome-based, product support strategy;
c. Promote opportunities to maximize competition while meeting the objective of best-value long-term outcomes to the Warfighter;
d. Seek to leverage enterprise opportunities across programs and DoD Components;
e. Use appropriate analytical tools and conduct appropriate cost analyses, including cost-benefit analyses, as specified in Office of Management and Budget Circular A-94 (Reference (h)), to determine the preferred product support strategy;
f. Develop and implement appropriate product support arrangements;
g. Assess and adjust resource allocations and performance requirements for product support, not less than annually, to meet Warfighter needs and optimize implementation of the product support strategy;
h. Document the product support strategy in the Life Cycle Sustainment Plan (LCSP), in accordance with Reference (c);
i. Conduct periodic product support strategy reviews and revalidate the supporting business case analysis prior to each change in the product support strategy or every 5 years, whichever occurs first.

E. When Is Product Support Management Delivered and Managed in the Life Cycle

The acquisition process is structured by DoDI 5000.02 into discrete phases separated by major decision points (called milestones or decision reviews) with a number of key activities to provide the basis for comprehensive management and informed decision making. The number of phases and decision points are tailored to meet the specific needs of individual programs. This is called the "Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System" and is illustrated on the front of the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System Chart, also known as the “Wall Chart” or ILC .

Tables 2-1, 2-2, 3, 4, and 5 within DoDI 5000.02 show the information requirements for all milestones and phases, both statutory and regulatory. MDAs may tailor regulatory program information to fit the particular conditions of an individual program. Decisions to tailor regulatory information requirements shall be documented by the MDA.

This Guidebook further explains when deliverables are required during the acquisition life cycle.

F. How Product Support Management Is Developed, Established and Managed

DoDD 5000.01 establishes a simplified and flexible management framework for translating capability needs and technology opportunities, based on approved capability needs, into stable, affordable, and well-managed acquisition programs that include weapon systems, services, and Automated Information Systems (AISs). Consistent with statutory requirements, the DoDI 5000.01 authorizes Milestone Decision Authorities (MDAs) to tailor the regulatory information requirements and acquisition process procedures to achieve cost, schedule, and performance goals.

The Product Support Manager will be designated as a Key Leadership Position (KLP) for all Major Defense Acquisition Programs and major weapon systems and designated a Critical Acquisition Position (CAP) for all other major weapon systems. The Product Support Manager will be an integral part of the program management team and will report directly to the PM. The areas as identified within this Guidebook as "PSM Activities" represent functions and responsibilities which should be of high importance to The Product Support Manager. Depending on program goals and objectives, priorities and scope of work or responsibility may differ widely.

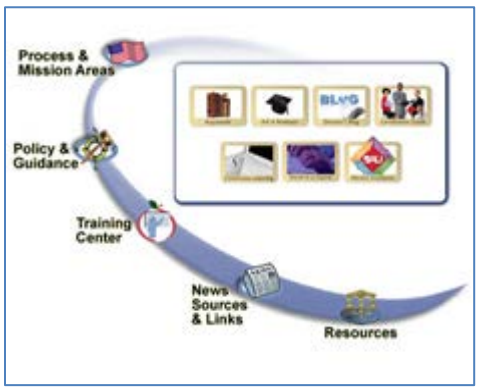
G. Communities of Interest and Practice

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- **Acquisition, Technology & Logistics Knowledge Sharing System (AKSS).** *https://akss.dau.mil* The AKSS provides links to mandatory and discretionary information and best practices for defense acquisition;
- **Acquisition Community Connection (ACC).** *https://acc.dau.mil* ACC provides information on acquisition, technology, and logistics processes. ACC has links to acquisition-related communities of practice, other special interest areas, and to the DAU Continuous Learning Center;
- **DAU Continuous Learning Center (CLC).** *http://clc.dau.mil* The CLC provides access to lessons for professional development and current information on new initiatives;
- **Defense Acquisition Policy Center.** *https://akss.dau.mil/dapc/index.html* The Acquisition Policy Center provides a tutorial, a multimedia JCIDS presentation, and copies of the latest military department, DoD 5000, and CJCS 3170 policy documents;
- PM e-Tool Kit Performance Learning Tools found at https://pmtoolkit.dau.mil/ ;
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, ACQuire Search);
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook);

- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02);
- Web enabled new JCIDS Instruction and Guidebook;
- Acquisition Community Connection (CoPs and Special Interest Areas);
- PM Certification Course materials and PM Continuous Learning Modules;
- Probability of Program Success (PoPS) Model and Service Implementations;
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation);
- DoD IG Audit Guides for Acquisition and Contracting ;
- Service and Agency PMO support sites;
- Contract Management Processes Guide ;
- Leadership Support Center (Requires ACC log-in).

The Defense Logistics Agency (DLA) provides a website called "Assist Online" which is a search engine for Data Item Deliverables, found at https://assist.daps.dla.mil/online/start/



Specific information about current budgets can be found at the website of the Office of the Undersecretary of Defense (Comptroller) at http://comptroller.defense.gov/Budget2011.html

The Product Support BCA team should use guidance from OMB Circular A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs (OMB A-94) on cost benefit analysis at all relevant points. As a general rule, the Product Support BCA team should include the following financial analysis metrics, tools, and techniques unless there is a documented rationale not to use them: Net Present Value (NPV), Payback Period, Break Even Point, Return on Investment (ROI), Internal Rate of Return (IRR), Life Cycle Cost (LCC), Time Value of Money Considerations (current or constant dollars and discounted dollars), Operating and Support (O&S) cost.

Cost analysis tools to analyze operational data can be found at the U.S. Army's Logistics Support Activity's Logistics and Engineering Support Center website at https://www.logsa.army.mil/lec/ . Their products include about 12 cost and logistics data analysis tools plus information on development of Electronic Technical Manuals.
Each year the Cost Assessment Office sponsors a Department of Defense Cost Analysis Symposium. Further information may be found at the DoD Cost Analysis Symposium web site.

The R-TOC Website at http://ve.ida.org/rtoc/rtoc.html provides information on many topics related to R-TOC management to include: templates, newsletters, policy, training resources, etc.

See also the Life Cycle Cost (LCC) section on the Logistics Community of Practice for additional references and resources, including information related to the Undersecretary of Defense for Acquisition, Technology & Logistics (AT&L) 14 Sep 10 policy memo entitled "Better Buying Power: Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending", which provides detailed and specific guidance from for achieving the efficiencies, productivity growth, and "in simple terms, to do more without more" for achieving the mandate contained in an earlier 28 June 2010 USD AT&L memo entitled "Better Buying Power: Mandate for Restoring Affordability and Productivity in Defense Spending".

DAU offers a community of practice devoted to contracting rules, regulations, training and resources. It is located at https://acc.dau.mil/cm

The DCARC, which is part of OSD Cost Assessment and Program Evaluation (CAPE), exists to collect Major Defense Acquisition Program (MDAP) cost and software resource data and make those data available to authorized Government analysts. This website is the authoritative source of information associated with the Cost and Software Data Reporting (CSDR) system, including but not limited to: policy and guidance, training materials, and data. CSDRs are DoD's only systematic mechanism for capturing completed development and production contract "actuals" that provide the right visibility and consistency needed to develop credible cost estimates. Since credible cost estimates enable realistic budgets, executable contracts and program stability, CSDRs are an invaluable resource to the DoD cost analysis community and the entire DoD acquisition community. Their website is at http://dcarc.pae.osd.mil/default.aspx

Information on Earned Value Management can be found at http://www.acq.osd.mil/pm/. This government site provides information in integrating cost, schedule and technical performance management for program managers with a focus on earned value management.

The Defense Contract Management Agency (DCMA) is the Department of Defense (DoD) component that works directly with Defense suppliers to help ensure that DoD, Federal, and allied government supplies and services are delivered on time, at projected cost, and meet all performance requirements. Their website is at http://www.dcma.mil/.

The Life Cycle Logistics Community of Practice contains a comprehensive discussion of the Logistics Assessment (LA) Logistics Assessments (LA) [ACC] as a part of the Sustainment process.

The Office of the Director, Defense Research and Engineering's website is located at http://www.acq.osd.mil/dte/ and contains policy, guidance, outreach, and other information related to Developmental Test and Evaluation.

The website of the Office of the Director, Operational Test and Evaluation is found at http://www.dote.osd.mil/index.html with news, policy, and many links to helpful information.

The Defense Acquisition University's Test & Evaluation community of practice website is at https://acc.dau.mil/t&e with links to policy, a career gateway portal, tools and other information.

The Defense Acquisition University's Acquisition Community Connection found at https://acc.dau.mil offers many website dedicated to topics of interest such as Performance Based Life Cycle Product Support, Continuous Process Improvement / Lean Six Sigma, and many other topics.

The Office of the Deputy Chief Management Office has a Continuous Process Improvement / Lean Six-Sigma Program Office, website at http://dcmo.defense.gov/ which contains many links to policy, information, guides, etc. The Lean Six Sigma Program Office uses a disciplined performance improvement methodology to improve the efficiency and effectiveness of the DoD business operations supporting the Warfighter. The office drives DoD-wide performance improvement activities; tracks results; provides training; assists the Department in establishing and growing its program; and captures the best business practices Enterprise-wide. The LSS Program Office is an enabling resource that helps DoD components achieve their goals.

DoD Maintenance Policy Programs and Resources (ADUSD(MPP&R))
The lean section of the ADUSD(MPP&R) website contains briefings on a broad range of productivity improvement initiatives in the DoD maintenance arena and hyperlinks to numerous resources regarding lean concepts and other productivity improvement tools (e.g., Six Sigma and Theory of Constraints).
http://www.acq.osd.mil/log/logistics_materiel_readiness/organizations/mppr/html/lean.htm

Air Force Material Command Lean Transformation
The AFMC Depot Maintenance Transformation (DMT) Office web site contains a variety of information on the DMT Trailblazers, material initiatives, change management information and a library of briefings. https://afkm.wpafb.af.mil/ASPs/CoP/openCoP.asp?Filter=OO-LG-CC-DM

Army Materiel Command (AMC) Lean Six Sigma
The AMC Lean Six Sigma website contains information about how AMC activities are using Lean and Six Sigma to improve productivity, decrease turnaround time and return savings to customers. http://www.amc.army.mil/LEAN/index.aspx

Marine Corps Logistics Command (LOGCOM)
The LOGCOM website contains links to productivity improvement initiatives being pursued by the Marine Corps Maintenance Centers at Albany and Barstow.
http://www.LOGCOM.usmc.mil/

Navy AIRSpeed
The Navy's AIRSpeed website contains information about AIRSpeed concepts and tools (e.g., lean six sigma and theory of constraints) and links to other AIRSpeed-related sites.
https://logistics.navair.navy.mil/airspeed/index.cfm

- The security assistance owners are at Defense Institute of Security Assistance Management (DISAM) at http://www.disam.dsca.mil/ ;
- The DoD Security Cooperation Agency maintains a website at http://www.dsca.osd.mil/samm/ containing the Security Assistance Management Manual and DoD Security policy documents.

The Department of Defense established DSCA as a separate agency to direct, administer, and supervise security assistance programs. DSCA receives policy direction, as well as staff supervision, from the Assistant Secretary of Defense for International Security Affairs, which in turn is directed and supervised by the Under Secretary of Defense for Policy.

DSCA administers programs in the Arms Export Control Act (P.L. 90-269, or the AECA) and part II of the Foreign Assistance Act of 1961 (P.L. 87-195, or the "FAA"). These include:

- Sales of defense articles, training and services under the Foreign Military Sales (FMS) program *(Section 524 FAA; Sections 21-40A, AECA)*;
- Drawdowns of defense articles, training and services *(Section 506 FAA)*;
- Grants and sales of Excess Defense Articles (EDA) *(Section 516 FAA)*;
- Leases of defense articles *(Sections 61-64 AECA)*;
- Funding of FMS purchases through the Foreign Military Financing (FMF) program *(Section 23 AECA)*; and
- Funding of training through the International Military Education and Training (IMET) program *(Sections 541-546 FAA)*.

H. Lessons Learned / Best Practices

The Defense Acquisition University's Best Practices Clearinghouse. This clearinghouse is found at https://acc.dau.mil/bpch or at https://bpch.dau.mil. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;

- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

Practice Name: **Technical Performance Measurement, Practice Summary:** Measurement approach that compares actual versus planned performance on technical development and design. It helps balance cost and schedule throughout the lifecycle, found at https://bpch.dau.mil

Practice Name: **Integrated Developmental Test and Operational Test (DTOT)**. The Defense Acquisition Guidebook (DAG) recommends that, whenever possible, Developmental Test and Operational Test events should be combined to achieve the most benefit for the test effort spent. The DAG notes that this implies that "the user community needs to be involved early in test planning," to make sure that the user needs for the final system are understood and tested realistically.

Practice Name: **Proper verification and validation of product design**. Verification and validation of product design, early in the development lifecycle, is necessary to ensure that design changes do not adversely impact the production process and program cost. The appropriate mix of design verification and validation activities (e.g., critical design review) must be balanced with the program goals (e.g., cost, schedule) and product characteristics / requirements (e.g., complexity, safety) to ensure that technical problems are uncovered early and do not lead to costly retrofits and redesign of the production versions since these lead to increasing the product cost and significantly moving out the schedule.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices

PSM Guidebook, especially Appendix B, "Typical Supporting Performance Metrics" and Appendix I, "Sustainment Maturity Levels"

As part of the Reduction of Total Ownership Costs (R-TOC) Program, the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics/Systems and Software Engineering has developed a template that could be used as a guideline in the development of a CAIV implementation plans. The use of this template is optional. The template may be found at the DoD R-TOC web site. This web site is restricted to .mil users; the template is designated as "For Official Use Only." Per the OSD R-TOC Program, the best practices are organized in six sections, http://ve.ida.org/rtoc/open/bestpractices.html . The first three sections describe innovative practices in the area of R-TOC management, discuss some innovative efforts by Pilot Programs to develop new R-TOC assessment tools, and describe acquisition practices that can

help reduce TOC. The last three sections present best practices in the three primary R-TOC focus areas: reliability and maintainability improvements, supply chain response time improvements and footprint reduction, and competitive product support.

The reader should also consider risk management references such as DAU's Risk Management Guide for DoD Acquisition, Jun 2003

Best Practice: Maintain a firm baseline for operational and system requirements, Practice Summary: Measurable requirements and a firm baseline are required for managing expectations and facilitate the integration of subsystems. Found at http://bpch.dau.mil.

The U.S. General Services Administration (GSA) hosts a website focusing on best practices primarily related to contracting and procurement of Federal Agencies, with the DoD being heavily represented. This site is at http://www.thecre.com/fedlaw/legal25/1008.htm

American National Standards Institute (ANSI) /EIA 748-98, http://www.assistdocs.com

DAU Earned Value Management *Gold Card*, January 2009

DoD DCMA *EVM Implementation Guide*, December 2006

I. Training Resources

1.11.1. Defense Acquisition University (DAU) Courses
1.11.2. Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System Chart
1.11.3. DAU Acquipedia Articles
1.11.4. Additional DoD Training Resources

12.1 Defense Acquisition University (DAU) Courses

Note: The reader can view short videos and get additional details on all elements of DAU's knowledge sharing tools at http://www.dau.mil/images/Pages/Knowledge_Sharing.aspx.

12.1.1.1 DAU iCatalog

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

- DoD 5000 Tutorial plus other subjects such as the PPBES process, Life Cycle Wall Chart, etc. Can be found at https://dap.dau.mil/policy/Pages/overview.aspx
- LOG 101 Acquisition Logistics Fundamentals
- LOG 102 Systems Sustainment Management Fundamentals
- LOG 200 Intermediate Acquisition Logistics Part A

- LOG 201 Intermediate Acquisition Logistics Part B
- LOG 204 Configuration Management
- LOG 235 PBL Online Course
- LOG 350 Enterprise Life Cycle Logistics Management
- ACQ 101 Fundamentals of Systems Acquisition Management
- ACQ 201A Intermediate Systems Acquisition, Part A
- ACQ 201 Intermediate Systems Acquisition, Part B
- BCF 106 Fundamentals of Cost Analysis
- BCF 107 Applied Cost Analysis
- BCF 204 Intermediate Cost Analysis
- BCF 206 Cost/Risk Analysis
- BCF 208 Software Cost Estimating
- BCF 209 Acquisition Reporting for MDAPs and MAIS
- BCF 215 Operating and Support Cost Analysis
- CLB 007 Cost Analysis
- CLB 009 Planning, Programming, Budgeting, and Execution and Budget Exhibits
- CLB 011 Budget Policy
- CLB 024 Cost Risk Analysis Introduction
- CLB 028 Software Cost Estimating
- CLC 013 Performance-Based Services Acquisition
- CLC 026 Performance-Based Payments Overview
- CLC 037 A-76 Competitive Sourcing Overview
- CLC 045 Partnering
- CLC 112 Contractors Accompanying the Force
- CLE 001 Value Engineering
- CLE 004 Introduction to Lean Enterprise Concepts
- CLE 008 Six Sigma: Concepts and Processes
- CLE 007 Lean Six Sigma for Manufacturing
- CLE 008 Six Sigma: Concepts and Processes
- CLE 023 Modeling and Simulation for Test and Evaluation
- CLE 063 Capability Maturity Model-Integration (CMMI)
- CLE 201 ISO 9000:2000
- CLL 004 Life Cycle Logistics For The Rest of US
- CLL 011 Performance-Based Logistics
- CLL 014 Joint Systems Integrated Support Strategies (JSISS)
- CLL 015 Business Case Analysis
- CLL 019 Technology Refreshment Planning
- CLL 020 Independent Logistics Assessments
- CLM 014 IPT Management and Leadership
- CLM 016 Cost Estimating
- CLM 021 Introduction to Reducing Total Ownership Costs (R-TOC)
- CLM 029 Net-Ready Key Performance Parameter (NR-KPP)
- CON 110 Mission-Support Planning
- CON 214 Business Decisions for Contracting

- PMT 250 Risk Management
- PMT 401 Program Manager's Course
- PMT 402 Executive Program Manager's Course
- PQM 101 Production, Quality, and Manufacturing Fundamentals
- PQM 301 Advanced Production, Quality, and Manufacturing
- PQM 103 Defense Specification Management
- SYS 101 Fundamentals of Systems Planning, Research, Development and Engineering
- SYS 202 Intermediate Systems Planning, Research, Development and Engineering, Part I
- TST 102 Fundamentals of Test and Evaluation
- TST 203 Intermediate Test and Evaluation
- TST 303 Advanced Test and Evaluation
- LOG 102 Systems Sustainment Management Fundamentals

12.1.1.2 DAU International Acquisition Career Path (IACP) Training

Listed below are the entry level (I), intermediate level (II), and advanced level (III) International Acquisition Career Path courses offered at the Defense Acquisition University. For a description of IACP, read the New Career Path Recognizes Global Scope of Acquisition - International Acquisition Career Path article in the Defense AT&L magazine - January-February 2009.

DAU's International Acquisition Career Path consists of:

- Level I - CLI 001- International Armaments Cooperation (IAC), Part 1
- Level I - CLI 002- International Armaments Cooperation (IAC), Part 2
- Level I - CLI 003- International Armaments Cooperation (IAC), Part 3
- Level II - CLI 004 - Information Exchange Program (IEP), DoD Generic Research, Development, Test, and Evaluation (RDT&E)
- Level II - CLI005 - Information Exchange Program (IEP), Army-Specific Research, Development, Test, and Evaluation (RDT&E)
- Level II - CLI006 - Information Exchange Program (IEP), Navy-Specific Research, Development, Test, and Evaluation (RDT&E)
- Level II - CLM 036 - Technology Transfer and Export Control Fundamentals
- Level II - PMT 202 - Multinational Program Management
- Level II - PMT 203 - International Security and Technology Transfer/Control
- Level III - PMT 304 Advanced International Management Workshop

12.1.1.3 Rapid Deployment Training describes updates to DoDI 5000.02

12.2 Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System Chart

The Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System Chart, also informally called the “Wall Chart”, is a training aid for Defense Acquisition University (DAU) courses. It serves as a pictorial roadmap of key activities in the systems acquisition processes.

The chart illustrates the interaction of the three-key processes that must work in concert to deliver the capabilities required by the Warfighter: the requirements process (Joint Capabilities Integration &Development System [JCIDS]); the acquisition process (Defense Acquisition System); and program and budget development (Planning, Programming, Budgeting, and Execution [PPBE] process).

This chart, both front and back, is a "must read" for all DoD Community members involved with Acquisition and Support. A graphic representation of the front and back of the chart is below. The website is at https://ilc.dau.mil/html/ILC_Main.htm. On-line the Chart is interactive and the student can electronically "drill down" into its many sections.

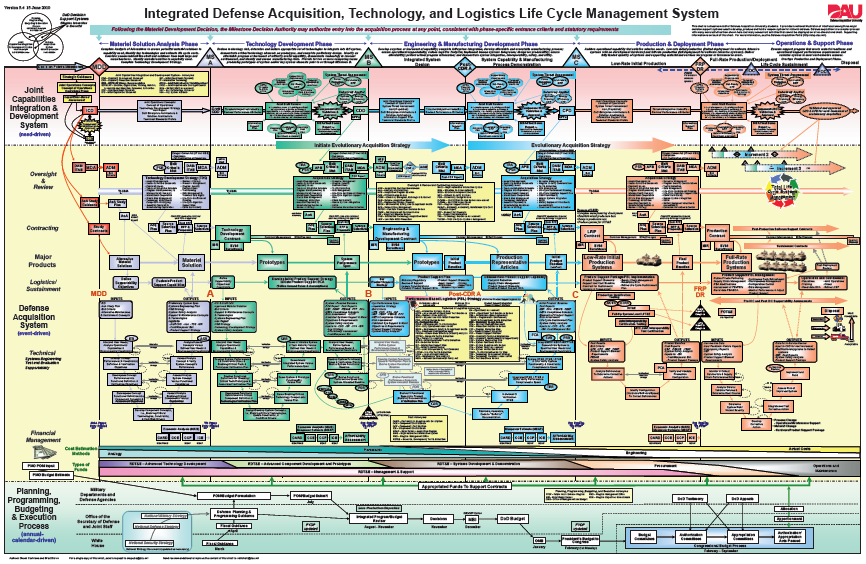


Figure 1.11.2.F1. Front of System Chart.

Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System

1. INTRODUCTION. The Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System Chart is a training aid for Defense Acquisition University (DAU) courses. It serves as a pictorial roadmap of key activities in the systems acquisition processes. The chart illustrates the interaction of the three-key processes that must work in concert to deliver the capabilities required by the warfighter: the requirements process (Joint Capabilities Integration & Development System [JCIDS]); the acquisition process (Defense Acquisition System); and program and budget development (Planning, Programming, Budgeting, and Execution [PPBE] process). These three major decision support systems are illustrated in the top left frame of this chart. This chart is based on policies and guidance from the following federal and Departments of Defense (DoD) documents and Web sites:

- **DoD Directive 5000.01.** *The Defense Acquisition System*, May 12, 2003
- **DoD Instruction 5000.02.** *Operation of the Defense Acquisition System*, Dec. 8, 2008
- **Defense Acquisition Guidebook (DAG).** *https://dag.dau.mil*
- **CJCS Instruction 3170.01G.** *Joint Capabilities Integration and Development System*, Mar 1, 2009
- **JCDC Manual** *Operation of the Joint Capabilities Integration and Development System*, July 31, 2009
- **CJCS Instruction 6212.01E.** *Interoperability & Information Technology and National Security Systems*, Dec. 15, 2008
- The following Internet sites provide additional information:
  - **Acquisition Community Connection (ACC).** *https://acc.dau.mil*. ACC provides information on acquisition, technology, and logistics processes. ACC has links to acquisition-related communities of practice, other special interest areas, and to the DAU Continuous Learning Center.
  - **DAU Continuous Learning Center (CLC).** *http://clc.dau.mil*. The CLC provides access to lessons for professional developments and current information on new initiatives.
  - **Defense Acquisition Portal.** *http://dap.dau.mil*. One-stop source for acquisition information and tools.
- **Directive-Type Memorandum (DTM) 09-027 - Implementation of the Weapon Systems Acquisition Reform Act of 2009.**
- **Federal Acquisition Regulation (FAR), Defense Federal Acquisition Regulation Supplement (DFARS), and Procedures, Guidance, and Information (PGI).** *http://www.acq.osd.mil/dpap/*

2. ACQUISITION PROCESS. The acquisition process is structured by DoD 5000.02 into discrete phases separated by major decision points (called milestones or decision reviews) with a number of key activities so provide the basis for comprehensive management and informed decision making. The number of phases and decision points are tailored to meet the specific needs of individual programs. This is called the "Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System" and is illustrated on the front of this chart.

Acronyms List

BES	Budget Estimate Submission	IOC	Initial Operational Capability
DAES	Defense Acquisition Executive Summary	IOT&E	Initial Operational Test and Evaluation
DCMA	Defense Contract Management Agency	OASD(NII)	Office of the Assistant Secretary of Defense for Networks and Information Integration
DISA	Defense Information Systems Agency	PPBE	Planning, Programming, Budgeting, and Execution
DOT&E	Director, Operational Test and Evaluation	P-CDRR	Post-Critical Design Review Assessment
DOTMLPF	Doctrine, Organization, Training, Material, Leadership and Education, Personnel, and Facilities	POM	Program Objectives Memorandum
EWMS	Earned Value Management System	R&D	Research and Development
FOT&E	Follow-On Operational Test and Evaluation	T&E	Test and Evaluation
JCIDS	Joint Capabilities Integration and Development System		
JITC	Joint Interoperability Test Command		

Figure 1. **Requirements for Milestone/Decision Reviews**

Figure 1.11.2.F2. Back of System Chart.

12.3 DAU Acquipedia Articles

The Defense Acquisition University hosts an "Acquipedia" site features articles written by leading subject matter experts in the field. Areas of topic study include:

Note: these buttons are active hyperlinked to the DAU Acquipedia site.

There are currently 263 total articles. Life Cycle Logistics article titles are listed below and hyperlinked to the DAU Acquipedia site.

- **Administrative Delay Time**
- **Alternative Maintenance & Sustainment Concepts**
- **Availability Key Performance Parameter (KPP)**
- **Business Case Analysis**
- **Condition Based Maintenance Plus (CBM+)**
- **Configuration Management**
- **Corrective Maintenance Time**
- **Demonstrate Product Support Capability**
- **Develop Initial Product Support Strategy**
- **Diminishing Manufacturing Sources and Material Shortages (DMSMS)**
- **Disposal**
- **DoD Logistics Human Capital Strategy (HCS)**
- **Elements of Product Support**
- **Evaluate Product Support Capabilities**
- **Failure Modes & Effects Analysis (FMEA)**
- **Failure Modes Effects & Criticality Analysis (FMECA)**
- **Failure/Fault Tree Analysis (FTA)**
- **Item Unique ID (IUID)**
- **Level of Repair Analysis (LORA)**
- **Life Cycle Logistics Career Field**
- **Life Cycle Sustainment Outcome Metrics**
- **Life Cycle Sustainment Plan (LCSP)**
- **Maintainability Demonstration (M-Demo)**
- **Maintenance Plan**
- **Maintenance Planning**
- **Maintenance Task Analysis (MTA)**
- **Materiel Availability**
- **Mean Time Between Failure (MTBF)**
- **Modeling & Simulation (M&S) for Logistics: Advantages and Disadvantages of using M&S**
- **Modeling & Simulation (M&S) for Logistics: Classes of M&S**

- **Modeling & Simulation (M&S) for Logistics: Hierarchy of M&S**
- **Modeling & Simulation (M&S) for Logistics: M&S Verification, Validation, and Accreditation**
- **Modification Management**
- **Operations and Sustainment**
- **Ownership Cost Key System Attribute (KSA)**
- **Performance-Based Logistics (PBL)**
- **Post Deployment Review**
- **Post IOC Supportability**
- **Post Production Software Support Contract**
- **Pre-IOC Supportability Assessment**
- **Product Support Integrator (PSI)**
- **Product Support Manager (PSM)**
- **Product Support Package / PBL Implementation**
- **Product Support Package / PBL Management**
- **Product Support Plan (PSP)**
- **Reliability Centered Maintenance (RCM)**
- **Reliability Key System Attributes (KSA)**
- **Set Product Support Strategy**
- **Supportability Analysis**
- **Supply Chain Management (SCM)**
- **Supportability Objectives (Define/Refine)**
- **Value Engineering Change Proposal (VECP)**

12.4 Additional DoD Training Sources

The CPI/LSS Program Office offers training to DoD employees at the Community of Practice website on the secure Defense Knowledge Online (DKO): https://www.dko.mil (requires DKO account*), then https://www.us.army.mil/suite/page/574292. Click on "Training" in the left menu bar to go to the Training page and then click on "Training Schedule" to view our class schedule for FY 2010. To register for a class, click Course Registration form, then complete and return to dodcpi@osd.mil.

For more OSD training / certification information, please contact: dodcpi@osd.mil or visit the Community of Practice website on the secure Defense Knowledge Online (DKO): http://www.dko.mil (requires DKO account*), then go to https://www.us.army.mil/suite/page/574292.

Army Logistics University (ALU), Operations Research/ Systems Analysis (ORSA) Familiarization Course; http://www.almc.army.mil/.

J. Key References

Note: these references are listed alpha-numerically and by DoD Component

- CJCSM 3170.01G, “Joint Capabilities Integration and Development System”
- CJCS Instruction 6212.01E, “Interoperability of Information Technology and National Security Systems”
- Defense Federal Acquisition Regulation Supplement (DFARS) clauses 252.234-7001 and 252.234-7002 to place the Earned Value Management System (EVMS)
- DoDM 4160.28-M, “Defense Demilitarization”, Volumes 1-3, provides guidance on the DoD’s “Sales / Resource Recovery and Recycling Program”. All installations, worldwide, shall have recycling programs as required by Executive Order 12780. Pursuant to Public Law 97-214 (10 USC 2577), and DoD Instruction (DoDI) 4715.4
- DoD 4500.9-R (Part II) (reference (q)). Disposal procedures are in DoD 4160.21-M, Chapter 10). Also see DLA Disposition Services at http://www.drms.dla.mil/index.shtml.
- DoD 5000.04-M-1, “Cost and Software Data Reporting (CSDR) Manual”
- DoD Manual 5105.38M, “Security Assistance Management Manual”
- DoD Manual 5220.22-M, “National Industrial Security Program (NISP) Operating Manual”
- DoDD 2010.9, “Acquisition and Cross-Servicing Agreements”
- DoDD 3200.11, Major Range and Test Facility Base (MRTFB)
- DoDD 5000.01, 12 May 2003, “The Defense Acquisition System”
- DoDD 5000.04, “Cost Analysis Improvement Group (CAIG)”
- DoDD 5010.42, “DoD-Wide Continuous Process Improvement (CPI)/Lean Six Sigma (LSS) Program”, May 15, 2008
- DoDD 5107.71, “Department of Defense Test Resource Management Center (TRMC)”DoDI 5200.39, “Critical Program Information (CPI) Protection Within the Department of Defense”
- DoDD 5250.01, “Management of Signature Support Within the Department of Defense”
- DoDD 7045.14. “The Planning, Programming, and Budgeting System (PPBS)”DoDI 7041.3, “Economic Analysis for Decision Making”
- DoDD 7045.20, 25 September 2008, “Capability Portfolio Management”
- DoDI 5000.02, 2 December 2008, “Operation of the Defense Acquisition System”
- DoDI 5200.39, “Critical Program Information (CPI) Protection Within the Department of Defense”
- DoDI 7043.3, “Economic Analysis for Decision Making”
- Department of Defense Regulation 5200.1–R, “Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs”
- DoD Strategic Sustainability Plan
- Executive Order (EO) 12958, “Classified National Security Information”
- Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS) guidance for contracting
- DoD 5000.4-M, “Cost Analysis Guidance and Procedures”
- Financial Management Regulation, volume 12 chapter 23, various places throughout
- Executive Order (EO) 13423, "Strengthening Federal Environmental, Energy, and Transportation Management”
- FY 2010 NDAA Sec. 805, “Life Cycle Management and Product Support”

- GEIA-STD-0007, “Logistics Products Data”
- IEEE Standard 828-2005, “CM Software”
- Joint Capabilities Integration and Development System Instruction 3170.01G
- Joint Publication 4.0, “Joint Logistics”, 18 July 2008
- MIL-HDBK-502, “DoD Acquisition Logistics Handbook (ALH)”
- MIL-HDBK 61B, “Configuration Management Guidance”, also includes the “ECP Management Guide”
- MIL-STD-882D, "DoD Standard Practice for System Safety"
- P.L. 106–580, Dec. 29, 2000, “Federal Property and Administrative Services Act of 1949”
- P.L. 108-136, National Defense Authorization Act for FY04, Section 802, “Quality Control in the Procurement of Aviation Critical Safety Items and Related Services”
- P.L. 110-417, Section 814, “
- P.L. 111-84 National Defense Authorization Act for Fiscal Year 2010
- 10 U.S.C. 139, “Director of Operational Test and Evaluation”
- 10 U.S.C. 153, “Chairman: functions”
- 10 U.S.C. 163, “Role of Chairman of Joint Chiefs of Staff”
- 10 U.S.C. 167, “Unified Combatant Command for Joint Warfighting Experimentation: Acquisition Authority”
- 10 U.S.C. 181, “Joint Requirements Oversight Council”
- 10 U.S.C. 2244, “Equipment Scheduled for Retirement or Disposal: Limitation on Expenditures for Modifications”
- 10 U.S.C. 2399, “Operational Test and Evaluation of Defense Acquisition Programs”
- 10 U.S.C. 2460, “Definition of Depot-level Maintenance and Repair”
- 10 U.S.C. 2464, “Core Logistics Capabilities”
- 10 U.S.C. 2466, “Limitations on the Performance of Depot-level Maintenance of Materiel”
- 10 U.S.C. 2474, “Centers of Industrial and Technical Excellence: Designation; Public-private Partnerships”
- 10 U.S.C. 2572, “Documents, Historical Artifacts, and Condemned or Obsolete Combat Materiel: Loan, Gift, or Exchange”
- 10 U.S.C. 2576, “Excess Personal Property: Sale or Donation to Assist Firefighting Agencies”
- 15 U.S.C. 3710(i), “Utilization of Federal Technology”
- 15 CFR 774, “Commerce Control List”
- 22 CFR 121, “U.S. Munitions List”
- 40 U.S.C. 484(j)(2), “Disposal and Utilization of Surplus Federal Real Property for Educational Purposes”
- 40 U.S.C. 512(a), “Foreign Excess Property”
- 41 U.S.C. 432, “VE Procedures and Processes”

DoD Guidebooks and Miscellaneous

- FED-STD-5F, “Standard Guides for Preparation of Proposed Item Logistics Data Records”

- Manual for the Operation of the Joint Capabilities Integration and Development System, February 2009.
- JCIDS Manual, "Operation of the Joint Capabilities Integration and Development System"
- "Risk Management Guide for DoD Acquisition", 6th Edition, Version 1, August 2006
- PBL Toolkit (12 step Framework Online)
- DoD Integrated Defense Acquisition, Technology and Logistics Life Cycle Management System, also known as the "Wall Chart" or ILC . Don't forget to review the page of the chart for key references, definitions, etc.
- Performance Based Logistics: A Program Manager's Product Support Guide 2005
- Product Support for the 21st Century - A Guide to Buying Performance
- Designing and Assessing Supportability in DoD Weapon Systems: A Guide to Increased Reliability and Reduced Logistics Footprint, 24 Oct 03
- OSD (AT&L) Total Life Cycle Systems Management and PBL Template
- Product Support Boundaries dtd 1 Aug 04
- Defense Acquisition Guidebook (DAG), emphasis on Chapter 5
- SD-15, "Performance Specifications Guide"
- DAU's "Acquisition Logistics Guidebook"
- DoD Handbook, "Acquisition Logistics"
- DoD Product Support Business Case Analysis Guidebook
- Business Case Development Guide, Template, and Spreadsheets.
- "DoD Integrated Product and Process Development Handbook", August 1998
- "DoD Rules Of The Road, A Guide For Leading Successful Integrated Product Teams", Revision 1, October 1999
- The DLA Life Cycle Logistics Assessment (LA) Guidebook guides DLA Weapon System Support Managers (WSSMs), Weapons System Program Managers (WSPMs) and other DLA lead Program Manager (PM) Program Executive Office (PEO)/customer representative engagement with the Services' Life Cycle Logistics management process.
- Joint Aeronautical Logistics Commanders' Aviation Critical Safety Items (CSIs) Handbook
- Joint Publication 1-02, "DOD Dictionary of Military and Associated Terms"
- Joint Service Guide for Aviation Post Production Support Planning, Oct 97
- Joint Service instruction, "Management of Aviation Critical Safety Items, "Defense Acquisition University "Test and Evaluation Management Guide", Jan 2005
- Office of the Director, International Cooperation, USD(AT&L), "International Armaments Cooperation Handbook", April 2010
- "Department of Defense Reliability, Availability, Maintainability, and Cost (RAM-C) Rationale Report Manual", 2009
- Briefing, Alan Estevez (ASD(L&MR)), "Logistics Reset Sustainment", Mar 12, 2008
- Office of Management and Budget Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs", as well as other appropriate DoD and Service guidance consistent with Public Law 111-84
- OMB Circular A-131, "Value Engineering"
- Unified Facilities Criteria (UFC), http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

- CRS Report for Congress, "Demilitarization of Significant Military Equipment", October 30, 2006
- "Incorporating Test and Evaluation into Department of Defense Acquisition Contracts", DoD Guidebook
- DoD Systems and Software Engineering, "Defense Acquisition Program Support Methodology", V2.0
- "Test and Evaluation Policies and Practices: A New Emphasis", Darlene Mosser-Kerner, Office of the Deputy Director, Developmental Test and Evaluation, Office of the Secretary of Defense, Washington, D.C., ITEA Journal 2008; 29: 157–159
- U.S. Navy's Navy Historical Center, website at http://www.history.navy.mil/faqs/faq128-1.htm
- USD (AT&L), "Rules of the Road, A Guide for Leading Successful Integrated Product Teams"
- ANSI/EIA-649-1998, "National Consensus Standard for Configuration Management"
- ANSI-EIA-649, "National Consensus Standard for CM"
- ANSI/EIA-748, "Earned Value Management Systems"
- EIA-836A, "Configuration Management Data Exchange and Interoperability"

U.S. Air Force

- AFI 63-101, "Acquisition and Sustainment Life Cycle Management"
- AFI 63-1101, "Modification Management"
- AF PAMPHLET 63-128, "Guide to Acquisition and Sustainment Life Cycle Management, explains the materiel fielding process and responsibilities directed in Chapter 3 of AFI 63-101, *Acquisition and Sustainment Life Cycle Management*. It describes a collaborative process designed to ensure the seamless and transparent transition of Air Force materiel from product development and manufacturing entities to operational users in the field.
- The Air Force Logistics Assessment (LA) Handbook Version 1.0 outlines the step-by-step process and offers extensive program evaluation criteria that can be used to conduct formal assessments of a program's product support planning and implementation. It includes information to help assessors focus on metrics and documentation most relevant to logistics planning and performance-based logistics (PBL) arrangements.

U.S. Army

- 2010 Army Posture Statement, https://secureweb2.hqda.pentagon.mil/vdas_armyposturestatement/2010
- AE PAM 220-5, "Commander's Checklist for Restructuring / Rebasing"
- AR 70-1, " Army Acquisition Policy"
- AR 71-9, "Warfighting Capabilities Determination"
- AR 73–1, "Test and Evaluation Policy"
- AR 700-127, "Integrated Logistics Support"
- AR 700–142, "Instructions for Materiel Release, Fielding and Transfer"
- DA PAM 73-1, "Test and Evaluation in Support of Systems Acquisition"

- DA PAM 700-56, “Logistics Supportability Planning and Procedures in Army Acquisition”
- Army Logistics Assessment (LA) Checklist provides a comprehensive Army checklist for conducting Independent Logistics (Logistician's) Assessment (LA).
- Army Depot Maintenance Enterprise Strategic Plan 2008 – 2025, April 2008
- US Army Cost and Economic Analysis Center (CEAC), “Army Economic Analysis Manual”

U.S. Navy

- Navy NAVSO P-3692 Independent Logistics Assessment Handbook, DTD Sep 06 is the Navy’s standard for continuing assessment of logistics.
- Department of the Navy (DoN) Guide for Developing Performance Based Logistics (PBL) Business Case Analyses, DTD 6 Nov 07
- SECNAV Manual 5210.1, Department of the Navy, Navy Records Management Program

U.S. Marine Corps

- 16-99 CMD MARCORSYSCOM, “Exchange of Equipment”
- MCO 4540.2, “USMC Acquisition Procedures Handbook”

2.0 Design Interface
2.0.1 Objective
2.0.2 Description
Product Support Manager Activities
Design Interface in the Life Cycle
A. Purpose
B. Data Item Description (DID) Deliverables
C. OSD Proponency, Policy, Regulations and Statutes
D. Who Develops, Delivers and Manages Design Interface
E. When Is Design Interface Delivered and Managed in the Life Cycle
F. How Design Interface Is Developed, Established and Managed
G. Communities of Interest and Practice
H. Lessons Learned / Best Practices
I. Training Resources
J. Key References

2.0. Design Interface

2.0.1. Objective

Participate in the systems engineering process to impact the design from its inception throughout the life-cycle, facilitating supportability to maximize the availability, effectiveness and capability of the system at the lowest TOC.

2.0.2. Description

Design interface is the integration of the quantitative design characteristics of systems engineering (reliability, maintainability, etc.) with the functional Integrated Product Support Elements (i.e., Integrated Product Support Elements). Design interface reflects the driving relationship of system design parameters to product support resource requirements. These design parameters are expressed in operational terms rather than as inherent values and specifically relate to system requirements. Thus, product support requirements are derived to ensure the system meets its availability goals and design costs and support costs of the system are effectively balanced. The basic items that need to be considered as part of design interface include:

- Reliability
- Maintainability
- Supportability
- IPS Elements
- Affordability
- Configuration Management
- Safety requirements
- Environmental and HAZMAT requirements
- Human Systems Integration
- Calibration
- Anti-Tamper

- Habitability
- Disposal
- Legal requirements

Product Support Manager Activities

2.1 Design for Suitability

Suitability is the measure of an item's ability to be supported in its intended operational environment. Measures of suitability typically relate to readiness or operational availability, and hence reliability, maintainability, and the item's support structure. Suitability measures will be reflected in Warfighter requirements, key performance parameters, key sustainment attributes, or other subordinate metrics. In designing for suitability, the PSM or Life Cycle Logistician (LCL) works as part of the systems engineering team early in the acquisition cycle to model and forecast the impact which the design of the system will have on these suitability measures.

2.1.1 Reliability

Reliability is defined as the ability of a system or component to perform its required functions under stated conditions for a specified period of time. It is often measured as a probability of failure or a measure of availability.

2.1.1.1 Fault Tree Analysis

A Fault Tree Analysis (FTA) analyzes high-level failures and identifies all lower-level (sub-system) failures that cause it. Generally, the undesired event constitutes the highest level (top) event in a fault tree diagram and represents a complete or catastrophic failure of the system.

2.1.1.2 Reliability Block Diagrams

A reliability block diagram (RBD) is a drawing and calculation tool used to model complex systems. An RBD is a series of images (blocks) representing portions of a system. Once the images (blocks) are configured properly and image data is provided, the failure rate, MTBF, reliability, and availability of the system can be calculated. As the configuration of the diagram changes, the calculation results also change. Reliability block diagrams often correspond to the physical arrangement of components in the system.

2.1.1.3 Failure Modes and Effects Criticality Analysis (FMECA)

FMECA is a methodical process that provides identification of all the probable ways that parts, assemblies, and the system may fail, the causes for each failure, and the effect that the failure will have on the capability for the system to perform its mission is essential in the system design process.

2.1.2 Availability

Availability is a measure of the degree to which an item is in an operable state and can be committed at the start of a mission when the mission is called for at an unknown (random) point in time. Availability as measured by the user is a function of how often failures occur and corrective maintenance is required, how often preventative maintenance is performed, how quickly indicated failures can be isolated and repaired, how quickly preventive maintenance tasks can be performed, and how long logistics support delays contribute to down time.

Availability has been designated as the Sustainment Key Performance Parameter. The Sustainment (Availability) KPP is required for all Acquisition Category (ACAT) I programs requiring a materiel solution; for ACAT II and below programs, the sponsor will determine the applicability of this KPP. The Availability KPP has two components, Materiel Availability (A_M) and Operational Availability (A_O).

Materiel Availability (A_M) is defined as, "Percentage of the total inventory of a system operationally capable (ready for tasking) of performing an assigned mission at a given time, based on materiel condition. Development of the Materiel Availability metric is a program manager (PM) responsibility." A_M measures the percentage of systems in operational use. This measure provides a meaningful snapshot of the overall efficiency of the program elements to provide the necessary capability to the Warfighter. Also note the difference between A_M and A_O. The A_M measurement applies to all end items acquired throughout their life cycle, while A_O applies to end items in the operational environment only – excluding float / spare systems, systems at depot for overhaul or repair, and systems that have not been operationally assigned. For a more in-depth discussion of Materiel Availability, see the Acquipedia article "Materiel Availability Key Performance Parameter." (Number of Operational End Items/Total Population).

Operational Availability (A_O) is the degree (expressed as a decimal between 0 and 1, or the percentage equivalent) to which one can expect a piece of equipment or weapon system to work properly when it is required—or, the percent of time the equipment or weapon system is available for use. (Uptime/Uptime + Downtime). A_O is the probability that a system or equipment, when used under stated conditions in an actual operational environment, will operate satisfactorily when called upon. It is expressed as

A_O = uptime divided by total time.

2.1.3 Maintainability

Maintainability is the ability of an item to be retained in, or restored to, a specified condition when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair.

2.1.4 Design for Affordability

Affordability can be defined as the degree to which the life-cycle cost of an acquisition program is in consonance with the long-range modernization, force structure, and manpower plans of the individual DoD Components, as well as for the Department as a whole.

Program affordability is part of the Joint Capabilities Integration and Development System, which balances cost versus performance in establishing Key Performance Parameters. Moreover, all elements of life-cycle cost (or total ownership cost, if applicable) are documented as part of the acquisition milestone deliverables. To ensure the program is affordable, cost goals are established in terms of thresholds and objectives to provide flexibility for program evolution and to support system performance and program schedule-related trade-off studies.

Affordability is the degree to which the life-cycle cost of an acquisition program is in consonance with the long-range investment and force structure plans of the Department of

Defense or individual DoD Components. The following procedures establish the basis for fostering greater program stability through the assessment of program affordability and the determination of affordability constraints:

- The DoD Components shall plan programs consistent with the DoD Strategic Plan, and based on realistic projections of likely funding available in the Future Years Defense Program (FYDP) and in years beyond the FYDP;
- The DoD Component sponsors shall emphasize affordability early in the proposed program. The CDD (CJCS Instruction 3170.01B (reference (f))) shall address cost;
- The MDA shall assess affordability at each decision point. No acquisition program shall proceed into Engineering and Manufacturing Development unless sufficient resources, including manpower, are programmed in the most recently approved FYDP, or will be programmed in the next Program Objective Memorandum (POM), Budget Estimate Submission (BES), or President's Budget (Pub. L. 104-106 (1996) (reference (bo)) and OMB Circular A-11 (reference (b))).

Also, see Section 1.3.7.6 of this document titled, "Should Cost / Will Cost" for additional discussion on affordability. Key references are located at the DAU website, https://acc.dau.mil/CommunityBrowser.aspx?id=399121 . They include the OUSD Memo titled, "Better Buying Power: Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending". Also, see Section 1.3.20.1.4 of this document for the Product Support Sustainment Chart, also known as the "Estevez Chart".

2.1.5 Sustainability

Sustainability is measured as the time it takes to restore the system to operational status (the "downtime") after a failure directly affects the availability of the system.

2.1.6 Modularity and Open System Architecture (MOSA)

Modularity is the packaging of components such that they can be repaired via 'remove and replace' action vs. on-board repair. Within a systems engineering construct, MOSA is an integrated business and technical strategy that employs a modular design and, where appropriate, defines key interfaces using widely supported, consensus-based standards that are published and maintained by a recognized industry standards organization.

2.1.7 Interoperability

While interoperability often refers to software and data exchange, interoperability also extends to hardware, processes, and services. The DoD definition of interoperability, per AT&L memo "Materiel Interoperability and Standardization with Allies and Coalition Partners", 29 Jul 2009, is that systems, units, and forces shall be able to provide and accept data, information, materiel, and services to and from other systems, units, and forces and shall effectively interoperate with those of allies and coalition partners.

2.1.8 Producibility

Producibility is the relative ease by which a product can be manufactured as measured in yield, cycle times, and the associated costs of options in product designs, manufacturing processes, production and support systems, and tooling. Producibility can significantly impact supportability because easily producible items are normally faster to obtain and have lower total

ownership costs. Per the NAVSO P-3687, "Producibility System Guidelines," there are specific tools and techniques that contribute to the achievement of producibility. PSM's should be familiar with these tools and techniques for product and process assessment purposes.

Tools and Techniques
Benchmarking
Cost Tools
Database Management Systems
Decision Support Tools
Design for Manufacture / Assembly (DFMEA)
Failure Mode & Effects Analysis (FMEA)
- Design Failure Mode & Effects Analysis (DFMEA)
- Process Failure Mode & Effects Analysis (PFMEA)
Integrated Product and Process Development (IPPD)
Knowledge-Based Systems
Manufacturing Planning Tools
Manufacturing Simulations
Producibility Assessment Worksheet (PAW)
Prototyping
Quality Functions Deployment (QFD)
Rapid Prototying
Risk Management Tools
Root Cause Analysis
Six Sigma
Statistical Process Control (SPC)
Statistical Quality Control (SQC)

Figure 3.3.1.T1. - Producibility Tools and Techniques

2.1.9 Testability

Testability, an important subset of maintainability, is a design characteristic that allows the status (operable, inoperable or degraded) of an item to be determined, and faults within the item to be isolated in a timely and efficient manner. The ability to detect and isolate faults within a system, and to do so efficiently and cost effectively, is important not only in the field, but also during manufacturing. All products must be tested and verified prior to release to the customer.

2.1.10 Transportability

The inherent capability of an item or system to be effectively and efficiently moved by required transportation assets and modes. DoDI 4540.07, October 12, 2004.

2.1.11 Survivability

Survivability attributes are those that contribute to the survivability of a manned system. This includes attributes such as speed, maneuverability, detectability, and countermeasures that reduce a system's likelihood of being engaged by hostile fire, as well as attributes such as armor and redundancy or critical components that reduce the system's vulnerability if it is hit by hostile

fire. The Survivability KPP is a mandatory KPP, Manual for the Operation of the Joint Capabilities Integration and Development System, updated February 2009, Enclosure B.

2.1.12 Supportability

Supportability of weapon systems begins with designing for increased reliability and reduced logistics footprint continuing through Operations and Support to provide for effective product support through performance-based logistics (PBL) strategies. Weapon systems are supportable when program sustainment KPP and KSAs are achievable given existing resources.

2.2 Human Systems Integration

Human Systems Integration (HSI) activities assist program managers by focusing attention on the human part of the system and by integrating and inserting manpower, personnel, training, human factors engineering, environment, safety, occupational health, habitability, and survivability considerations into the Defense acquisition process.

2.2.1 Human Factors Engineering

Human factors are the end-user cognitive, physical, sensory, and team dynamic abilities required to perform system operational, maintenance, and support job tasks. Human factors engineers contribute to the acquisition process by ensuring that the program manager provides for the effective utilization of personnel by designing systems that capitalize on and do not exceed the abilities (cognitive, physical, sensory, and team dynamic) of the user population. The human factors engineering community works to integrate the human characteristics of the user population into the system definition, design, development, and evaluation processes to optimize human-machine performance for operation, maintenance, and sustainment of the system. Human factors engineering is primarily concerned with designing human-machine interfaces consistent with the physical, cognitive, and sensory abilities of the user population.

2.2.2 Personnel

Personnel factors are those human aptitudes (i.e., cognitive, physical, and sensory capabilities), knowledge, skills, abilities, and experience levels that are needed to properly perform job tasks. Personnel factors are used to develop the military occupational specialties (or equivalent DoD Component personnel system classifications) and civilian job series of system operators, maintainers, trainers, and support personnel. Personnel officials contribute to the Defense acquisition process by ensuring that the program manager pursues engineering designs that minimize personnel requirements, and keep the human aptitudes necessary for operation and maintenance of the equipment at levels consistent with what will be available in the user population at the time the system is fielded.

2.2.2.1 Aptitudes

Personnel capabilities are normally reflected as knowledge, skills, abilities (KSAs), and other characteristics. The availability of personnel and their KSAs should be identified early in the acquisition process. The DoD Components have a limited inventory of personnel available, each with a finite set of cognitive and psychomotor abilities. This could affect specific system thresholds.

2.2.2.2 User Population Description

The program manager should use the target audience description (TAD) as a baseline for personnel requirements assessment. The TAD should include information such as inventory; force structure; standards of grade authorizations; personnel classification (e.g., Military Occupational Code / Navy Enlisted Classification) description; biographical information; anthropometric data; physical qualifications; aptitude descriptions as measured by the Armed Services Vocational Aptitude Battery (ASVAB)); task performance information; skill grade authorization; Military Physical Profile Serial System (PULHES); security clearance; and reading grade level.

2.2.3 Habitability

Habitability factors are those living and working conditions that are necessary to sustain the morale, safety, health, and comfort of the user population. They directly contribute to personnel effectiveness and mission accomplishment, and often preclude recruitment and retention problems. Habitability factors are those living and working conditions that result in levels of personnel morale, safety, health, and comfort adequate to sustain maximum personnel effectiveness, support mission performance, and avoid personnel retention problems.

2.2.4 Manpower

Manpower factors are those job tasks, operation/maintenance rates, associated workload, and operational conditions (e.g., risk of hostile fire) that are used to determine the number and mix of military and DoD civilian manpower and contract support necessary to operate, maintain, support, and provide training for the system. Manpower officials contribute to the Defense acquisition process by ensuring that the program manager pursues engineering designs that optimize manpower and keep human resource costs at affordable levels (i.e., consistent with strategic manpower plans). Technology-based approaches used to reduce manpower requirements and control life-cycle costs should be identified in the capabilities documents early in the process. For example, material-handling equipment can be used to reduce labor-intensive material-handling operations and embedded training can be used to reduce the number of instructors.

2.2.4.1 Manpower Mix Criteria

Manpower analysts determine the number of people required, authorized, and available to operate, maintain, support, and provide training for the system. Manpower requirements are based on the range of operations during peacetime, low intensity conflict, and wartime. They should consider continuous, sustained operations and required surge capability. The resulting Manpower Estimate accounts for all military (Active Reserve, and Guard), DoD civilian (U.S. and foreign national), and contract support manpower.

DoD Instruction 5000.02 requires the program manager to work with the manpower community to determine the most efficient and cost-effective mix of DoD manpower and contract support, and identify any issues (e.g., resource shortfalls) that could impact the program manager's ability to execute the program. This collaboration is conducted within the Human Systems Integration (HSI) framework to ensure integration with the other HSI domains. The HSI lead for a program / project should be able to draw expertise from the manpower community to provide program assistance. Generally, the decision to use DoD civilians and contract labor in theater during a conflict where there is a high likelihood of hostile fire or collateral damage is made on an

exception basis. In all cases, risk reduction should take precedence over cost savings. Additionally, the program manager shall consult with the manpower community in advance of contracting for operational support services to ensure that sufficient workload is retained in-house to adequately provide for career progression, sea-to-shore and overseas rotation, and combat augmentation. The program manager should also ensure that inherently governmental and exempted commercial functions are not contracted. These determinations shall be based on current Workforce Mix Guidance (DoD Instruction 1100.22).

2.2.4.2 Manpower Estimate Report

Manpower estimates serve as the authoritative source for out-year projections of active-duty and reserve end-strength, civilian full-time equivalents, and contractor support work-years. As such, references to manpower in other program documentation should be consistent with the manpower estimate once it is finalized. In particular, the manpower estimates should be consistent with the manpower levels assumed in the final Affordability Assessment and the Cost Analysis Requirements Description (CARD).

2.2.5 Training

Training is the learning process by which personnel individually or collectively acquire or enhance pre-determined job-relevant knowledge, skills, and abilities by developing their cognitive, physical, sensory, and team dynamic abilities. The “training/ instructional system" integrates training concepts and strategies and elements of logistic support to satisfy personnel performance levels required to operate, maintain, and support the systems. It includes the "tools" used to provide learning experiences such as computer-based interactive courseware, simulators, and actual equipment (including embedded training capabilities on actual equipment), job performance aids, and Interactive Electronic Technical Manuals.

When developing the training/instructional system, the program manager should employ transformational training concepts, strategies, and tools such as computer based and interactive courseware, simulators, and embedded training consistent with the strategy, goals and objectives of the Strategic Plan for Transforming DoD Training and the Training Transformation Implementation Plan. In addition, the program should address the requirement for a systems training key performance parameter as described in the JCIDS Manual.

2.2.6 Environment, Safety, and Occupational Health (ESOH)

DoD ESOH Guidance for systems acquisition programs can be found in Chapter 4, Systems Engineering, section 4.4, and in the ESOH Special Interest Area on the Acquisition Community Connection. What is important to the HSI practitioner and the systems engineer is that these three domains are of vital importance to the HSI effort and must be integrated within the HSI effort.

2.2.6.1 Environmental

Environment includes the conditions in and around the system and the operational context within which the system will be operated and supported. This "environment" affects the human's ability to function as a part of the system.

2.2.6.2 Safety

Safety factors consist of those system design characteristics that serve to minimize the potential for mishaps causing death or injury to operators and maintainers or threaten the survival and/or operation of the system. Prevalent issues include factors that threaten the safe operation and/or survival of the platform; walking and working surfaces including work at heights; pressure extremes; and control of hazardous energy releases such as mechanical, electrical, fluids under pressure, ionizing or non-ionizing radiation (often referred to as "lock-out/tag-out"), fire, and explosions.

2.2.6.3 Occupational Health

Occupational health factors are those system design features that serve to minimize the risk of injury, acute or chronic illness, or disability; and/or reduce job performance of personnel who operate, maintain, or support the system. Prevalent issues include noise, chemical safety, atmospheric hazards (including those associated with confined space entry and oxygen deficiency), vibration, ionizing and non-ionizing radiation, and human factors issues that can create chronic disease and discomfort such as repetitive motion diseases. Many occupational health problems, particularly noise and chemical management, overlap with environmental impacts. Human factors stresses that create risk of chronic disease and discomfort overlap with occupational health considerations.

2.3 Key Performance Parameters (KPPs) and Key System Attributes (KSAs)

A Key Performance Parameter (KPP) and Key System Attribute (KSA) are metrics which contain those attributes or characteristics of a system that are considered critical or essential to the development of an effective military capability. KPPs and KSAs are usually quantitative in nature and can be described by a mathematical equation. A KPP normally has a threshold value, representing the required value, and an objective value, representing the desired value. KPPs are contained in the Capability Development Document (CDD) and the Capability Production Document (CPD) and are included verbatim in the Acquisition Program Baseline (APB). Certain KPPs may be “mandatory” or “selectively applied,” depending on the system.

Currently there are up to five required KPPs depending on the program:

- **Survivability** and **Force Protection** KPPs are required for manned systems employed in an asymmetric threat environment;
- The **Availability** KPP is required for all Acquisition Category (ACAT) I programs requiring a materiel solution; for ACAT II and below programs, the sponsor will determine the applicability of this KPP. The Availability KPP has two components, **Materiel Availability (A_M) and Operational Availability (A_O)**;
- A **Net-Ready KPP (NR-KPP)** is required for all information technology (IT) and National Security Systems (NSS) that process, store, display, or transmit DoD information.

KPPs traceable to capability definitions in the Initial Capabilities Document (ICD), and to joint functions identified in Joint Publication 3-0, “Joint Operations”, are required for systems with a primary mission or missions or other attributes that contribute significantly to the capabilities in the ICD or the joint functions in Joint Publication 3-0.

Key System Attributes (KSAs) are considered most critical or essential for an effective military capability but are not selected as Key Performance Parameters (KPPs). KSAs provide decision makers with an additional level of capability prioritization below the KPP but with senior sponsor leadership control (generally four star, defense agency commander, or principal staff assistant). KSAs do not apply to the net-ready KPP (NR-KPP). Sustainment KSAs required by the Joint Capabilities Integration and Development System (JCIDS) Manual are included verbatim in the Acquisition Program Baseline (APB). Sustainment KSAs include Material Reliability and Ownership (O&S) Cost. The JCIDS manual website is found at https://acc.dau.mil/ILC_KPP.

Per the JCIDS Manual, "The CDD and CPD identify the attributes that contribute most significantly to the desired operational capability in threshold-objective format. Whenever possible, attributes should be stated in terms that reflect the range of military operations that the capabilities must support and the joint operational environment intended for the system (Family of Systems (FoS) or System of Systems (SoS)). There are compatibility and interoperability attributes (e.g., databases, fuel, transportability, ammunition) that might need to be identified for a capability to ensure its effectiveness. These statements will guide the acquisition community in making tradeoff decisions between the threshold and objective values of the stated attributes. Because testing and evaluation throughout a system's lifecycle will assess the ability of the system(s) to meet the production threshold values as defined by the KPPs, key system attributes (KSA), and other performance attributes, these attributes must be measurable and testable."

The logistics prioritized attributes from Appendix A of the JCIDS Manual are as listed below:

- Deployment And Distribution: Visibility, Reliability, Velocity, Precision and Capacity;
- Supply: Responsiveness, Sustainability, Flexibility, Survivability, Attainability, Economy and Simplicity;
- Maintain: Sustainability, Responsiveness, Attainability, Flexibility, Economy, Survivability, Simplicity;
- Logistics Services: Responsiveness, Attainability, Sustainability, Flexibility, Economy, Survivability and Simplicity;
- Operational Contract Support: Responsiveness, Attainability, Flexibility, Survivability, Sustainability, Simplicity and Economy;
- Engineering: Effective, Expeditionary, Agile / Tailorable, Networked, Integrated, Precise and Enduring/ Persistent.

2.3.1 Sustainment KPPs and KSAs

The Sustainment KPP Review Proponent is the Maintenance Division (MXD), Joint Staff Logistics Directorate J4. J4-MXD will receive analytical support from the Office of the Assistant Deputy Under Secretary of Defense for Materiel Readiness (ADUSD (MR)) and Deputy Under Secretary of Defense for Acquisition and Technology (DUSD(A&T)) Systems and Software Engineering Directorate.

2.3.1.1 Availability

Availability will consist of two components: Materiel Availability and Operational Availability. The components provide availability percentages from a corporate, fleet-wide perspective and an

operational unit level, respectively. The Operational Availability metric is an integral step to determining the fleet readiness metric expressed by Materiel Availability.

2.3.1.1.1 Materiel Availability

Materiel Availability is a measure of the percentage of the total inventory of a system operationally capable (ready for tasking) of performing an assigned mission at a given time, based on materiel condition. This can be expressed mathematically as number of operational end items/total population. The Materiel Availability addresses the total population of end items planned for operational use, including those temporarily in a non-operational status once placed into service (such as for depot-level maintenance). The total life-cycle timeframe, from placement into operational service through the planned end of service life, must be included. This is often referred to as equipment readiness. Development of the Materiel Availability metric is a program manager responsibility.

2.3.1.1.2 Operational Availability

Operational Availability indicates the percentage of time that a system or group of systems within a unit are operationally capable of performing an assigned mission and can be expressed as (uptime/(uptime + downtime)). Determining the optimum value for Operational Availability requires a comprehensive analysis of the system and its planned use as identified in the CONOPS, including the planned operating environment, operating tempo, reliability alternatives, maintenance approaches, and supply chain solutions. Development of the Operational Availability metric is a requirements manager responsibility.

2.3.1.2 Reliability

Reliability is a measure of the probability that the system will perform without failure over a specific interval. Reliability must be sufficient to support the Warfighting capability needed. Considerations of reliability must support both Availability metrics. Reliability may initially be expressed as a desired failure-free interval that can be converted to a failure frequency for use as a requirement (e.g., 95 percent probability of completing a 12-hour mission free from mission-degrading failure; 90 percent probability of completing 5 sorties without failure). Specific criteria for defining operating hours and failure criteria must be provided together with the Reliability. Single-shot systems and systems for which other units of measure are appropriate must provide supporting analysis and rationale. Development of the Reliability metric is a requirements manager responsibility.

2.3.1.3 Ownership (O&S) Cost

Ownership Cost provides balance to the sustainment solution by ensuring that the operations and support (O&S) costs associated with Availability are considered in making decisions. For consistency and to capitalize on existing efforts in this area, the Cost Analysis Improvement Group O&S Cost Estimating Structure will be used in support of this KSA (http://dcarc.pae.osd.mil/reference/osd_ces/index.aspx). As a minimum the following cost elements are required: 2.0 Unit Operations (2.1.1 (only) Energy (fuel, petroleum, oil, lubricants, electricity)); 3.0 Maintenance (All); 4.0 Sustaining Support (All except 4.1, System Specific Training); 5.0 Continuing System Improvements (All). Fuel costs will be based on the fully burdened cost of fuel. Costs are to be included regardless of funding source. The O&S value should cover the planned lifecycle timeframe, consistent with the timeframe used in the Materiel

Availability metric. Sources of reference data, cost models, parametric cost estimating relationships, and other estimating techniques or tools must be identified in supporting analysis. Programs must plan for maintaining the traceability of costs incurred to estimates and must plan for testing and evaluation. The planned approach to monitoring, collecting, and validating operating and support cost data to supporting the O&S must be provided. Development of the Ownership Cost metric is a program manager responsibility.

2.3.1.4 Mean Down Time

Mean Down Time has previously been required as an reported outcome metric. It is not listed in the recent update of the JCIDS Manual (as of 31 January 2011). Current JCIDS Manual found at https://acc.dau.mil/CommunityBrowser.aspx?id=267116&lang=en-US. Policy memo from 2008 found at http://www.acq.osd.mil/log/mr/library/LMR-ARA_LCS_Outcome_4.pdf

Mean Downtime (MDT) is the average Total Downtime required to restore an asset to its full operational capabilities. MDT includes the time from reporting of an asset being down to the asset being given back to operations / production to operate. MDT includes administrative time of reporting, logistics and materials procurement and lock-out / tag-out of equipment, etc. for repair or preventive maintenance. Mathematically, MDT equals total down time for all failures divided by total number of failures.

2.3.2 Net-Ready

A NR-KPP will be developed for all information technology (IT) and national security systems (NSS) used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, or transmission or reception of DoD data or information regardless of classification or sensitivity. This includes telecommunications or information systems operated by the U.S. Government, the function, operation, or use of which involves: intelligence activities; cryptologic activities related national security; command and control of military forces; equipment that is an integral part of a system; and is critical to the direct fulfillment of military or intelligence missions. There are some exceptions as noted in the JCIDS Manual.

2.3.3 Force Protection

Force protection attributes are those that contribute to the protection of personnel by preventing or mitigating hostile actions against friendly personnel, military and civilian. This may include the same attributes as those that contribute to survivability, but the emphasis is on protecting the system operator or other personnel rather than protecting the system itself. Attributes that are offensive in nature and primarily intended to defeat enemy forces before they can engage friendly forces are not considered force protection attributes. Attributes that protect against accidents, weather, natural environmental hazards, or disease (except when related to a biological attack) are also not part of force protection.

2.3.4 Survivability

Survivability attributes are those that contribute to the survivability of a manned system. This includes attributes such as speed, maneuverability, detectability, and countermeasures that reduce a system's likelihood of being engaged by hostile fire, as well as attributes such as armor

and redundancy of critical components that reduce the system's vulnerability if it is hit by hostile fire.

2.3.5 Selectively Applied KPP's

The JROC has defined two KPPs to be selectively applied to programs: system training and energy efficiency. The sponsor will perform an analysis on the use of these parameters as KPPs. If the analysis determines that they should not be KPPs, a summary of the justification will be provided in the CDD.

2.3.5.1 System Training

System training should be considered early in the capabilities development process beginning with the analyses that support development of the ICD and continues with development of the CDD. Ensure system training is addressed in the AoA and supporting analysis for subsequent acquisition phases and ensure projected training requirements and associated costs are appropriately addressed across the program life cycle. Embedded training and net-centric enabled training shall be considered the first alternative for cost effective delivery of instruction. The training capability requirements should be on par with operational systems capability. Further guidance on this KPP can be found in Appendix C of the JCIDS Manual.

2.3.5.2 Energy Efficiency

Include fuel efficiency considerations in systems consistent with future force plans and approved planning scenarios. Include operational fuel demand and related fuel logistics resupply risk considerations with the focus on mission success and mitigating the size of the fuel logistics force within the given planning scenarios. These assessments will inform the setting of targets and thresholds for the fuel efficiency of materiel solutions. Consider fuel risk in irregular warfare scenarios, operations in austere or concealed settings, and other asymmetric environments, as well as conventional campaigns.

The GAO published a report, GAO-08-426 March 13, 2008, "Defense Management: Overarching Organizational Framework Needed to Guide and Oversee Energy Reduction Efforts for Military Operations", to identify key efforts under way to reduce mobility energy demand and (2) assess the extent to which DoD has established an overarching organizational framework to guide and oversee DoD energy reduction efforts.

Per the Defense Acquisition Guidebook, para 3.1.6, Inefficient use of energy in tactical systems has many significant but unrecognized liabilities. It results in operational constraints and significant force protection challenges. Conversely, reductions in energy demand improve operational flexibility and reduce dependence on logistics forces. One cause for this lack of recognition is that the DoD acquisition process undervalues the benefits of technologies that can reduce energy demands by deployed systems. To remedy this, DoD has adopted the policy to apply the concept known as fully burdened cost of delivered energy for trade-off analysis conducted for all operational (or "tactical") systems with end items that create a demand for delivered energy (see DoD Instruction 5000.02, Enclosure 7, paragraph 6). This policy applies to all military systems that may be employed in military operations. Vehicles such as buses or cars used in support of routine base operations normally would not be regarded as "tactical."

For tactical systems with delivered energy requirements, the Analysis of Alternatives conducted during the Materiel Solution Analysis phase shall include an estimate of the fully burdened cost of delivered energy, added to the total ownership cost estimate, to help guide system design and technology trades (see DoD Instruction 5000.02, Enclosure 7, paragraphs 5.f.(2)). Further explanation of the concept and the methodology for this estimate can be found in the following related documents:

- Background Information on Calculating the Fully Burdened Cost of Fuel;
- USD(AT&L) policy memo on Fully Burdened Cost of Fuel Pilot Program; and
- D,PA&E memo on Fully Burdened Cost of Fuel Methodology

2.4 Standardization

A standard establishes uniform engineering or technical criteria, methods, processes, and practices. In relation to product data, standards provide a method of specifying requirements, establishing quality, verifying results, allowing exchange and providing for the economic capture, storage and retention of the data. Standards are important throughout the government, commercial, scientific, and technological worlds so that managers, developers, suppliers, and customers can be certain that requirements are consistently stated, results are clearly identified, and that the data generated meets the need for which it was developed.

Standards offer benefits at all phases of the lifecycle from concept and design through manufacture, operation, and disposal. In today's environment standards compliance is not an option — it's a requirement. Only with clearly defined standards can needed product data be created and communicated with results being understood and useable. Standards provide users with a yardstick to measure everything from quality, to hazardous material usage, to physical characteristics such as size, weight, and material properties.

The goal of data standards is to enable the defining, sharing and exchanging of information between multiple parties in a way that guarantees that the interactive parties share the same understanding of what is represented within that information. In each instance, the proper application and tailoring of the standard will provide the government quality, useable data, at a lower acquisition cost. The benefits to the Army and DoD, associated with the use of data standards, are listed below:

• Improves interoperability amongst U.S. forces and with coalition partners;
• Reduces life cycle costs due to reduced inventories, more efficient supply chains and supply chain management, lower acquisition costs, and smaller deployment footprints;
• Provides unambiguous requirements, data elements and their definitions related to the acquisition of minimum essential product data;
• Provides an organized structure for acquiring product data, including intra-Army and multi-Service acquisitions;
• Provides a comprehensive requirement statement that allows the tailoring of data requirements based on user need;
• Provides the methods required to perform verification and assure the data meets quality requirements;
• Provides a set of data requirements for use as fundamental building blocks for establishing and negotiating national and international standardization efforts;

• Allows government and industry to standardize processes, which results in the savings of time and money;
• Allows the use of different information technology (IT) systems to exchange data without the costly need for translations or interfaces;
• Prevents duplication of data and inconsistencies between data objects.

DoD policy is to promote standardization of materiel, facilities, and engineering practices to improve military operational readiness, and reduce total ownership costs and acquisition cycle time. Standardization can be achieved through robust configuration management. It is also DoD policy to state requirements in performance terms, wherever practical, and to make maximum use of non-Government standards and commercial technologies, products, and practices. To pursue these policies, there is a single, integrated Defense Standardization Program and a uniform series of specifications, standards, and related documents. The Website for policy and guidance is:
http://www.dsp.dla.mil/APP_UIL/policy.aspx?action=content&accounttype=displaypolicy&contentid=79

Per the DAG 4.4.12, parts management is a design strategy that seeks to reduce the number of unique or specialized parts used in a system (or across systems) to reduce the logistic footprint and lower total life-cycle costs. In addition, it also will enhance the reliability of the system and mitigate parts obsolescence because of Diminishing Manufacturing Sources and Material Shortages. Parts management is an important design consideration and should be used whenever parts are not defined based on open systems design interfaces or Commercial-off-the-shelf items, as described in DAG sections 4.4.6 and 4.4.2 , respectively.

One of the most effective methods to improve standardization opportunities is for The Product Support Manager to ensure that commodity-based contractual vehicles are developed and executed in a manner that balances acquisition costs and technology insertion with cost savings and/or readiness improvements. Significant value can be gained if we take advantage of design-stable standardization opportunities.

Standardization can significantly reduce the acquisition and life-cycle cost of the system, from design to procurement, through manufacturing, and all the way to end of service. The challenge is to deliver/sustain the right standardized equipment and performance based life cycle sustainment that meets the technical acceptance requirements, on time, and at optimum value.

2.5 Corrosion Prevention

Corrosion is the wearing away of metals due to a chemical reaction, the most common example being the presence of rust on a metallic surface. DoD Instruction 5000.02, Enclosure 12, paragraph 7, directs that*:* As part of a long-term DoD corrosion prevention and control strategy that supports reduction of total cost of system ownership, each ACAT I program shall document its strategy in a Corrosion Prevention Control Plan. The Plan shall be required at Milestones B and C. Corrosion considerations shall be objectively evaluated throughout program design and development activities, with trade-offs made through an open and transparent assessment of alternatives. The program manager should consider and implement corrosion prevention and mitigation planning to minimize the impact of corrosion and material deterioration throughout

the system life cycle (see the Corrosion Prevention and Control Planning Guidebook). Corrosion prevention and mitigation methods include, but are not limited to, the use of effective design practices, material selection, protective finishes, production processes, packaging, storage environments, protection during shipment, and maintenance procedures. The program manager establishes and maintains a corrosion prevention and mitigation reporting system for data collection and feedback and uses it to address corrosion prevention and mitigation logistic considerations and readiness issues. Corrosion prevention and mitigation considerations are integral to all trade-off decisions as required in DoD Directive 5000.01 E1.1.17.

2.6 Trade Studies

Trade studies are systematic, interdisciplinary examinations of the factors affecting system costs. These studies are accomplished by analyzing multiple system concepts and approaches to find the most acceptable ways to attain necessary performance while balancing essential requirements, such as cost or operational availability that must be satisfied for the system to be successful. For example, the objective of a cost performance trade study is not to minimize the cost of the system, but to achieve a specified level of cost reduction at a maximized level of performance.

Design Interface in the Life Cycle

A. Purpose

Design interface is intended to be a set of activities to control and manage design choices that impact supportability. The special test equipment example presented in section 2.1.1 could be controlled by limiting the introduction of new test equipment, or limiting the design of the test equipment to fit within the existing support infrastructure training, facilities, supply support, etc., for test equipment. The inclusion of product support objectives into the management of design will greatly increase the probability that product support objects are met in innovative and effective ways.

a. Why is Design Interface Important

The activities of design interface begin during requirements definition of the system and continue throughout the system's life cycle. In each stage of the acquisition process, Life Cycle Logisticians will work with design and systems engineering, cost analysis, test and evaluation, quality control and many other program areas to ensure every aspect of the system is focused on meeting the required product support objectives.

Design interface is therefore a "leading activity" that impacts all the product support elements because a well performed design interface is one that minimizes the logistics footprint, maximizes reliability, ensures that maintainability is user friendly and effective, and addresses the long term issues related to obsolescence management, technology refreshment, modifications and upgrades, and overall usage under all operating conditions.

The success of design interface is completely dependent upon the entire program leadership recognizing that supportability goals must be achieved. A forward-looking culture needs to be

encouraged throughout the program that the end products must be as easy to use and maintain as possible.

b. Summary of Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

Note that the Logistics Assessment (LA), also known as an independent logistics assessment, is part of **each** Milestone Decision Package and is a requirement for type classification.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Design Interface IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, includes in the left column a listing of all deliverables to support **requirements for Milestone/Decision Reviews**, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. *The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.*

Acquisition Phase	**Design Interface Activities**
User Need / Technology Opportunities & Resources	Performance-based life-cycle product support implementation begins in the JCIDS process with the exploration of capabilities. Every system is acquired to provide a particular set of capabilities in a specific concept of operations, sustained to an optimal level of readiness. Understanding user needs in terms of performance is an essential initial step in developing a meaningful product support strategy because changes to the CONOPS or the sustainment approach may impact the effectiveness, suitability, or cost of the system. The Product Support Manager (PSM) perspective must drive understanding design interface and forecasting requirements to actual product support sustainment activities and outcomes. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Key Products: • Requirements

	• Metrics • Design impacts related to intended support strategy
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. The AoA requires, at minimum, full consideration of possible design interface trade-offs among cost, schedule, and performance objectives for each alternative considered. The ICD documents the system's capability requirements. Refer to the Defense Acquisition Guidebook (DAG), Chapters 3.3 and 5 for more information. Design interface process steps focus on a systems engineering integration of requirement, functions, and design influence to ensure a smooth, seamless system design. Design interface activities define and specifies measurable support performance requirements, and provides policy and procedures to develop and conduct supportability assessments to identify how: • Components or sub-systems are designed and interfaced to achieve the best mix and/or design trade-off among the IPS Elements; • The overall supportability design of the system interfaces – in terms of interoperability, standardization, commonality – with other systems and external services; • Supportability design parameters address operational effectiveness and suitability requirements. While not officially designated until Milestone B, the outcomes of a PSM perspective should be introduced at this point as inputs to Milestone review documents which can be summarized as the impacts of design on initial sustainment cost estimates, the initial Life Cycle Sustainment Plan (LCSP) and related sustainment metrics. Specific analysis focuses on the approach for implementing enabling sustainment technologies to implement the product support strategy and achieve the sustainment metrics. The appropriate trade-off studies validate and forecast product support sustainment outcomes as a result of design of the system and its intended sustainment footprint encompassing all twelve product support elements. The specific enabling support technologies should be identified along with the corresponding plan to technically mature each support element. Risks from system design to achieving the necessary support structure for the time frame of the program by IOC should be identified and a mitigation strategy outlined. The initial Reliability, Availability and Maintainability – Cost report is prepared, outlining supportability requirements, a system support concept, maintenance concept, and a Technology Development Strategy for the preferred technology product support concept. The System Requirement Document is prepared and contains KPPs and KSAs from JCIDS that are traceable to the draft CDD used by competing contractors who respond to the RFP for prototype development.

	Programs should understand the amount of testing, test schedule and resources available for achieving the specification requirement. Programs should consider the following: • Develop the growth planning curve as a function of appropriate life units (hours, cycles, etc,) to grow to the specification value. • How the starting point that represents the initial value of reliability for the system was determined. • How the rate of growth was determined. Rigorous test programs which foster the discovery of failures, coupled with management-supported analysis and timely corrective action, will result in a faster growth rate. The rate of growth should be tied to realistic management metrics governing the fraction of initial failure rate to be addressed by corrective actions along with the effectiveness of the corrective action. • Describe the growth tracking and projection methodology that will be used to monitor reliability growth during system-level test (e.g., AMSAA-Crowe Extended, AMPM). The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of Milestone Decision Review required documents. Key Products: • Inputs into the Human Systems Integration (HSI) Plan • Design Interface inputs into the LCSP • Results from Analysis of Alternatives • Functional requirements for product support • Results of design analyses for product support • Documentation of the reliability Growth Curve
Technology Development	The primary document incorporating design interface plans and outcomes is the LCSP. After Milestone A the LCSP evolves from a strategic outline to a management plan describing the sustainment efforts in the system design and acquisition processes to achieve the required performance and sustainment outcomes necessary to ensure required Warfighter capabilities. Supportability analyses to impact design for product support include: • Developing and updating use cases to refine intended operational and maintenance environment, constraints, and interfaces; • Performing functional analysis to provide preliminary identification of maintenance of the equipment in its intended environment, potential failure modes and identification of design deficiencies; • Developing alternative support concepts that provide the optimized support solution for system alternatives and refining the maintenance

	concept using previous results; • Performing trade-ff analyses of considerations for cost impacts on planned and existing weapon and/or support systems, training, and other continuing and Phase-specific requirements; • Developing a baseline comparison system to identify problems to be avoided and areas to be enhanced; • Conducting comparative analysis to develop supportability design factors; • Developing a supportability analysis plan to demonstrate that the contractor understands the supportability analysis process, the program strategy and how product support processes will be applied to meet program requirements. A detailed outline for the LCSP can be found in the Defense Acquisition Guidebook, Chapter 5.1.2.2. and at the DAU community of practice website found at https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3303/USA005157-11_SignedLCSPMemo_14Sep2011.pdf. The Product Support Manager will also have significant input into the Systems Engineering Plan due to the impacts on design engineering from supportability analysis. The Product Support Manager is required to also provide information on many other acquisition documents as listed below under deliverables and the DAU site, https://dag.dau.mil/Pages/Default.aspx. The Product Support Manager will also have significant input into the Systems Engineering Plan (SEP) and other required deliverables due to the impacts on design engineering from supportability analysis. To satisfy DoD Instruction 5000.02, the PM/PSM shall have a plan for Human Systems Integration (HSI) in place prior to entering Engineering and Manufacturing Development. The following engineering activities are described in the Acquisition Strategy to be stated in the request for proposal(s): • R&M Allocations, block diagrams and predictions • Failure definitions and scoring criteria • Failure Mode, Effects and Criticality Analysis (FMECA) • Built-in test and maintainability demonstrations • Reliability Growth testing at system/subsystem level • Failure Reporting, Analysis and Corrective Action System (FRACAS) The Acquisition Strategy and Systems Engineering Plan specify how the JCIDS sustainment thresholds have been translated into R&M design requirements for use in contract specifications. **Key Products**: • Outputs from

	o R&M Analysis o R&M Modeling o R&M Predictions o Fault Tree Analysis • Failure Modes and Effects Criticality Analysis (FMECA) • Initial Failure Reporting, Analysis and Corrective Action System (FRACAS) • Corrosion Prevention and Control Plan • Product Support Strategy • Updates to the AoA • On-going trade studies • Logistics use profiles • Design for testing, focus on built in test (BIT) • Updated RAM-C Rationale Report • Programmatic Environmental, Safety, and Health Evaluation (PESHE) • Standardization and interoperability study results
Engineering & Manufacturing Development	During this phase, The Product Support Manager's goal is to continue to influence and validate design for supportability. Supportability requirements designed earlier in the acquisition process should be validated and those that were not defined are assessed for impact. Any final engineering changes as a result of design interface analysis must be implemented no later than this phase to achieve maximum benefit. Detailed product support requirements are identified using a common source database, consisting of actual system product support requirements and resources that have been analytically developed. These product support requirements are used to synthesize, test, evaluate, and verify analysis results, hardware vendor updates, and to approve the Maintenance Plan. The most promising design approach is translated into a stable, interoperable, producible, supportable and cost-effective design. Manufacturing and production capability is validated, and system capabilities are demonstrated through testing during low rate initial production. By Milestone C, Contractor Logistics Support is used primarily used to achieve the Sustainment KPP/KSAs. The LCSP is updated and it now details how the program will manage O&S costs and reduce the logistics footprint. Key Products: • Product Support Plan • Integrated Product Support Demonstration (Test) • Risk assessment for meeting sustainment KPP and KSAs • Mock-ups, prototypes and/or simulations • Quality program to ensure implementation of product support design requirements

Production & Deployment	Design interface activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, taking part in planning activities that may be on-going already for product improvement, and developing long term plans for design interface improvements for both the system and its support infrastructure as part of the LCSP. After the Full Rate Production Decision Review update, the LCSP describes the plans for sustaining affordable materiel availability as well as accommodating modifications, upgrades, and re-procurement. Fielding occurs during this phase and significant planning is required associated with deploying a system to the operational site. This is the starting point when design for sustainment is proven out. Adequate and justifiable product support, as detailed in the LCSP, is now acquired. After the production decision has been made, the program begins the process of identifying and procuring the product support required to achieve system maintenance capability and material support. Activation of operational sites begins with the objective of achieving an operational capability that satisfies mission needs, and a supportability capability that meets established objectives and thresholds. Key Products: • IPS Demo (OT) • Implementation of parts obsolescence and technology insertion plans • Critical Items List • Quality control screening for latent, intermittent or incipient defects or flaws introduced during the manufacturing process • Product support assessments to identify program risk and mitigation actions
Operations & Support	Design interface continues, throughout the system's operations and support phase but in a different manner than in earlier acquisition life cycle phases. Design interface is now implemented through multiple avenues which include: 1) engineering change proposals (ECP's), 2) new technology refresh activities, 3) modifications and changes to the system, 4) analysis of failure data and reliability growth programs, plus others. The Product Support Manager 's responsibility is to continue reviewing system performance while looking for opportunities to improve design of both the system itself and the support infrastructure to optimize cost versus availability. Key Products: • R&M Analysis • R&M Modeling • R&M Predictions • Engineering Change Proposals

Table 2.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DI-CMAN-81121, Functional and Allocated Baselines Inputs
DI-CMAN-81248A, Interface Control Document (ICD)
DI-EMCS-81542B, Electromagnetic Environmental Effects (E3) Verification Report
DI-ENVR-81375, Environmental Health and Safety Plan
DI-ENVR-81378, Environmental Operation and Maintenance (O&M) Plan
DI-ENVR-81663, Environmental Stress Screening Report
DI-GDRQ-80941, Standardization Accomplishment Report
DI-HFAC-81743, Human Systems Integration Program Plan
DI-ILSS-80739, Depot Maintenance Study
DI-ILSS, Reliability-Centered Maintenance Analysis Data
DI_ILSS-80134A, Proposed Spare Parts List
DI-IPSC-81316, Functional Configuration Audit Inputs
DI-IPSC-81431A, System Specification
DI-IPSC-81434A, Interface Requirements Specification
DI-IPSC-81436A, Interface Design Description
DI-MGMT-80898, Environmental Compliance Assessment and Management Program Action Plan Report
DI-MGMT-81398A, Hazardous Materials Management Program (HMMP)
DI-MISC-80215, Energy Information Report
DI-MISC-80370, Safety Engineering Analysis Report
DI-MISC-81259A, Value Engineering Study Proposal
DI-MISC-81319, Avionics Systems Installation, Interface, and Test Specifications
DI-MISC-81397A, Hazardous Materials Management Program (HMMP)
DI-RELI-81496, Reliability Block Diagrams
DI-RELI-81497, Reliability and Maintainability Predictions
DI-RELI-81500, Survivability Cost Effectiveness Trade-off Studies Report
DI-SAFT-80101B, System Safety Hazard Analysis Report
DI-SAFT-80106B, Health Hazard Assessment Report (HHAR)
DI-SAFT-80184A, Radiation Hazard Control Procedures (RHCP)
DI-SAFT-80402, Operating Procedures for Hazardous Materials
DI-SAFT-81125, Hazard Assessment Test Report
DI-SAFT-81300A, Mishap Risk Assessment Report (MRAR)
DI-SAFT-81626, System Safety Program Plan
DI-SESS-81314A, System / Segment Interface Control Specification
DI-SESS-81613, R&M Program Plan
DI-SESS-81632, Interface Specification
DI-SDMP-81470A, DoD Interface Standard Documents
DI-SDMP-81748, Parts Management Plan
DI-TMSS-81711A, Automatic Test Equipment (ATE) Interface Hardware Manual

C. OSD Proponency, Policy, Regulations

a. Proponency

- Deputy Assistant Secretary for Materiel Readiness (DASD(MR)) drives DoD life cycle management to optimize weapon system Materiel Readiness for the Joint Force Commander. DASD(MR) advises and assists the Assistant Secretary of Defense for Logistics & Materiel Readiness in establishing policies, procedures and implementing actions to integrate acquisition and sustainment processes into a Life Cycle Management framework to optimize weapon system Materiel Readiness. Policy, implementation guidance and links can be found at http://www.acq.osd.mil/log/mr/index.html.

- The Office of the Director, Research & Engineering (DDR&E). Within the DDR&E, the systems engineering office is organized as in the figure below. Policy, implementation guidance and links to more information can be found at http://www.acq.osd.mil/ddre/.

- Office of the Deputy Under Secretary of Defense (Installations and Environment). Their mission is to ensure installation assets and services are available when and where needed, with the joint capabilities and capacities necessary to effectively and efficiently support DoD missions. The website can be found at http://www.acq.osd.mil/ie/ie_orgchart.shtml.

- Office of the Under Secretary of Defense for Acquisition Technology and Logistics (OUSD(AT&L)), Office of Corrosion Policy and Oversight. Website is found at https://www.corrdefense.org/CorrDefense%20WebPage%20Content/WelcomeToCorrDefense.aspx

b. Policy, Regulations and U.S. Statutes

- DoD Directive 5000.01, “The Defense Acquisition System”
- DoD Directive 1322.18, “Military Training”
- DoD Instruction 5000.02, “Operation of the Defense Acquisition System”
- DoD Instruction 1322.26, “Development, Management, and Delivery of Distributed Learning. References”
- DoD Directive 5250.01 requires that an LSSP shall be established for signature dependent programs
- Executive Order (E.O.) 12114, "Environmental Effects Abroad of Major Federal Actions"
- CJCS Instruction 3170.01, “Operation of the Joint Capabilities Integration and Development System”
- CJCSI 6212.01D, “Interoperability and Supportability of Information Technology and National Security Systems”
- CJCSI 6212.01D – Interoperability and Supportability of Information Technology and National Security Systems, 8 March 2006

- The Defense Standardization Program Website for policy and implementation guidance is http://www.dsp.dla.mil/APP_UIL/policy.aspx?action=content&accounttype=displaypolicy&contentid=79.
- Reliability, Availability, Maintainability-Cost (RAM-C) Report Manual, found at https://acc.dau.mil/CommunityBrowser.aspx?id=378147&lang=en-US
- "FY09 Department of Defense Human Systems Integration Management Plan", Version 1.0, found at http://www.acq.osd.mil/se/docs/FY09-DoD-HSI-Management-Plan.pdf
- FY09 Department of Defense Human Systems Integration Management Plan", Version 1.0
- DoD Coverage and Return on Investment (ROI) Report, 2008
- Designing and Assessing Supportability in DoD Weapon Systems, A Guide to Increased Reliability and Reduced Logistics Footprint, Prepared by the Office of the Secretary of Defense, Oct 24, 2003
- Defense Acquisition Guidebook, sections as identified throughout this handbook. A detailed outline of the LCSP can be found in the DAG, Chapter 5.1.2. and at https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3303/USA005157-11_SignedLCSPMemo_14Sep2011.pdf.
- The U.S. Navy's "Naval Open Architecture Contract Guidebook for Program Managers", Version 2.0, 30 June 2010, for contracting for opens systems architectures. It can be found at https://acc.dau.mil/adl/en-US/375114/file/51790/FOR%20E-DISTRIBUTION_NOA%20Contract%20Guidebook%20V2.0_Statement%20A_FINAL.pdf
- For Corrosion prevention, see Public Law 107-314 Sec: 1067, Prevention and mitigation of corrosion of military infrastructure and equipment. Also see DoD *Corrosion Prevention and Control* policy letter, signed by the Acting Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]), 12 November 2003 (see Attachment 1), and the *Facility Corrosion Prevention and Control* memorandum, signed by the Deputy Under Secretary of Defense for Installations and Environment, 10 March 2005. A good reference is the "Corrosion Prevention and Control Planning Guidebook", Sept 2007 located at www.dodcorrosionexchange.org.
- For Technical Data Rights Strategy content, the PM should consult 10 USC 2320, DoD Instruction 5000.02, Enclosure 12, paragraph 9, and the DFARS to determine appropriate Technical Data Rights Strategy content.
- MIL-STD-3018, "Parts Management"
- MIL-HDBK-189B NOT 1, "Reliability Growth Diagrams"
- MIL-HDBK-470A, "Designing and Developing Maintainable Products and Systems"
- 10 U.S.C. 2334(a)(6)(A), "Independent Cost Estimation and Cost Analysis"
- 10 USC 2434, "Independent Cost Estimates; Operational Manpower Requirements"
- 42 USC 4321, "National Environmental Policy Act"

D. Who Develops, Delivers and Manages Design Interface

Supportability features cannot be easily "added-on" after the design is established. Consequently supportability should be accorded a high priority early in the program's planning and integral to

the system design and development process. In addition to supportability features, the associated product support package, along with the supply chain, are important because they significantly impact the processes used to sustain the system, allowing it to be ready to perform the required missions.

The Life Cycle Logisticians working on a system's early acquisition phases should be assigned to the respective Integrated Product Teams (IPTs) addressing Cost, Technical and Programmatic issues. Historically, these IPT's have not been required to address long-term sustainment issues and, as a result, The Product Support Managers are going to find that they may need to develop the basic processes to incorporate design interface considerations into early engineering and costing activities.

The major document deliverables during the early acquisition phases, when typically most design interface activity occurs, are not the primary responsibility of The Product Support Manager. However, the analysis, forecasts, and data necessary to determine achievement of program KPPs and KSAs can only be completed by incorporation of the product support life cycle data provided by The Product Support Managers

E. When Is Design Interface Delivered and Managed in the Life Cycle

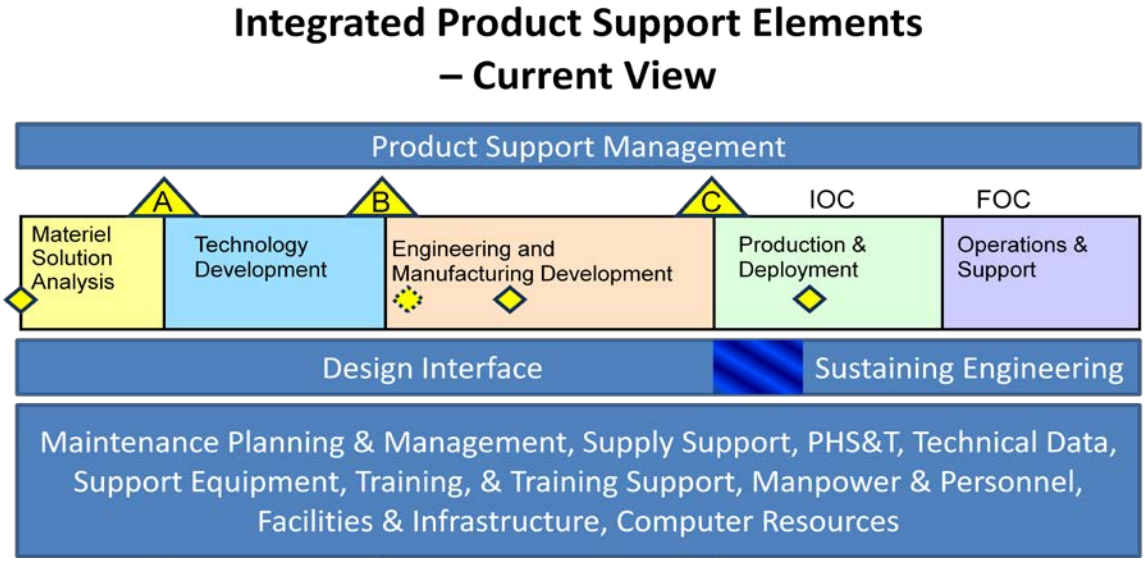


Figure 2.7.F1. Design Interface in the Acquisition Life Cycle

Early in the process, analyses are conducted to influence design and to determine a Maintenance Concept. Maintenance Planning and Design Interface analyses to be considered are:

• Use Study to define intended operational and maintenance environment, constraints and interfaces;
• Standardization and Interoperability to investigate the potential to incorporate standardization of hardware and software and to use GFE and GFM;

• Comparative Analysis to develop a Baseline Comparison System (BCS) to identify problems to be avoided and areas to be enhanced;
• Technological Opportunities enabling possible insertion of state-of-the-art technology;
• Supportability Requirements to quantify Supportability design factors such as the identification and definition of data rights and design, cost and logistical constraints;
• Functional Analysis to provide preliminary identification of maintenance of the equipment in its intended environment, potential failure modes, and identification of design deficiencies;
• Support Synthesis to develop alternative Support Concepts that provide the optimized support solution for system alternatives and refines the Maintenance Concept using previous results; and
• Trade-Off Analyses of considerations for cost, impacts on planned and existing weapon and/or support systems, training, and other continuing and Phase-specific requirements.

NAVAIR 00-25-406, "Design Interface Maintenance Planning Guide" is recommended reading.

Design interface activities do not stop at production and fielding, they continue in conjunction with sustaining engineering for modifications, upgrades, technology refresh, configuration management, and other improvement tasks for both the weapon system and the support infrastructure.

F. How Design Interface Is Developed, Established and Managed

It is within the systems engineering process where most design interface activity occurs. The systems engineering process transforms needed operational capabilities as defined by the Warfighter into an integrated system design. The Product Support Manager's responsibility is to ensure that supportability is addressed in the systems engineering process, at the same time that cost, schedule, and performance requirements are addressed. Designing for supportability requires analyzing, defining, and verifying supportability requirements and associated supportability performance measures often in the form of threshold and objective values.

When addressing supportability in the design phase, The Product Support Manager seeks to influence system design to make the system as reliable and as easy to maintain as possible. The more reliable and maintainable the system is, the less support it will require once it is fielded. The primary objective is to reduce the need for logistics support after a weapon system in fielded.

The following areas typically present significant opportunities to influence design:

- Technology: Technology maturity and refreshment, commercial off-the-shelf technology, open system standards, proprietary issues, and single source items all present unique supportability challenges that must be addressed;
- Commonality (physical, functional and operational): Does the system's design leverage existing products and services, or is it unique and require development of new infrastructure;
- Modularity (physical and functional): A design approach that adheres to four fundamental tenets of cohesiveness, encapsulation, self-containment, and high binding to design a system component as an independently operable unit subject to change;

- Standardization (system element and parts, test and support equipment): The process by which the DoD achieves the closest practical cooperation among forces, the most efficient use of research, development, and production resources; and agreement to adopt on the broadest possible basis the use of common or compatible operational, administrative, and logistics procedures and criteria; common or compatible technical procedures and criteria; common or compatible, or interchangeable supplies, components, weapons, or equipment; and common or compatible tactical doctrine with corresponding organizational compatibility;
- Diminishing manufacturing sources and material shortages (DMSMS): Are system components provided by multiple or single sources? Are system components subject to frequent change, i.e., short technology cycle, obsolescence?

During the design process, The Product Support Manager and the logistics team work with systems engineers to ensure that supportability is addressed. This is not a linear process. As system designs evolve, supportability factors also change. For example, a design change to reduce the weight of an aircraft may improve its performance and even lower the production unit cost. However, the redesigned aircraft may not be as reliable or easily repaired as the initial design choice, i.e. The new design choice may decrease supportability and, in the end, increase life cycle cost.

The Product Support Manager provides, whenever possible, quantitative analysis of the supportability impacts of design changes to the PM so an informed decision can be made on the tradeoffs between performance, cost and supportability. Examples of these supportability impacts include:

- Reliability, availability and maintainability impacts on life cycle metrics;
- “Multiplier factors” to minimize the logistics footprint;
- Proving how inherent design attributes impact external logistics support;
- Credible forecasting of reliability growth, cost, and changes in system usage rates;
- Operational factors to include environment, OPTEMPO, obsolescence and supply base risk.

The Product Support Manager should especially make maximum use of the results of test and evaluation to support the results of supportability analysis. The DoD is starting to use integrated DT/OT activities to simulate realistic operational parameters during early testing. The Product Support Manager should ensure that sustainment factors are included in all test plans whenever possible. Early data can be invaluable for improved forecasting and trade-off studies.

Major areas of system operations that need to be considered when designing for supportability include, but are not limited to:

- Deployment: Different geographical and environmental conditions impose different supportability design requirements. For example, supporting a system in a harsh desert environment may be very different from supporting a system in an arctic environment;
- Mobility: Different operating environments and customer missions place different demands on mobility requirements. The implications of the planned mode of transportation may cause a supportability plan to completely fail if not properly planned.

These implications or factors typically include size, weight, hazardous materials, and transport requirements to and from the operational site;

- Mission frequency and duration: Some systems require very little support, while others may demand a sophisticated support structure. A system such as a satellite that is deployed for extended periods of time will have different support requirements than a fighter aircraft;
- Human capability and limitations: The intended operating environment may affect the resources needed to support the system. For example, if a system must be maintained in a hazardous biological or chemical environment, the maintainers will need protective suits;
- Anticipated service life: Evolving technology cycles may reduce the service life for some segments of a system. If the technology cycle of an electronics component is very short and the component is not very costly, then supportability should be focused on a design that provides for easy access to replace the component.

G. Communities of Interest and Practice

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- PM e-Tool Kit Performance Learning Tools found at https://pmtoolkit.dau.mil/
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, Acquire Search)
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook)
- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02)
- Web enabled new JCIDS Instruction and Guidebook
- Best Practices Clearing House (With addition of Multimedia Assets – video, audio)
- Acquipedia
- Acquisition Community Connection (CoPs and Special Interest Areas)
- PM Certification Course materials and PM Continuous Learning Modules
- Probability of Program Success Model and Service Implementations
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation)
- DoD IG Audit Guides for Acquisition and Contracting
- Service and Agency PMO support sites
- Contract Management Processes Guide
- Leadership Support Center (Requires ACC log-in)

The Defense Logistics Agency (DLA) provides a website called “Assist Online” which is a search engine for Data Item Deliverables, found at https://assist.daps.dla.mil/online/start/

The Defense Acquisition University hosts an “Acquipedia” site features articles written by leading subject matter experts in the field. Areas of topic study include:

Note: these buttons are active hyperlinked to the DAU Acquipedia site.

There are currently 263 total articles. Life Cycle Logistics article titles are accessible through these hyperlinked buttons to the DAU Acquipedia site.

Additionally there are many professional organizations which provide critical knowledge supporting Design Interface topics.

The International Council on Systems Engineering (INCOSE) is a not-for-profit membership organization founded to develop and disseminate the interdisciplinary principles and practices that enable the realization of successful systems. The INCOSE Tools Database Working Group (TDWG) makes information on commercial-of-the-shelf (COTS) and government-off-the-shelf (GOTS) tools of interest to systems engineers available via their website.

- The Annual Reliability and Maintainability Symposium is sponsored by several professional groups. More information can be found at http://rams.org/ ;
- The DoD sponsors every year a Diminishing Manufacturing Sources and Material Shortages (DMSMS) & Standardization Conference. More information can be found at http://www.dmsms2011.com/ ;
- Maintenance topics are explored every year at the DoD Maintenance Symposium hosted by the Society of Automotive Engineers International (SAE), more information can be found at http://www.sae.org/ ;
- The DoD also sponsors a Defense Manufacturing Conference usually held in December timeframe.

H. Lessons Learned / Best Practices

The Defense Acquisition University's Best Practices Clearinghouse. This clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;

- Intelligent front-end to quickly get to answers;
- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

Most programs employ requirements management (RM) tools (e.g., Dynamic Object Oriented Requirements System (DOORS) or similar RM tools) to provide requirements management and traceability for stakeholder, statutory, regulatory, and derived requirements. It is critical for The Product Support Manager to ensure that all design interface related requirements are formally captured as part of the requirements documentation process.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

I. Training Resources

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

CLE 062 Human Systems Integration
CLM 029 Net-Ready KPP (NR-KPP)
CLM 035 Environmental, Safety and Occupational Health.
CLM 038 Corrosion Prevention and Control
CLM 200 Item Unique Identification (IUID)
LOG 103 Reliability, Availability, Maintainability

J. Key References

- DoD Directive 5000.01, “The Defense Acquisition System”
- DoD Directive 1322.18, “Military Training”
- DoD Directive 5250.01 requires that an LSSP shall be established for signature dependent programs
- DoD Instruction 5000.02, “Operation of the Defense Acquisition System”
- DoD Instruction 1322.26, “ Development, Management, and Delivery of Distributed Learning”
- Executive Order (E.O.) 12114, "Environmental Effects Abroad of Major Federal Actions"
- E.O. 12114, "Environmental Effects Abroad of Major Federal Actions"

- CJCS Instruction 3170.01, "Operation of the Joint Capabilities Integration and Development System"
- CJCSI 6212.01D, "Interoperability and Supportability of Information Technology and National Security Systems"
- CJCSI 6212.01D – Interoperability and Supportability of Information Technology and National Security Systems, 8 March 2006
- The Defense Standardization Program Website for policy and implementation guidance is http://www.dsp.dla.mil/APP_UIL/policy.aspx?action=content&accounttype=displaypolicy&contentid=79.
- Reliability, Availability, Maintainability-Cost (RAM-C) Report Manual, found at https://acc.dau.mil/CommunityBrowser.aspx?id=378147&lang=en-US
- "FY09 Department of Defense Human Systems Integration Management Plan", Version 1.0, found at http://www.acq.osd.mil/se/docs/FY09-DoD-HSI-Management-Plan.pdf
- FY09 DoD Human Systems Integration Management Plan", Version 1.0
- DoD Coverage and Return on Investment (ROI) Report, 2008
- Designing and Assessing Supportability in DoD Weapon Systems, A Guide to Increased Reliability and Reduced Logistics Footprint, Prepared by the Office of the Secretary of Defense, Oct 24, 2003
- Defense Acquisition Guidebook, sections as identified throughout this handbook. A detailed outline of the LCSP can be found in the DAG, Chapter 5.1.2. and at https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3303/USA005157-11_SignedLCSPMemo_14Sep2011.pdf.
- U.S. Navy's "Naval Open Architecture Contract Guidebook for Program Managers", Version 2.0 for contracting for opens systems architectures. It is found at https://acc.dau.mil/adl/en-US/375114/file/51790/FOR%20E-DISTRIBUTION_NOA%20Contract%20Guidebook%20V2.0_Statement%20A_FINAL.pdf
- For Corrosion prevention, see Public Law 107-314 Sec: 1067, "Prevention and mitigation of corrosion of military infrastructure and equipment." Also see DoD *Corrosion Prevention and Control* policy letter, Acting Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]), 12 November 2003 (Attachment 1), and the *Facility Corrosion Prevention and Control* memorandum, Deputy Under Secretary of Defense for Installations and Environment, 10 March 2005. Also see "Corrosion Prevention and Control Planning Guidebook", at www.dodcorrosionexchange.org.
- For Technical Data Rights Strategy content, the PM should consult 10 USC 2320, DoD Instruction 5000.02, Enclosure 12, paragraph 9, and the DFARS to determine appropriate Technical Data Rights Strategy content.
- MIL-STD-3018, "Parts Management"
- MIL-HDBK-189B NOT 1, "Reliability Growth Diagrams"
- MIL-HDBK-470A, "Designing and Developing Maintainable Products and Systems"
- SD-22, "Department of Defense (DOD) Diminishing Manufacturing Sources and Material Shortages (DMSMS) Guidebook"
- 10 U.S.C. 2334(a)(6)(A), "Independent Cost Estimation and Cost Analysis"
- 10 U.S.C 2434, "Independent Cost Estimates; Operational Manpower Requirements"
- 42 U.S.C 4321, "National Environmental Policy Act"

- AR 73–1, “Test and Evaluation Policy”
- DA PAM 73–1, “Test and Evaluation in Support of Systems Acquisition”
- ASTM F1166, Standard Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities
- ASTM F1337, Human Factors Engineering Plan

The following sources provide useful information about IUID:

- IUID policy announcements,
  - DoD Directive 8320.03, "Unique Identification (UID) Standards for a Net-Centric Department of Defense," March 23, 2007
  - DoD Instruction 8320.04, "Item Unique Identification (IUID) Standards for Tangible Personal Property," June 16, 2008
  - DoD Instruction 5000.64, "Accountability and Management of DoD-Owned Equipment and Other Accountable Property," November 2, 2006
  - DoD Instruction 4151.19, "Serialized Item Management (SIM) for Materiel Maintenance," December 26, 2006
- DoD guides for IUID implementation and planning
- DFARS 211.274, "Unique Item Identification and Evaluation"
- MIL-STD-130, "Identification Marking of U.S. Military Property"
- MILS-STD-129, "Military Marking for Shipment and Storage"
- Systems Engineering Plan Preparation Guide for Annex A

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3.0. Sustaining Engineering

3.0.1. Objective

Support in-service systems in their operational environments.

3.0.2. Description

Sustaining Engineering spans those technical tasks (engineering and logistics investigations and analyses) to ensure continued operation and maintenance of a system with managed (i.e., known) risk. This includes:

- Collection and triage of all service use and maintenance data;
- Analysis of safety hazards, failure causes and effects, reliability and maintainability trends, and operational usage profiles changes;
- Root cause analysis of in-service problems (including operational hazards, deficiency reports, parts obsolescence, corrosion effects, and reliability degradation);
- The development of required design changes to resolve operational issues;
- Other activities necessary to ensure cost-effective support to achieve peacetime and wartime readiness and performance requirements over a system's life-cycle.

Technical surveillance of critical safety items, approved sources for these items, and the oversight of the design configuration baselines (basic design engineering responsibility for the overall configuration including design packages, maintenance procedures, and usage profiles) for the fielded system to ensure continued certification compliance are also part of the sustaining engineering effort. Periodic technical review of the in-service system performance against baseline requirements, analysis of trends, and development of management options and resource requirements for resolution of operational issues should be part of the sustaining effort.

Product Support Manager Activities

3.1 Analysis

Sustaining engineering analysis includes technical management activities required to measure progress, evaluate and select alternatives, and document data and decisions. These activities apply to all steps of the systems engineering and performance based life cycle product support process and occur during all phases of the weapon system's acquisition. System analysis activities include trade-off studies, effectiveness analyses, and design analyses. They evaluate alternative approaches to satisfy technical requirements and program objectives, and provide a rigorous quantitative basis for selecting performance, functional, and design requirements. Analysis tools are used to provide input to analysis activities and include modeling, simulation, experimentation, and test.

3.1.1 Operational Profile Analysis

The rate of usage of a weapon system is measured by its Operational Tempo (OPTEMPO). OPTEMPO may be defined by hours per mission, missions per year or month, flight hours per hour, etc. The OPTEMPO describes the period of time and the amount of time spent performing the mission during that specified period. Analysis is performed to understand not only the rate of use of the weapon system but also how it is used and under what conditions it is used. Often product support data is collected to correspond to this usage. Product support data includes failures, maintenance performed, supply actions, usage of services, fuel, oil, batteries and commodities, etc. The operational profile is often called the mission profile or operational summary.

More specifically, an operational profile describes the anticipated mix of ways units, by unit or mission task mix, will use equipment during a typical year in peacetime and during national conflict in wartime. It provides the basis for the essential characteristics described in readiness documents. It covers all missions and profiles for each mission and the relative frequency of the various missions. The operational profile also includes the percentage of time the materiel will be exposed to each type of environmental condition during the life of the system. It must address special conditions of use, such as wartime usage surge rates, operations other than war (OOTW) or high-intensity peacetime usage, when appropriate. It identifies sequentially the tasks, events, duration, and operating conditions of the system for each phase of a mission. The operational profile typically does not specify unscheduled downtime.

3.1.2 Failure Analysis

Failure analysis is the process of collecting and analyzing data to determine the cause of a failure.

3.1.2.1 Failure Reporting and Corrective Action System (FRACAS)

FRACAS is a feedback path to collect, record, and analyze failures of system data sets. The user captures predetermined types of data and submits the data to that supplier. A Failure Review Board (FRB) analyzes the failures and recommends corrective action.

Per MIL-HDBK 2155, "Failure Reporting, Analysis and Corrective Action Taken," the essence of a closed loop FRACAS is that failures and faults of both hardware and software are formally reported, analysis is performed to the extent that the failure cause is understood and positive

corrective actions are identified, implemented and verified to prevent further recurrence of the failure.

Corrective action options and flexibility are greatest during design evolution when even major design changes can be considered to eliminate or significantly reduce susceptibility to known failure causes.

3.1.2.2 Trend Analysis

Trend analysis refers to the concept of collecting information and attempting to spot a pattern, or trend. In statistics, trend analysis often refers to techniques for extracting an underlying pattern of behavior in a time series which would otherwise be partly or nearly completely hidden by unrelated data. Although trend analysis is often used to predict future events, it is also used to estimate uncertain events in the past.

3.1.2.3 Root Cause Analysis

Root cause analysis is a method of risk management that includes analysis to identify the root causes of the risks identified. Root causes are identified by examining each WBS product and process element in terms of the sources or areas of risk.

An approach for identifying and compiling a list of root causes is generally to:

- List WBS product or process elements;
- Examine each in terms of risk sources or areas;
- Consider results of technical and trend analyses;
- Determine what could go wrong; and
- Ask “why” multiple times until the source(s) is discovered.

A common misconception and program office practice concerning risk management of root cause analysis is to identify and track issues (vice risks) and then manage the consequences (vice the root causes). Risks should not be confused with issues (realized risks). If a root cause is described in the past tense, the root cause has already occurred and is, therefore, an issue that needs to be resolved but not a risk. Root causes most frequently addressed as part of sustaining engineering include (defined below):

- Operational Hazards;
- Deficiency Reports;
- Parts Obsolescence (discussed in Section 3.3.9.);
- Corrosion effects (discussed in Section 3.3.6.);
- Reliability degradation.

3.1.2.3.1 Operational Hazards

As part of the program's overall cost, schedule, and performance risk reduction, the Program Manager (PMs) shall prevent ESOH hazards, where possible, and manage their associated risks where hazards cannot be eliminated. Risk acceptance and implementation of mitigating measures is necessary to avoid loss of life or serious injury to personnel; damage to facilities or equipment; failure with adverse impact on mission capability, mission operability, or public opinion; and harm to the environment and the surrounding community.

The scope of potential risks includes all ESOH regulatory compliance requirements associated with the system throughout its lifecycle, including:

- Hazardous material use and hazardous waste generation;
- Demilitarization;
- Disposal requirements;
- Safety (including explosives safety);
- Human health;
- Noise;
- Impacts to the environment.

The preferred mitigation strategy is source reduction or elimination of the hazards (pollution prevention). The PM should strive to eliminate or reduce ESOH risks as part of the system's total lifecycle risk reduction strategy. If effectively executed, ESOH risk management identifies system-specific ESOH risk information. The PM should integrate into the ESOH risk management data any additional ESOH risks or mitigation measures identified during the formal National Environmental Policy Act (NEPA)/ Executive Order 12114 analysis process.

The PM/PSM should monitor and assess the effectiveness of mitigation measures to determine whether additional control actions are required. The PM then documents the effectiveness of mitigation measures in the Programmatic Environmental, Safety, and Occupational Health Evaluation (PESHE). Relevant information may include related mishap data, adverse health effects, and significant environmental impacts from system development, testing, training, operation, sustainment, maintenance, and demilitarization and disposal.

DoD Instruction 5000.02 establishes requirements for PMs to manage ESOH risks for a system's lifecycle. The PM is required to have a PESHE for Milestone B (or Program Initiation for ships), Milestone C, and Full-Rate Production Decision Review (FRP DR) that includes:

- Identification of ESOH responsibilities;
- The strategy for integrating ESOH considerations into the systems engineering process;
- Identification of ESOH risks and their status;
- A description of the method for tracking hazards throughout the life cycle of the system;
- Identification of hazardous materials, wastes, and pollutants (discharges /emissions / noise) associated with the system and plans for their minimization and/or safe disposal;
- A compliance schedule covering all system-related activities for the NEPA.

3.1.2.3.2 Deficiency Reporting Process

Per DLAR 4155.24, “Product Quality Deficiency Report Program”, there shall be a cross-Component system that will feed back quality data to activities responsible for design, development, purchasing, production, supply, maintenance, contract administration, and other functions so that action can be initiated to correct and prevent product quality deficiencies.

Quality deficiency data will be reported across Component lines in a timely manner to ensure prompt determination of cause, corrective action, and prevention of recurring deficiencies are initiated.

Components will assure, as applicable, that contract clauses or quality assurance provisions are incorporated into contracts that provide for contractor and subcontractor participation in the deficiency reporting and investigation program.

Components will assure that all product quality deficiencies subject to the provisions of this regulation are reported. This includes deficiencies which may occur in major weapon systems, Government-owned products used during development/test, items supplied as Government-furnished property (GFP), or deficiencies in any other items not specifically excluded

The Joint Deficiency Reporting System (JDRS) was launched on 05 May 2008. JDRS provides a common, seamless solution for deficiency reporting and resolution management across the Aeronautical Enterprise. JDRS is a cross-service (used by the Navy, Army, Air Force, Marines, Coast Guard and DCMA) web enabled automated tracking system designed to initiate, process and track deficiency reports from the Warfighter through the investigation process. JDRS (for registered users) is located at: https://jdrs.mil and the public site (with presentations and resources) is located at http://www.jdrs.mil.

Benefits of JDRS include:

- Improved quality of material and Warfighter readiness;
- Visibility of deficiency reports across all services;
- Critical safety item visibility aeronautical enterprise wide;
- Reduction of total ownership cost and cycle time;
- Government and industry partnering;
- Improved exhibit inventory management and management metrics;
- Automated routing of deficiency reports and ease of use.

3.1.2.3.3 Reliability Degradation

System RAM is often difficult to accurately assess until the system is deployed or fielded. PSM's should ensure that integrated testing incorporates as fully as possibly realistic conditions for assessing the sufficiency of the proposed product support infrastructure. The below table, taken from the superseded DoD Guide For Achieving Reliability, Availability, and Maintainability, Aug 2005, contains typical reasons which can accelerate reliability degradation on a system.

Reason	Discussion
Change in operating concept	If system is used in a manner different from that originally allowed for in the design, new failure modes can occur, and the overall frequency of failures can increase. In such cases, corrective actions can be expensive or impractical. If the new operating concept is essential, decreased RAM levels may have to be accepted.
Change in operating environment	If a system is used in an environment different from that originally allowed for in the design, new failure modes can occur, and the overall frequency of failures can increase. In such cases, corrective actions can be expensive or impractical. If the system must operate in the new environment, decreased RAM levels may have to be accepted.

Inadequate training	Inadequate operating or maintenance training usually increases the number of failures induced by improper operation or maintenance. The corrective action is to improve the training.
Wear-out / Inadequate Reliability Centered Maintenance Program	As systems age, the number of failures per unit time for parts having wear-out characteristics will increase. A preventive maintenance program to replace or overhaul such parts will prevent wear-out from becoming a problem. Ideally the preventive maintenance program is based on the reliability characteristics of the parts (i.e., a reliability-centered maintenance program based on the field data within the DCACAS).
Inadequacies of design analysis and test	All engineering models, analytical tools, and test methods are imperfect. It is also impossible to perfectly model or simulate the actual operational environment during design and test. Finally, the time and funds available for analysis and testing are limited. For all of these reasons, failure mechanisms may go undetected until after the system is fielded.
Lack of understanding the role of software in RAM performance.	Most modern weapons systems are digital in design. The mission success, availability, and supportability are largely governed by software. Previously, classical RAM levels were component failure intensive. Currently, software plays a more important role. Personnel managing, developing, and producing these new systems need to understand that software intensive systems require a different approach to failure detection, isolation and ultimate repair or corrective action.
Change in supplier	If a supplier chooses to stop manufacturing a part or material, goes out of business, or no longer maintains the necessary levels of quality, an alternate source of supply is needed. If RAM is not a major consideration in selecting the new supplier, system reliability may degrade. If there are a limited number of new suppliers to select from, lower RAM levels may have to be accepted.
Poor configuration control	Over a system's life, there is the temptation to reduce costs by substituting lower-priced parts and materials for those originally specified by the designer. Although the purchase price may be lower, life cycle costs will increase, and the mission will suffer if the "suitable subs" do not have the necessary RAM characteristics. Strong configuration management and a change control process that addresses all factors, including RAM performance, are essential throughout the life of the system.
Manufacturing problems	Although the manufacturing processes may have been qualified and statistical processes implemented at the start of production, changes can occur during the production line that degrade RAM. This possibility increases as the length of the production run increases; therefore, constant quality control is essential.
Inadequate funding	Inadequate support funding can affect many factors, including availability of repair parts, support equipment, and maintainer training, which can have a profound effect on RAM.

Table 3.1.2.3.3.T1. Typical Reasons for Weapon System Reliability Degradation

Per the DAG 5.3.2, the requirements determination process offers the first opportunity to positively influence a system from a reliability perspective. Trade-offs among "time to failure," system performance, and system life-cycle cost are necessary to ensure the correct balance and to maximize materiel availability. Sustaining engineering plans must be proactive in seeking to prevent, rather than correct, reliability degradation.

Options that should be considered and implemented to enhance system reliability and achieve the Materiel Reliability KSA include:

- Over-designing to allow a safety margin;
- Redundancy and/or automatic reconfiguration upon failure allowing graceful degradation;
- Fail safe features (e.g., in the event of a failure, systems revert to a safe mode or state to avoid additional damage and secondary failures). Features include real time reprogrammable software, or rerouting of mission critical functions during a mission;
- Calibration requirements; and
- Reliability Growth Program.

3.1.2.4 Safety Hazard Analysis

Safety factors consist of those system design characteristics that serve to minimize the potential for mishaps causing death or injury to operators and maintainers or threaten the survival and/or operation of the system. Prevalent issues include factors that threaten the safe operation and/or survival of the platform; walking and working surfaces including work at heights; pressure extremes; and control of hazardous energy releases such as mechanical, electrical, fluids under pressure, ionizing or non-ionizing radiation (often referred to as "lock-out/tag-out"), fire, and explosions.

The DoD is committed to protecting: private and public personnel from accidental death, injury, or occupational illness; weapon systems, equipment, material, and facilities from accidental destruction or damage; and public property while executing its mission of national defense. The DoD has implemented environmental, safety, and health efforts to meet these objectives. Integral to these efforts is the use of a system safety approach to manage the risk of mishaps associated with DoD operations. A key objective of the DoD system safety approach is to include mishap risk management consistent with mission requirements, in technology development by design for DoD systems, subsystems, equipment, facilities, and their interfaces and operation. The DoD goal is zero mishaps.

Per MIL-STD-882D, “Standard Practice for System Safety,” mishap risk must be identified, evaluated, and mitigated to a level acceptable (as defined by the system user or customer) to the appropriate authority, and compliant with federal laws and regulations, Executive Orders, treaties, and agreements. Program trade studies associated with mitigating mishap risk must consider total life cycle cost in any decision. Residual mishap risk associated with an individual system must be reported to and accepted by the appropriate authority.

3.1.2.5 Mishap Investigation

A mishap is any activity with an unintended outcome involving a death, injury, illness or property damage. Recent AT&L memo, “Mishap Notification, Investigation, Reporting, and

Record Keeping", 6 Jun 2011, provides detailed instructions on Proponency, responsibilities, and requirements regarding mishaps. http://www.dtic.mil/whs/directives/corres/pdf/605507p.pdf.

Each DoD Service has established safety centers that collect accident or mishap data. These centers offer a wealth of expertise and experience to assist the Program Manager, systems and design engineers, and system safety engineers in identifying historical and current safety and health hazard risk information for DoD systems. Safety centers can also be contacted for representation at System Safety Working Group meetings and for assistance in assessing and resolving hazard risks.

Air Force Safety Center:

- Develops, implements, executes, and evaluates Air Force aviation, ground, weapons, space, and system mishap prevention and nuclear surety programs to preserve combat readiness;
- Conducts research to promote safety awareness and mishap prevention;
- Oversees mishap investigations;
- Evaluates corrective actions and ensures implementation;
- Develops and directs safety and operational risk management education.

Army Combat Readiness Center:

- Prevents the accidental loss of personnel and conserves materiel resources through safe air and ground practices;
- Enhances combat readiness through proactive risk management to prevent accidents;
- Assist commanders in integrating risk management into all Army efforts;
- Provides proactive assistance to Command risk management and safety programs through assessments and educational tools;
- Trains military and civilian safety professionals in the latest risk management techniques and integration skills;
- Develops safety policies that promote safe practices and processes;
- Conducts accident investigations.

Marine Corps Safety:

- Enhances Marine Corps readiness by educating and equipping Marines, Sailors, and civilians to manage risks and reduce mishaps;
- Implements an effective strategy for force protection;
- Provides support in determining safety program policies and objectives;
- Develops procedural guides and implementing directives.

Naval Safety Center:

- Trains and motivates Sailors and Marines to prevent mishaps and save lives;
- Evaluates emerging safety technology and processes in Government and private industry;
- Solicits feedback from the Fleet and Naval Safety Center team;
- Assesses mishap trends;
- Provides safety policies, guidance, and assessments.

3.1.3 Value Engineering (VE)

VE is an organized/systematic approach that analyzes the functions of systems, equipment, facilities, services, and supplies to ensure they achieve their essential functions at the lowest life-cycle cost consistent with required performance, reliability, quality, and safety.2 Typically the implementation of the VE process *increases* performance, reliability, quality, safety, durability, effectiveness, or other desirable characteristics. SD-24, "Value Engineering: A Guidebook of Best Practices and Tools", Jun 13, 2011, is an excellent reference for both government and contractors. Defense Acquisition University's community of practice website on value engineering, https://acc.dau.mil/CommunityBrowser.aspx?id=399567&lang=en-US, provides insights, references and information on developing the value engineering change proposal.

Value engineering is required by statute, the Federal Acquisition Regulation (FAR), and Office of Management and Budget (OMB) policy. Section 36 of the Office of Federal Procurement Policy Act (41 USC 432) states that "Each executive agency shall establish and maintain cost-effective value engineering procedures and processes." FAR Part 48 and the contract clauses at FAR 52.248-1 through 52.248-3 further delineate VE requirements. OMB Circular No. A-131 (attachment 1) requires Federal Departments and Agencies to use VE as a management tool, where appropriate, to reduce program and acquisition costs; it also assigns agency responsibilities and contains the format for reporting VE activities. AT&L memo, "Value Engineering", 21 Sep 2007, highly encourages continuous process improvement in contracts identified in subpart 48.2 of the FAR.

3.2 Engineering Technical Services and Engineering Dispositions

3.2.1 Engineering Technical Services (ETS)

ETS provide training (on the job and formal); advanced fault isolation and troubleshooting support; technical information research and advice; and assistance in resolving complex problems in conjunction with the installation, operation, maintenance, modification, and repair of applicable weapon systems and support systems. ETS personnel assist in documenting emerging support processes and procedures within knowledge management systems, which provides a repository that establishes records and support materials to serve as a foundation for future technicians and maintenance personnel. As a result, ETS provide continuity from the beginning of the acquisition life cycle through the completion of the sustainment phase.

In order to establish an ETS capability, there is a requirement for early planning and resource allocation. Implementation of an ETS strategy in support of the Warfighter is an enabler of system availability and mission readiness. Therefore, it is important for programs to plan for the right mix of organic and contractor ETS support that will take advantage of enterprise utilization of ETS services and eliminate duplicative services across programs. Early ETS planning will allow organic tech reps to be trained on unique systems through cadre/factory training, plan for issues such as technical data access for tech reps/OEM reach back, and help programs by utilizing the tech rep's experience on legacy systems for testing and reviews of the new program.

Programs are responsible for funding ETS up until 12 months after IOC. At that point, ETS are funded via the OMA account for ETS. It is important to plan for this transition and identify the mix of organic and contractor ETS/Field Service Representatives (FSRs) throughout the

program's life cycle in order for organic tech reps to have the skills and OEM reach back needed to support the program at the time of the transition. Early in the acquisition process, programs typically use OEM tech reps (usually called FSRs). Organic tech reps should start to be introduced (from a legacy system if available) before milestone C by participating in cadre/factory training. The organic tech reps should also be utilized in ST&E events such as maintenance monitoring and other reviews/testing in order to take advantage of their experience and help organic ETS become familiar with the new program. The program should work with their ETS technical authority to incorporate OMN ETS/FSR requirements into the POM submittal at least 24 months before IOC. 12 months after IOC the ETS/FSR requirements transfer from program funded to OMN funded and managed through the DOD service ETS/FSR technical authority.

If ETS/FSR planning is not coordinated early in the acquisition process, it might be difficult to organically support programs with tech reps due to ETS/FSRs not being trained on unique systems and not having OEM reach back / tech data access. If this is the situation, then programs will have no option but to fund OEM tech reps (if needed) which is typically at a higher cost than organic ETS/FSRs. As PBL or like contracts have become increasingly popular, programs need to make sure they are considering and mitigating the impacts of not having the capability to organically support the fleet in some areas, such as access to technical data and unique system training requirements. In these situations, Public Private Partnerships (PPP) integrating organic ETS within these sustainment contracts needs to be considered by the programs.

3.2.2 Engineering Dispositions

The below list indicates the types of activities which may occur as a result of sustaining engineering analysis and engineering technical support. These activities serve to complete, improve, correct, or review for decision a situation with the end result to improve sustainment metric outcomes:

- Technical manual and technical order updates;
- Repair or upgrade vs. Disposal or retirement;
- Maintenance data evaluation automation;
- Engineering change proposals;
- Technology insertion;
- Materiel Improvement Plan (MIP) review boards.

3.2.2.1 Technical Manual and Technical Order Updates

The strategy for management of technical manuals and technical orders should be included in the Technical Data Rights Strategy and the Life Cycle Sustainment Plan (LCSP). The process and timing for updates will be dependent upon the requirements of the weapon system.

PSM's should check with their respective DoD Component for specific guidance.

For the Air Force, USAF Technical Order (TO) 00-5-1 "AF Technical Order System (ATOS)" describes the Air Force TO System established by Air Force Policy Directive (AFPD) 21-3, Technical Orders, and Air Force Instruction (AFI) 21-303. Technical Orders, under the control of HQ USAF/ILMM, specify business practices and responsibilities for operation and management of the TO system, and outline general procedures for use of the system. The

standard set of TO System functions consists of acquire, publish, stock, distribute, maintain and use TOs. This TO identifies and explains the various types of TOs and related procedures. Changes to this TO shall be submitted in accordance with Chapter 9. Request for waivers of TO System practices and procedures will be submitted IAW AFI 21-303. References and related publications, related forms, acronyms and terms used in this TO are listed in the Glossary, Appendix A.

The purpose of the Air Force TO system is to provide concise but clear instructions for safe and effective operation and maintenance of centrally-acquired and managed Air Force military systems and end items. All available formats of a TO or TO update (paper, digital medium, electronic file) must be released concurrently to maintain TO configuration control. TOs are published by authority of the Secretary of the Air Force in accordance with AFPD 21-3. Compliance with Air Force TOs is mandatory.

3.2.2.2 Repair or Upgrade vs. Disposal or Retirement

The decision to repair, upgrade, dispose or retire a weapon system, a subsystem thereof, or a product / process of the support infrastructure is dependent upon many factors to include needs of the Warfighter, obsolescence, cost, etc. PSMs should establish internal decision processes addressing these topics. Additional discussion is included in The Product Support Management and Maintenance Product Support Element sections.

3.2.2.3 Maintenance Evaluation Automation

The Product Support Manager needs tools and processes to be able to efficiently evaluate maintenance implementation and practices. The below are a few Service specific examples or newer commercial practices to evaluate maintenance activities.

3.2.2.3.1 U.S. Navy's Maintenance and Material Management (3-M) System

Per OPNAVINST 4790.4E, The Ship's 3-M System is the nucleus for managing afloat and applicable shore station equipment. This system provides maintenance and material managers throughout the Navy with a process for planning, acquiring, organizing, directing, controlling and evaluating the manpower and material resources used to support maintenance.

The Ship's 3-M System is designed to provide for managing maintenance and maintenance support to achieve maximum equipment operation readiness. The Ship's 3-M System shall provide for:

- Standardization to achieve uniform maintenance standards and criteria;
- Efficiency to effectively use available manpower and material resources in maintenance and maintenance support efforts;
- Documentation to record maintenance and maintenance support actions to establish a material history;
- Analysis to improve reliability and maintainability of systems and equipment, and to reduce cost of material ownership;
- Configuration status accounting to report and record changes to installed equipment, equipment configuration specifications and shipboard locations;
- Scheduling to plan, manage, execute and track maintenance requirements and accomplishments.

3.2.2.3.2 SAE JA1011 "Evaluation Criteria for Reliability-Centered Maintenance (RCM) Processes referencing Message Specification"

RCM is a specific process used to identify the policies which must be implemented to manage the failure modes which could cause the functional failure of any physical asset in a given operational context. This document is intended to be used to evaluate any process that purports to be an RCM process and supports such an evaluation by specifying the minimum criteria that a process must have in order to be an RCM process.

3.2.2.4 Engineering Change Proposals

This topic is discussed in detail in Section 1.3.19, Configuration Management.
PSMs should also review the Tools Section, 1.3.24, to include the Multi-User ECP Automated Review System (MEARS) tool. MEARS is a GOTS (Government off the Shelf) web-based system for processing engineering change documents including:

- Engineering Change Proposals (ECPs);
- Request For Deviations (RFDs);
- Specification Change Notices (SCNs).

3.2.2.5 Technology Insertion

Technology Insertion, sometimes also referred to as Technology Transition, is the process of applying critical technology in military systems to provide an effective weapons and support system-in the quantity and quality needed by the Warfighter to carry out assigned missions and at the "best value" as measured by the Warfighter.

3.2.2.6 MIP Review Boards

A Materiel Improvement Project (MIP) identifies a planned effort to investigate and resolve deficiencies or proposed enhancements. It implies an extraordinary effort to monitor and control related actions. It may require an extended effort and/or involve multiple agencies. Examples of where a MIP would be applicable are on system integration situations, where a deficiency reported on a single component involves corrective actions on multiple components or items within a system. Another example would be where multiple Deficiency Reports (DRs) have been submitted on a single item.

The MIP Review Board is the Program Manager's key process for management and oversight of the deficiency reporting and resolution process. The review board provides management oversight and visibility of all open reports, their status, and when necessary, energizes resources to ensure timely resolution. It is intended to be a management level, not working level review of DRI&R process status. Working level actions should occur prior to convening the MIPRB. The PM may delegate responsibility to lateral organizations such as Supply Chain Managers to hold review boards on items managed by them but shall maintain visibility of their actions and activities affecting the weapon system /end item. Delegation shall be documented, in writing, to ensure understanding of responsibilities, engineering, and program management authority. Additionally, the PM may consolidate these activities with other meetings/IPTs to assist in the collection, analysis, verification, and categorization of reliability, maintainability, and availability (RMA) data. An example for Test programs may include Joint Reliability and Maintainability Evaluation Team (JRMET), or similar IPT. The JRMET may also review

applicable DRs and recommend whether or not the DR should be closed. The Program Manager and the Chief Engineer/Lead Engineer shall develop a local process / documentation to review all DRs and the closing actions.

3.3 Reliability Growth

The focus of reliability growth program activities is the identification and elimination of failure modes. Initial prototypes of complex weapon systems will invariably have reliability and performance deficiencies that generally could not be foreseen and eliminated in early design stages. To uncover and mitigate these deficiencies, early prototypes, and later, more mature engineering models, are subjected to a series of Developmental and Operational Tests.

It is DoD policy for programs to be formulated to execute a viable RAM strategy that includes a reliability growth program. Relevant guidance can be found in the "DoD Reliability, Availability, Maintainability-Cost (RAM-C) Report Manual." The preliminary RAM-C Report is developed in support of Milestone A and updated for Milestones B & C. This report:

- Provides early (Pre-MS A) reliability, availability, maintainability and ownership cost feasibility assessments of alternative concepts;
- Includes early formulation of maintenance & support concepts;
- Provides an audit trail that documents and supports JCIDS thresholds;
- Ensures correct balance between the sustainment metrics (Availability-KPP, Materiel Reliability-KSA, and Ownership Cost-KSA);
- Provides early risk reductions by ensuring requirements are realistic and correct.

Reference is OSD AT&L DTM 11-003, “Reliability Analysis, Planning, Tracking, and Reporting”, 21 Mar 2011, and found at http://theriac.org/pdfs/DTM-11-003.pdf.

The reliability growth program should be an integral part of design and development and should be integrated within the systems engineering processes. Use of GEIA-STD-0009, "Reliability Program Standard for Systems Design, Development, and Manufacturing" (found at https://acc.dau.mil/CommunityBrowser.aspx?id=382313) and associated contractual language will ensure this occurs. The reliability scorecard can be used to evaluate the developer's reliability practices.

Reliability Growth Strategy:

- Documents system-level reliability growth curves in the SEP beginning at MS A and updated in the Test & Evaluation Master Plan (TEMP) beginning at MS B;
- Establishes intermediate goals for reliability growth curves that will be tracked through fully integrated system-level test and evaluation events until the threshold is achieved;
- Requires MS C PMs and Operational Test Agencies to assess reliability growth required to achieve the reliability threshold during Initial Operational Test and Evaluation.

Tracking and Monitoring

- Requires PMs to report status of reliability objectives and/or thresholds as part of the formal system engineering review process;
- Incorporates Reliability Growth Curves into the Defense Acquisition Executive System (DAES) review process.

The reliability growth program should be documented in the program's Systems Engineering Plan and Life-cycle Sustainment Plan, and assessed during technical reviews, test and evaluation, and Program Support Reviews.

Figure 3.3.F1. Program Reliability Planning Comparison between FY2008 and FY2009.

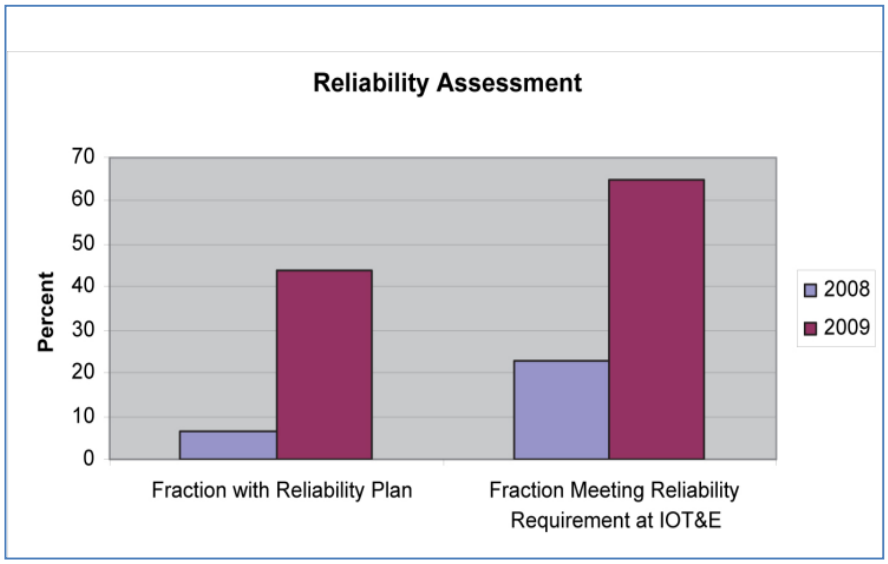
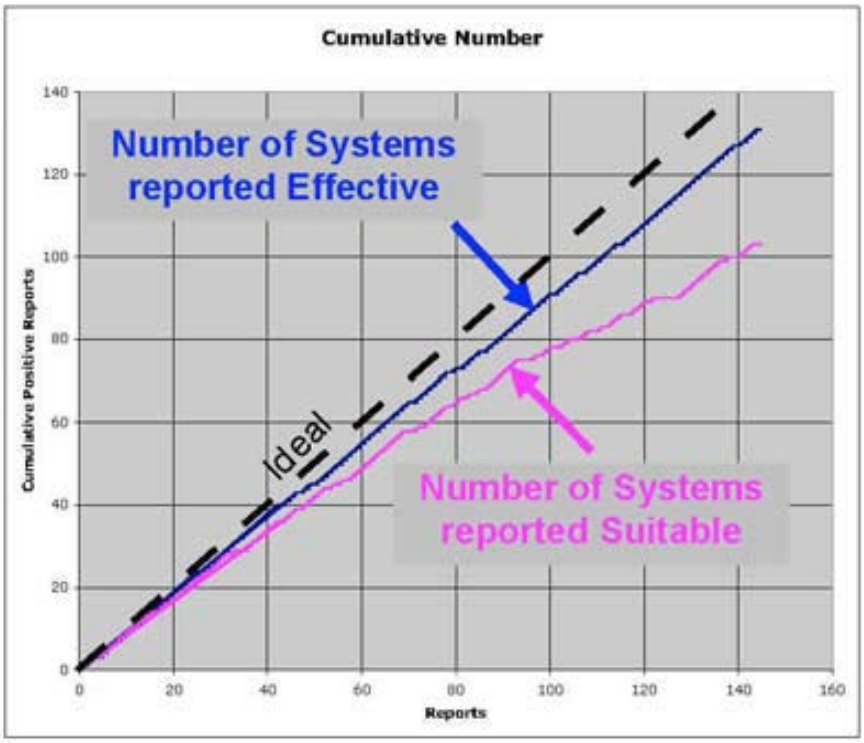


Figure 3.3. F2. Systems Evaluated Effective versus Suitable Beyond Low-Rate Initial Production Report



Applying a reliability growth model provides assessments and tracking of failure modes. Reliability growth modeling allows the analyst to estimate the current or projected system reliability performance and estimate the time required to develop specified levels of reliability.

For each weapon system, there is a level of basic reliability that must be achieved for the system to be militarily useful, or suitable, given its intended usage or operational concept. DOT&E's position is that addressing reliability must occur as early in the weapon system acquisition process as possible.

The DOT&E 2009 Report states that 44 percent of programs have a reliability plan, and 45 percent of programs are tracking reliability. Of the programs on DOT&E's current oversight list that have completed IOT&E, 66 percent met their reliability requirements. While these numbers represent an improvement from 2008 (see Figure 1), there is substantial room for continued improvement. As another measure of progress contained in the DOT&E 2009 Annual Report, eight Beyond Low-Rate Initial Production reports for programs on oversight were provided to Congress. Of those, two were not suitable for combat compared to two of nine the year before. The chart from last year's annual report has been updated in Figure 2 with the data from FY09 and shows no improvement in suitability. Over the 25 years of DOT&E's existence, about 75 percent of defense systems are found to be suitable in operational testing.

The conclusion to be drawn from the DOT&E reports is that the PM/PSM must be cognizant of the weapon system's reliability, availability and maintainability status based on testing – these outcomes will significantly drive the logistics footprint, life cycle cost and the degree of complexity of the product support infrastructure needed to achieve program KPP / KSAs.

3.4 Diminishing Manufacturing Sources and Material Shortages (DMSMS)

Product lines are discontinued when the economic factors for their continuance are unfavorable. As the market shifts to a new technology, demand is reduced for earlier models and configurations and the cost for supporting the technology escalates. Suppliers must either raise the price (to maintain profit margins and offset reduction in demand) or terminate the product line. Accepting price increases or diminished availability as the supplier eliminates the remaining inventory are poor choices for the customer. In the end, customers pay significantly increased sustainment costs and are eventually forced to upgrade or replace systems with newer technologies. This is referred to as Diminishing Manufacturing Sources.

To fully understand the DMSMS concept, examine the life cycle of technology. Just like living things, technology goes through a development life cycle: birth, maturity, illness, death, and replacement. All commercial technologies go through a similar cycle; only the length of the cycle varies. This section and the resources below deal with Diminishing Manufacturing Sources and Material Shortages (DMSMS), defined as*: the loss, or impending loss, of the last known manufacturer or supplier of raw materials and other critical components for production or repair parts.* DMSMS problems are an increasing concern as the service lives of DoD weapon systems are extended and the product life cycle for high technology components decrease.

The DMSMS Knowledge Sharing Portal can be accessed at http://www.dmsms.org/.

Two key focal points for DoD DMSMS mitigation are the Undersecretary of Defense for Acquisition, Technology and Logistics (AT&L) DMSMS Guidebook and the "DoD DMSMS Knowledge Sharing Portal (formerly the DMSMS COE)." The guidebook "highlights the most effective, proactive practices being used across DoD Services and Agencies to help the Program Manager reduce the risk of obsolescence. The Guidebook presents basic methodology to assist Program Managers with establishing programs and analyzing the results in regard to the basic parameters of cost, schedule, and performance. It stresses the importance of the DMSMS Center of Excellence and how the site can give valuable services to programs in any stage of development." The DoD DMSMS Knowledge Sharing Portal resources are extensive, and include:

- DLA sponsored access to DMSMS predictive tool (Bill of Material & Part # analysis);
- Comprehensive listing of DMSMS tools (free and subscription based);
- Listing of vendors (searchable by category);
- DMSMS training materials, including the "DMSMS Fundamentals" course;
- Library containing directives, manuals, presentations/papers, and newsletters;
- Calendar of DMSMS related events;
- Links to other useful sites and points of contact.

Two other key players in the DoD fight against DMSMS are the Government-Industry Data Exchange Program (GIDEP) and the Defense Microelectronics Activity (DMEA). GIDEP is a cooperative activity between government and industry participants seeking to reduce or eliminate expenditures of resources by sharing technical information essential during research, design, development, production and operational phases of the life cycle of systems, facilities and equipment. DMEA was established as a specially focused government unit, operating under the authority of the Deputy Undersecretary of Defense for Logistics and Materiel Readiness in the Department of Defense. It operates a sophisticated design, prototyping, and testing facility supported by a team of more than a hundred advanced technology specialists. DMEA helps resolve microelectronics technology issues in weapons systems. DMEA presents the program manager with appropriate solution options to keep the system operational. These solution options range from component replacement to board or system upgrades with advanced technology. In all cases, DMEA uniquely provides for the resolution to long-term obsolescence.

3.5 Product Improvement

Product improvement efforts encompass the spectrum from recapitalization to complete replacement with a new acquisition. Typically it is more cost effective and less risky to update and rebuild a weapon system, rather than acquire a completely new system, if the existing platform, those which are both fielded and still under development, can accommodate the new performance, capability and sustainment requirements.

3.5.1 Product Improvement Planning

3.5.1.1 Preplanned Product Improvements

Evolutionary acquisition is the preferred DoD strategy for rapid acquisition of mature technology for the user. An evolutionary approach delivers capability in increments, recognizing, up front, the need for future capability improvements. This strategy balances needs and available capability with resources, and provides the user with a capability more quickly. The success of the strategy depends on consistent and continuous definition of requirements, and the maturation of technologies that lead to disciplined development and production of systems that provide increasing capability towards a materiel concept. The two major approaches are to implement this strategy are Incremental Development (end-state requirements are known and the requirement is met in several increments) and Spiral Development (end-state requirements are not known at program initiation, but emerge as requirements increments). P3I is a planned future evolutionary improvement or group of improvements for a system in acquisition/production.

DoD Instruction 5000.02 requires the Milestone Decision Authority (MDA) to formally initiate each increment of an evolutionary acquisition program. Program initiation may occur at Milestone B or C. Therefore, the program manager should develop APB documented goals for each program increment or sub-program. Each increment will have its own set of threshold and objective values set by the user. Block upgrades, pre-planned product improvement, and similar efforts that provide a significant increase in operational capability and meet an acquisition category threshold specified in this document shall be managed as separate increments.

3.5.1.2 Service Life Extension Planning

Service life extension planning involves a consolidated approach which reconciles force structure requirements and force planning, inventory projections, usage forecasts, threat assessments, planning factors, and cost, schedule and performance status of current programs and in-service fleets. An extensive GAO report on service life extension of tactical aircraft is contained in GAO-1—789, July 2010, “Tactical Aircraft”.

Each DoD Component is responsible for service life extension planning and has modernization and recapitalization programs tailored to its respective requirements and constraints.

3.5.1.3 Aging Weapon System Management

Aging weapons systems management is composed of a number of initiatives usually focused on a specific type of system such as aircraft, submarines or ground vehicles. The area of aging weapon system management is typically composed of a combination of obsolescence, diminishing manufacturing sources and material shortages, continuous modernization, technology insertion, supply chain management, and special issues such as lead-free electronics.

One DoD sponsored group, Aging Aircraft, https://acc.dau.mil/CommunityBrowser.aspx?id=32255, jointly identifies, investigates and implements programs that will field products to improve the availability and affordability of all the services' and agencies' aging aeronautical systems.

3.5.2 Continuous Modernization and Improvement

Continuous modernization is a process by which state-of-the-art technologies are inserted continuously into weapon systems to increase reliability, lower sustainment costs, and increase

the war fighting capability of a system to meet evolving customer requirements throughout an indefinite service life. Continuous Modernization is aided by the use of performance standards, COTS/NDI preferences, commercial specifications and standards, and open system architectures. All enable the rapid insertion of new technologies across the weapon system life cycle. With continuous modernization, new technologies can be rapidly introduced into a weapon system to meet new requirements, thereby extending the serviceable life of a system indefinitely. Keep in mind, however -- the continuous modernization process must be repeated over and over to:

- Anticipate obsolescence;
- Ensure emerging requirements can be anticipated;
- Ensure technologies are available to satisfy emerging requirements.

Enclosure 2, Para 8.c.(2).(e) of DoD Instruction 5000.02 requires that "DoD Components shall initiate system modifications, as necessary, to improve performance and reduce ownership costs, as constrained by section 2244a of Title 10, US Code." In addition, Para E1.1.16. Of DoD Directive 5000.01 entitled *Performance-Based Acquisition* directs that "to maximize competition, innovation, and interoperability, and to enable greater flexibility in capitalizing on commercial technologies to reduce costs, acquisition managers shall consider and use performance-based strategies for acquiring and sustaining products and services whenever feasible. For products, this includes all new procurements and major modifications and upgrades, as well as re-procurements of systems, subsystems, and spares that are procured beyond the initial production contract award."

How are modifications funded? According to Volume 2A, Chapter 1, Para 0102 "Funding Policies", of the DoD 7000.14-R Financial Mgt Regulation, "the costs of modification kits, assemblies, equipment, and material for modernization programs, ship conversions, major reactivations, major remanufacture programs, major service life extension programs, and the labor associated with incorporating these efforts into or as part of the end item are considered investments. All items included in the modification kit are considered investment even though some of the individual items may otherwise be considered as an expense. Components that were not part of the modification content at the outset and which are subsequently needed for repair are expenses. The cost of labor for the installation of modification kits and assemblies is an investment."

In addition, DoD 7000.14-R goes on to differentiate between technology refreshment/ insertion and modifications, and how they are funded, stating that "continuous technology refreshment is the intentional, incremental insertion of newer technology to improve reliability, improve maintainability, reduce cost, and/or add minor performance enhancement, typically in conjunction with depot or field level maintenance. The insertion of such technology into end items as part of maintenance is funded by the operation and maintenance appropriations. However, technology refreshment that significantly changes the performance envelope of the end item is considered a modification and, therefore, an investment." It also indicates that modifications are funded in two phases:

- Phase 1: Development & Testing of Modification
  - If redesign increases performance or extends life of system beyond original design, use RDT&E to fund development, test and evaluation of the mod;

- If redesign does not increase performance (e.g., safety mod), only extends useful life of system to original design value, or requires extensive testing, use RDT&E to fund development, test & evaluation of the mod;
- If testing not required & system still in production, finance with Procurement funds;
- If the system is no longer in production, finance with O&M funds.

- Phase 2: Fabrication & Installation of Modification (Mod) Kits
  - Funding for second phase (fabrication and installation of mod kits) is more simple;
  - Regardless of funding used for development & testing of modification, mod kits fabricated and installed using Procurement appropriation of same type used to originally procure original end item.

Per AFI 63-101, "Acquisition and Sustainment Life Cycle Management," a modification is defined as a change to the form, fit, function, or interface of an in-service, configuration-managed asset. Modifications are identified as capability modifications or sustainment modifications and can be either temporary or permanent. All modifications must be coordinated through a formal configuration review/control process and implemented in accordance with DoD publications. All approved modifications shall be implemented by a PM or PSM who will be the designated individual with the responsibility for, and authority to accomplish modification program objectives for the development, production, and sustainment of materiel modifications that satisfy user operational needs.

Applicable regulations include:

- Defense Acquisition Guidebook (DAG) (Chapters 2, 5, and 11)
- MIL-HDBK-896 Manufacturing and Quality Program
- AR 750-10 The Army Modification Program
- Air Force Instruction 63-101 Acquisition and Sustainment Life Cycle Management (Para 3.21)
- Air Force Instruction 63-131, Modification Program Management
- DoD 7000.14-R Financial Management Regulation (Volume 2A, Chapter 1 - Appropriations and Funding Policies)
- SECNAVINST 5000.2E Implementation and Operation of the Defense Acquisition Systems and the Joint Capabilities Integration and Development System
- Title 10 US Code, Subtitle A, Part IV, Chapter 134, Subchapter § 2244a. Equipment scheduled for retirement or disposal: limitation on expenditures for modifications
- Title 10 US Code, Subtitle A, Part IV, Chapter 146, Subchapter § 2460 Definition of depot-level maintenance and repair

3.5.3 Technology Refresh

Technology Refresh (TR) is defined as the periodic replacement of both custom-built and Commercial-Off-The-Shelf (COTS) system components, within a larger DoD weapon system, to assure continued supportability throughout its lifecycle. The development of a planned and organized Technology Refresh program is critical to ensure long-term weapon system availability. A technology refresh program will need to have an enterprise perspective and include the functional areas of supply chain management, obsolescence and Diminishing Manufacturing Sources and Material Shortages, capability enhancement, life cycle sustainment

planning, and metrics to guide and drive resources and efforts. There is no specific DoD policy on how to structure a technology refresh program but the Services address technology refresh to align to their specific requirements. For example, the Navy is sponsoring the Technology Refresh for Navy Transformation (TRENT) project.

3.5.4 Recapitalization

Per the OSD Report to Congress, Sep 2006, Recapitalization, or RECAP, is the rebuild and/or systematic upgrade of currently fielded systems to ensure operational readiness and a zero time/zero mile status. Recapitalization is different from daily sustainment operations in that it involves a rebuild, replacement, modernization and/or restoration of the item. Recapitalization refers to the end use item that can be a facility, a weapon system or even a major subsystem such as an engine. Objectives of a recapitalization project can include extending service life, reducing Operations and Support costs, improving system reliability, and enhancing capability. Recapitalization work enhances the weapon system by adding new technological features as the equipment is being completely overhauled. RECAP is also conducted to account for damage/stress on vehicles due to the higher OPTEMPO and harsh usage environment. RECAP can be further subdivided into rebuild programs, which return equipment to original design specifications with required upgrade due to obsolescence of subcomponents, and upgrade programs, where capability is significantly enhanced. For the DoD, RECAP is done either in a depot/arsenal, by contractor (usually the Original Equipment Manufacturer), or by a partnership of the two entities. Funding for recapitalization is provided mostly in procurement accounts.

Sustaining Engineering in the Life Cycle

A. Purpose

Sustaining engineering consists of a combination of systems engineering and product support life-cycle management strategies to achieve the desired sustainment metric outcomes for the program. These metrics include the DoD required Key Performance Parameter (KPP) of Availability, the Key System Attributes (KSAs) of Reliability and Total Ownership Cost, the metric, Mean Down Time, plus other subordinate program metrics. The focus is on understanding the cost and logistics infrastructure and footprint associated with meeting the Warfighter requirements and the process to track, control and/or reduce metric results over the life cycle of the weapon system.

Historically, Sustaining Engineering activities were the primary responsibility of engineering and product development, with Sustaining Engineering activities conducted during Operations & Support being planned and implemented often under separate contract line items and separate management. The current view of integrated product support requires that the Life Cycle Sustainment Plan include and implement an integrated strategy, inclusive of all the Product Support Elements and Program functional areas, that is reviewed and reported on throughout the acquisition life cycle.

The current view Sustaining Engineering activities being heavily influenced prior to system deployment by the design interface activities which focus on ensuring that the program KPPs are achieved through a design to optimize availability and reliability at reduced life cycle cost. After

deployment and during Operations and Sustainment (O&S), the activities of sustaining engineering (including product improvement, reliability fixes, continuing process improvements and technology refresh) continue those of design influence and integrate both back with engineering and manufacturing activities and forward to collect and validate system operational performance with the user. The Product Support Manager is thus capable of implementing a total enterprise sustainment strategy inclusive of all acquisition phases and all product support element scopes.

a. Why is Sustaining Engineering Important?

Once the weapon system is fielded, achieving the support concept and sustaining operational capability requires the involvement of the logistics, engineering, testing, program management, contracts, supply chain, and financial management experts. The overall product support strategy, documented in the Life-Cycle Sustainment Plan, should include life-cycle support planning and address actions to assure long-term sustainment and continually improve product affordability for programs in initial procurement, re-procurement, and post-production support. A performance-based product support process will be used to align the support activities necessary to meet these objectives.

In today's world with the fast pace of technology, process, and skill-based changes, a continuous challenge to improve, upgrade, prevent or simply refresh the technical foundations of a weapon system confronts the PM/PSM. The sum of the technical activities (primarily maintenance and activities typically aligned to systems engineering areas), along with supporting activities such as financial, supply chain, etc., necessary to ensure the weapon system continues to meet user requirements and program KPP / KSAs is known as Sustaining Engineering. Listed under Section 3.4 of this Guidebook are those Sustaining Engineering activities which The Product Support Manager should ensure are successfully accomplished.

b. Summary of Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

Note that the Logistics Analysis (LA), also known as an independent logistics analysis, is part of each Milestone Decision Package and is a requirement for type classification.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Sustaining Engineering IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, includes in the left column a listing of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	**Sustaining Engineering Major Activities**
User Need / Technology Opportunities & Resources	Understanding user needs in terms of performance is an essential initial step in developing a meaningful product support strategy because changes to the CONOPS or the sustainment approach may impact the effectiveness, suitability, or cost of the system. The Product Support Manager (although not formally designated until MS B) must be able to understand and forecast sustaining engineering requirements to actual product support sustainment activities and outcomes during initial fielding and full operations. While sustaining engineering activities themselves are not yet performed on the system, the planning for these activities, strategies and technologies is important to long term sustainment strategy development. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Key Products: • Requirements • Metrics • Sustaining engineering strategy
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. The AoA requires, at minimum, full consideration of possible trade-offs among cost, schedule, and performance objectives for each alternative considered. From a sustaining engineering perspective (while not officially designated until Milestone B) the outcomes of a PSM perspective should be introduced at this point to include appropriate trade-off studies to validate and forecast product support sustaining engineering requirements as a result of design of the system, analysis for suitability and the intended sustainment footprint encompassing all twelve product support elements. The ICD documents the system's capability requirements. Refer to the Defense Acquisition Guidebook (DAG), Chapters 3.3 and 5 for more information. Specific analysis focuses on the approach for achieving the required enabling sustainment technologies to implement the product support strategy and

	achieve the sustainment metrics. The specific enabling support technologies should be identified along with the corresponding plan to technically mature them. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of Milestone Decision Review required documents. Key Products: • Long term product improvement strategies • RAM-C Report
Technology Development	The primary document incorporating sustaining engineering plans and outcomes is the LCSP. After Milestone A the LCSP evolves from a strategic outline to a management plan describing the sustainment efforts and acquisition processes to achieve the required performance and sustainment outcomes necessary to ensure required Warfighter capabilities. An outline for the LCSP can be found in the Defense Acquisition Guidebook, Chapter 5.1.2.2. The Product Support Manager will also have significant input into the Systems Engineering Plan due to results of supportability analysis. At Milestone B, the LCSP evolves into a detailed execution plan for how the product support package is to be designed, acquired, sustained, and how sustainment will be applied, measured, managed, assessed, modified, and reported from system fielding through disposal. The LCSP is submitted as a stand-alone deliverable prior to Milestone B. The Product Support Manager is required to also provide sustaining engineering information on many other acquisition documents as listed below under deliverables, and found on the DAU site, https://dag.dau.mil/Pages/Default.aspx. Key Products: • Sustaining Engineering Plan • Diminishing Manufacturing Sources and Material Shortages (DMSMS) Plan / Obsolescence Plan
Engineering & Manufacturing Development	Sustaining engineering requirements designed earlier in the acquisition process should be validated and those that were not defined are assessed for impact. Special considerations should be given to reliability growth, producibility, and scenario driven analysis. It is during this phase that the results of preliminary sustaining engineering analysis are validated through test results and supplier provided data. Any final design engineering changes as a result of sustaining engineering analysis must be implemented no later than this phase to achieve maximum benefit. Significant changes may be required as a result of sustaining engineering analysis to the product support package to achieve the objective sustainment

	metrics. As the program matures, the LCSP is updated to reflect increasing levels of detail as they become available. The detail and focus will vary depending on the life-cycle phase but in all cases the information should be in sufficient depth to ensure the acquisition, design, sustainment, and user communities have an early common understanding of the sustainment requirements, approach, and associated risks. Key Products: • Updated FRACAS • Reliability Growth Plan
Production & Deployment	Sustaining engineering activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, reliability growth, taking part in planning activities that may be on-going already for product improvement, and developing long term plans for design interface improvements for both the system and its support infrastructure as part of the LCSP. Quality control and quality assurance become important inputs to sustaining engineering analysis. Fielding occurs during this phase and significant planning is required associated with deploying a system to the operational site. Sustaining engineering takes over as initial design flaws and new requirements for improvements are identified. Key Products: • Engineering change proposals • DMSMS / obsolescence plan execution • Continuing failure analysis
Operations & Support	Sustaining engineering continues throughout the system's operations and support phase through multiple avenues which include: 1) engineering change proposals (ECP's), 2) new technology refresh activities, 3) modifications and changes to the system, 4) analysis of failure data and reliability growth programs, plus others. The Product Support Manager's responsibility is to continue reviewing system performance while looking for opportunities to improve design of both the system itself and the support infrastructure to optimize cost versus availability. The effectiveness of the LCSP is monitored by analysis of feedback data. Proactive and reactive data sources identify impacts on system cost, readiness, supportability and safety. This monitoring and analysis identifies potential problems, such as any breech of key KPP or KSAs, and provides opportunities for improvement. An investigation of an identified opportunity or problem solution is prioritized, resourced and scheduled for resolution or stored in a historical database for future prioritization. The PSM coordinates with supporting engineering and product support organizations on whether or not the problem requires interim actions to mitigate the impact while the final solution is being developed. Alternative solutions are developed by

	analyzing existing and potential problems and identifying and developing all possible solutions to the problem based on an assessment of technical attributes and non-program constraints. The recommended solution is validated by developing an implementation plan and executing a successful prototype prior to final implementation. The implemented solution is then documented in field historical records, which justify modification of the LCSP. These processes are repeated continuously in a sustained product support planning effort to monitor and optimize product support, which has been affected by changing operational environments, obsolete technology, or DMSMS issues. Key Products: • Product Improvement Plans • Execution of product improvement initiatives • Continuing failure analysis • Updates to the LCSP • Technology Refresh • Block Upgrades

Table 3.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Selected Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DI-CMAN-80639C, "Engineering Change Proposals"
DI-CMAN-81018, "Tracking Report for Equipment Modification"
DI-CMAN-81121, "Baseline Description Document"
DI-ILSS-80386, "Repairable Item Inspection Report"
DI-IPSC-81431A, "System / Subsystem Specifications"
DI-MFFP-81403, "Corrosion Prevention and Control Plan"
DI-MGMT-80797 "Producibility Analysis Report"
DI-MGMT-80933, "Repair / Modification / Overhaul Status Report"
DI-MGMT-81238, "Contractor Field Service Report"
DI-MGMT-81648, "Condition Found Report"
DI-MISC- 80359A, "Equipment Failure Info Report"
DI-MISC-80370, "Safety Engineering Analysis Report"
DI-MISC-80750, "Technical Data Package Review Report"
DI-MISC-80914B, "Small Arms Serialization Program (SASP)"
DI-MISC-81371, "Maintenance Data Collection Record"
DI-RELI-81315, "FRACAS Report"
DI-SAFT-80101B, "System Safety Hazard Analysis Report"
DI-SESS-80992A, "Planned Maintenance System (PMS) Maintenance Index Page (MIP)

DI-SESS-81656, "DMSMS Source Data"
DI-TMSS-80229D, "Technical Order Improvement Report and Reply"
DI-TMSS-81820, "Technical Manual Verification Discrepancy / Disposition Record"
DI-TMSS-81394, "Evaluation Field Change Report"

C. OSD Proponency, Policy, Regulations and Statutes

a. Proponency

- Systems Engineering: ASD(R&E), Assistant Secretary of Defense for Research and Engineering, http://www.acq.osd.mil/chieftechnologist/index.html
- Maintenance: Office of the Deputy Assistant Secretary of Defense for Maintenance Policy and Programs (DASD(MPP)), http://www.acq.osd.mil/log/mpp/index.html
- Materiel Readiness: Office of the Deputy Assistant Secretary for Defense for Materiel Readiness (DASD(MR)), http://www.acq.osd.mil/log/mr/index.html
- ESOH issues: Office of the Deputy Under Secretary of Defense, Installations and Environment, http://www.acq.osd.mil/ie/

b. Policy, Regulations and Statutes

Note: please see the References at the end of this section for a more complete list of relevant materials.

- DoDD 5000.01, 12 May 2003, "The Defense Acquisition System"
- DoDI 5000.02, 2 December 2008, "Operation of the Defense Acquisition System"
- The Defense Acquisition Guide, located at https://dag.dau.mil/Pages/Default.aspx.
- Undersecretary of Defense for Acquisition, Technology and Logistics (AT&L) DMSMS Guidebook
- DoD Guide to Development of the Programmatic Environmental, Safety, and Occupational Health Evaluation (PESHE)
- DMSMS and Obsolescence guidance can be found in para 4.3 of the Performance Based Logistics: A Program Manager's Product Support Guide. *T*echnology Refreshment and Obsolescence guidance can also be found in para 5.2.1.5 of the Defense Acquisition Guidebook. All three subjects are discussed in multiple instances in Designing and Assessing Supportability in DOD Weapon Systems: A Guide to Increased Reliability and Reduced Logistics Footprint dated 24 Oct 03
- For Corrosion prevention, see Public Law 107-314 Sec: 1067, Prevention and mitigation of corrosion of military infrastructure and equipment. Also see DoD "Corrosion Prevention and Control" policy letter, signed by the Acting Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]), 12 November 2003 (see Attachment 1), and the "Facility Corrosion Prevention and Control" memorandum, signed by the Deputy Under Secretary of Defense for Installations and Environment, 10 March 2005. A good reference is the "Corrosion Prevention and Control Planning Guidebook", Sept 2007 located at www.dodcorrosionexchange.org.
- For disposal requirements, see DoD 4160.21-M, "Defense Materiel Disposition Manual"
- For demilitarization requirements, see DoDM 4160.28M, "Defense Demilitarization".

- DoD 4140.1-R outlines end-to-end distribution requirements, stating in para C5.1.1.1. That "the DoD Components shall operate an integrated, synchronized, end-to-end distribution system to meet customer requirements for information and materiel. That system shall be comprised of requisitioning channels, distribution depots, and other storage locations, transportation channels, tracking systems, and other activities involved with the delivery, sale, or disposal of materiel." The Joint Staff J4 and the Acting Deputy Under Secretary of Defense (Logistics & Materiel Readiness) caveated this DoD 4140.1-R definition of distribution in their joint 28 Jul 04 Management of the Distribution Systems Portfolio: Sustainment & Force Movement memo by adding, "inherent in this definition are retrograde, return of materiel, and redeployment."
- MIL-STD-882D, "Standard Practice for System Safety,"
- MIL-HDBK 2155, "Failure Reporting, Analysis and Corrective Action Taken,"
- FY2009 Annual Report for the Office of the Director, Operational Test & Evaluation
- DoD Reliability, Availability, Maintainability-Cost (RAM-C) Report Manual
- DLAR 4155.24, "Product Quality Deficiency Report Program"
- DoD 7000.14-R Financial Mgt Regulation
- MIL-HDBK-896 Manufacturing and Quality Program
- DOD 7000.14-R Financial Management Regulation (Volume 2A, Chapter 1 - Appropriations and Funding Policies)
- Title 10 US Code, Subtitle A, Part IV, Chapter 134, Subchapter § 2244a. Equipment scheduled for retirement or disposal: limitation on expenditures for modifications
- Title 10 US Code, Subtitle A, Part IV, Chapter 146, Subchapter § 2460 Definition of depot-level maintenance and repair

D. Who Develops, Delivers and Manages Sustaining Engineering

The Product Support Manager is overall responsible for developing and delivering all the diverse activities and deliverables that make up the sustaining engineering scope. The individual functional activities will be organized based upon the individual program's integrated product team structure and focus. Typically, sustaining engineering analysis and planning activities are carried out by a specialty engineering group such as RAM, safety, quality, and sub-categories of design engineering. The Product Support Manager and Life Cycle Logisticians must be knowledgeable of the outcomes, major processes, evaluation standards and requirements determination in order to make well-informed decisions.

The execution of sustaining engineering mods, upgrades, repairs, and other maintenance is often carried out by the contractor or government depot activities. Depot maintenance is covered more fully under the Maintenance Product Support Element section, but briefly described below with a listing of DoD depots and logistics centers.

Depot level maintenance includes the repair, fabrication, manufacture, rebuilding, assembly overhaul, modification, refurbishment, rebuilding, test, analysis, repair-process design, in-service engineering, upgrade, painting and disposal of parts, assemblies, subassemblies, software, components, or end items that require shop facilities, tooling, support equipment, and/or personnel of higher technical skills, or processes beyond the organizational level capability. Depot level maintenance can be independent of the location at which the maintenance or repair is

performed, the source of funds, or whether the personnel are government or commercial (contractor) employees. DoD depots and logistics centers providing these capabilities include:

Air Force: • Aerospace Maintenance and Regeneration Group (AMARG) • Ogden Air Logistics Center (OO-ALC) • Oklahoma City Air Logistics Center (OC-ALC) • Warner Robins Air Logistics Center (WR-ALC)	**USMC:** • Marine Corps Logistics Base Albany • Marine Corps Logistics Base Barstow
Navy: • Naval Air Depot Cherry Point • Naval Air Depot Jacksonville • Naval Air Depot North Island • Naval Undersea Warfare Division Keyport • Norfolk Naval Shipyard • Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility • Puget Sound Naval Shipyard • Portsmouth Naval Shipyard • SPAWARCEN Charleston • SPAWARCEN San Diego • SPAWARCEN New Orleans • SPAWARCEN Norfolk • NSWC Crane	**Army:** • Anniston Army Depot • Corpus Christi Army Depot • Letterkenny Army Depot • Red River Army Depot • Tobyhanna Army Depot

E. When Is Sustaining Engineering Delivered and Managed in the Life Cycle

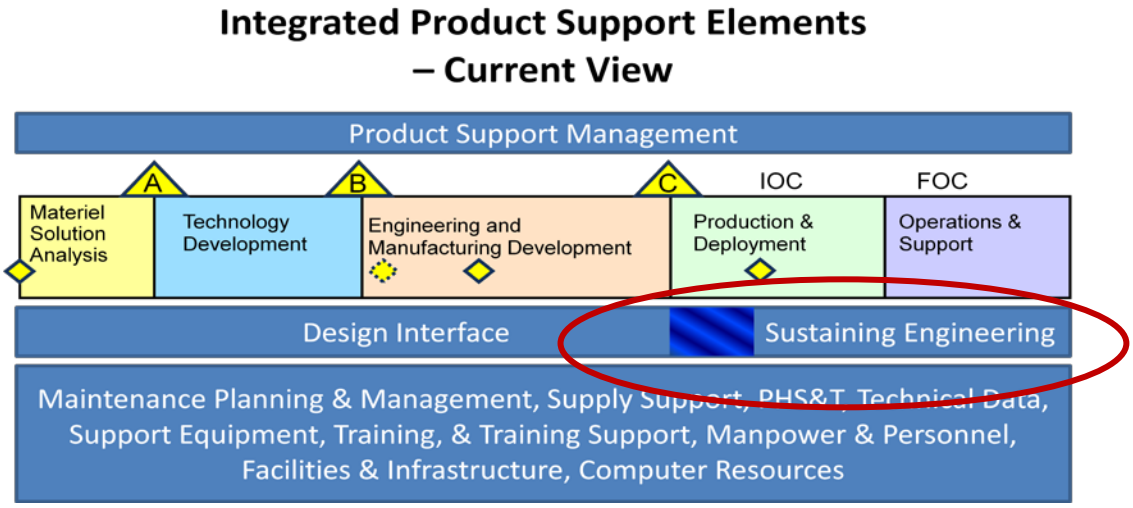


Figure 3.7.F1. Sustaining Engineering in the Life Cycle

As mentioned in Section 3.1 above, sustaining engineering is essentially a continuation of the design influence activities via modifications, configuration management changes and technology refresh / continuous modernization started early in the acquisition process. However,

sustaining engineering not only continues design influence throughout the operations and sustainment phase, but also is the execution arm to implement many of the changes to the weapon system through depot maintenance, recapitalization, rebuild, etc. Sustaining engineering activities also continue to upgrade and improve the sustainment infrastructure itself via pathways such as maintenance equipment upgrades and research into topics such as corrosion prevention and hazardous materials removal.

F. How Sustaining Engineering Is Developed, Established and Managed

Sustaining engineering is established by the Product Support Manager as a specific activity within the work breakdown structure to perform any of the set of activities, from simple analysis to actual re-design of equipment, in order to achieve a more reliable and sustainable product.

The system availability, reliability and total ownership cost objectives are aligned to existing resources and baseline system supportability requirements. It is at this time that the sustaining engineering activity is initiated to perform analysis, forecasting, and long term planning. During the weapon system acquisition phases, sustaining engineering is generally managed under the Systems Engineering IPT with participation and/ or direction from The Product Support Manager. Over time, as the system enters its operations and sustainment phase, The Product Support Manager may start managing the sustaining engineering activities, especially as they become more oriented towards maintenance and supply chain issues.

The Product Support Manager should perform reviews of PSI/PSP performance against the Product Support Arrangement on at least a quarterly basis and utilize that data to prepare for the DoD Component-level assessments. The Product Support Manager should reference the DoD BCA Guidebook and the DoD LA Handbook for further information.

G. Communities of Interest and Practice Topics

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- PM e-Tool Kit Performance Learning Tools found at https://acc.dau.mil/CommunityBrowser.aspx?id=18531
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, ACQuire Search)
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook)
- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02)
- Web enabled new JCIDS Instruction and Guidebook
- Best Practices Clearing House (With addition of Multimedia Assets – video, audio)
- ACQuipedia Library Articles
    - Administrative Delay Time
    - Business Case Analysis (BCA)

- Contract Modernization and Changes
- Corrective Maintenance Time
- Diminishing Manufacturing Sources and Material Shortages (DMSMS)
- Failure Modes Effects and Criticality Analysis (FMECA)
- Fault Tree Analysis (FTA)
- Mean Time Between Failure (MTBF)
- Product Support Package
- Operations and Maintenance (O&M) Funds
- Operations and Sustainment
- Post Deployment Review
- Post IOC Supportability
- Product Support Manager or Product Support Provider
- Product Support Integrator
- Value Engineering Change Proposal (VECP)

- Acquisition Community Connection (CoPs and Special Interest Areas)
  - Continuous Process Improvement (CPI)
  - Critical Item Management
  - Environmental, Safety and Occupational Health (ESOH)
  - Item Unique Identification (IUID)
  - Life Cycle Logistics
  - Operations Research and System Analysis
  - Reliability, Availability, Maintainability (RAM)
  - Systems Engineering

- PM Certification Course materials and PM Continuous Learning Modules
- Probability of Program Success (PoPS) Model and Service Implementations
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation)
- DoD IG Audit Guides for Acquisition and Contracting
- Service and Agency PMO support sites
- Contract Management Processes Guide
- Leadership Support Center (Requires ACC log-in)

The Defense Logistics Agency (DLA) provides a website called “Assist Online” which is a search engine for Data Item Descriptions, found at https://assist.daps.dla.mil/online/start/

Balanced Scorecard is a conceptual framework for translating an organization's strategic objectives into a set of performance indicators distributed among four perspectives:

- Financial Perspective;
- Customer Perspective;
- Business Process Perspective;
- Learning and Growth Perspective.

Organizations use some indicators to measure a business' progress toward achieving its vision and others to measure the long-term drivers of success.

H. Lessons Learned / Best Practices

*The Defense Acquisition University's Best Practices Clearinghouse. T*his clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;
- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

Examples of two Best Practices include:

Practice Name #1: Continuous Improvement

Practice Summary: This practice refers to a general approach to improving processes, based upon an iterative cycle of:

- Collecting metrics that provide insight as to the effectiveness of the process;
- Analyzing those metrics to see if the process is performing as expected, or areas for improvement could be identified;
- If areas for improvement are found, implementing changes to the process that are expected to result in better effectiveness;
- Returning to step 1 (collecting more metrics) to see if improvements are seen going forward, and continuing to monitor the process.

Practice Name #2: Lifecycle Support planning needs to consider system usage, sustainment, and retirement from early in development

Practice Summary: Systems can have long lifetimes and may be tasked with responding to

unanticipated missions and unforeseen events. Effectively responding to such challenges will be possible if programs adopt a "design-for-sustainment" approach, in which these issues are considered early on in lifecycle planning, and taken into consideration during requirements and design phases.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

I. Training Resources

a. DAU Training Courses

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

Sustaining engineering topics are primarily covered under the Life Cycle Logistics courses, examples are listed below:

- DAU LOG 101, Acquisition Logistics Fundamentals
- DAU LOG 102 System Sustainment Management Fundamentals
- DAU LOG 103 Reliability, Availability, Maintainability
- DAU LOG 206, Intermediate Systems Sustainment Management
- DAU LOG 235 Performance Based Logistics
- DAU LOG 236 Performance Based Logistics
- DAU SYS 101 Fundamentals of Systems Planning, Research, Development and Engineering
- CLB 007 Cost Analysis
- CLE 001 Value Engineering
- CLE 003 Technical Reviews
- CLE 004 Introduction to Lean Enterprise Concepts
- CLE 017 Technical Planning
- CLE 301 Reliability and Maintainability
- CLL 002 DLA Support to the PM
- CLL 004 Life Cycle Logistics for the Rest of Us
- CLL 008 Designing and Assessing Supportability in DOD Weapon Systems: A Guide to Increased Reliability and Reduced Logistics Footprint
- CLL 011 Performance Based Logistics
- CLL 015 Business Case Analysis
- CLL 019 Technology Refreshment Planning
- CLL 020 Independent Logistics Assessment
- CLL 119 Technology Refreshment Implementation
- CLL 201 Diminishing Manufacturing and Materiel Shortages (DMSMS) Fundamentals
- CLL 201 Diminishing Manufacturing and Materiel Shortages (DMSMS) Executive Course
- CLL 201 Diminishing Manufacturing and Materiel Shortages (DMSMS) Essentials for DLA

- CLL 201 Diminishing Manufacturing and Materiel Shortages (DMSMS) Case Studies
- CLL 201 Diminishing Manufacturing and Materiel Shortages (DMSMS) for the Technical Professional
- CLL 206 Parts Management Overview
- CLE 036 Engineering Change Proposals (ECPs) for Engineers

b. Defense Logistics Management System (DLMS) Training.

This training provides basic awareness and broad-spectrum knowledge of the Defense Logistics Management System (DLMS). The DLMS is a broad base of business rules designed to meet DoD's requirements for logistics support. The DLMS has been developed in collaboration with the Military Departments, Defense Agencies, and participating Federal Agencies and will accommodate the old DoD-unique logistics data exchange standards and processes commonly referred to as the "MILS" (Military Standard), plus new information exchange requirements supporting modernization. The DLMS transactional exchanges are founded in American National Standards Institute (ANSI) chartered Accredited Standards Committee (ASC) X12 commercial standards and support other emerging electronic business (EB) technologies. The training provides an introduction to electronic data interchange (EDI) as applied under the DLMS and includes an introduction to commercial EDI, DLMS background and concept, DLMS implementation strategy/planning, and an overview of understanding of DLMS-specific EDI. This training is of particular value to functional and technical subject matter experts involved with the migration from the Defense Logistics Standard Systems (DLSS e.g., MILSTRIP, MILSTRAP, MILSBILLS) to the DLMS. The website is found at https://www.dla.mil/j-6/dlmso/eApplications/Training/training.asp .

J. Key References

- DoDD 5000.01, 12 May 2003, “The Defense Acquisition System”
- DoDI 5000.02, 2 December 2008, “Operation of the Defense Acquisition System”
- The Defense Acquisition Guide, located at https://dag.dau.mil/Pages/Default.aspx.
- Undersecretary of Defense for Acquisition, Technology and Logistics (AT&L) DMSMS Guidebook
- DoD Guide to Development of the Programmatic Environmental, Safety, and Occupational Health Evaluation (PESHE)
- DMSMS and Obsolescence guidance can be found in para 4.3 of the Performance Based Logistics: A Program Manager's Product Support Guide. Technology Refreshment and Obsolescence guidance can also be found in para 5.2.1.5 of the Defense Acquisition Guidebook. *A*ll three subjects are discussed in multiple instances in Designing and Assessing Supportability in DOD Weapon Systems: A Guide to Increased Reliability and Reduced Logistics Footprint dated 24 Oct 03
- For Corrosion prevention, see Public Law 107-314 Sec: 1067, Prevention and mitigation of corrosion of military infrastructure and equipment. Also see DoD “Corrosion Prevention and Control” policy letter, signed by the Acting Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]), 12 November 2003 (see Attachment 1), and the “Facility Corrosion Prevention and Control” memorandum,

signed by the Deputy Under Secretary of Defense for Installations and Environment, 10 March 2005. A good reference is the "Corrosion Prevention and Control Planning Guidebook", Sept 2007 located at www.dodcorrosionexchange.org.

- For disposal requirements, see DoD 4160.21-M, "Defense Materiel Disposition Manual"
- For demilitarization requirements, see DoDM 4160.28-M, "Defense Demilitarization".
- DoD 4140.1-R outlines end-to-end distribution requirements, stating in para C5.1.1.1. That "the DoD Components shall operate an integrated, synchronized, end-to-end distribution system to meet customer requirements for information and materiel. That system shall be comprised of requisitioning channels, distribution depots, and other storage locations, transportation channels, tracking systems, and other activities involved with the delivery, sale, or disposal of materiel." The Joint Staff J4 and the Acting Deputy Under Secretary of Defense (Logistics & Materiel Readiness) caveated this DoD 4140.1-R definition of distribution in their joint 28 Jul 04 Management of the Distribution Systems Portfolio: Sustainment & Force Movement memo by adding, "inherent in this definition are retrograde, return of materiel, and redeployment."
- MIL-STD-882D, "Standard Practice for System Safety,"
- MIL-HDBK 2155, "Failure Reporting, Analysis and Corrective Action Taken,"
- FY2009 Annual Report for the Office of the Director, Operational Test & Evaluation
- GEIA-STD-0009, "Reliability Program Standard for Systems Design, Development, and Manufacturing", https://acc.dau.mil/CommunityBrowser.aspx?id=382313
- DoD Reliability, Availability, Maintainability-Cost (RAM-C) Report Manual
- DLAR 4155.24, "Product Quality Deficiency Report Program"
- DoD 7000.14-R Financial Mgt Regulation
- MIL-HDBK-896 Manufacturing and Quality Program
- DOD 7000.14-R Financial Management Regulation (Volume 2A, Chapter 1 - Appropriations and Funding Policies)
- Title 10 US Code, Subtitle A, Part IV, Chapter 134, Subchapter § 2244a. Equipment scheduled for retirement or disposal: limitation on expenditures for modifications
- Title 10 US Code, Subtitle A, Part IV, Chapter 146, Subchapter § 2460 Definition of depot-level maintenance and repair
- SAE JA1011 "Evaluation Criteria for Reliability-Centered Maintenance (RCM) Processes referencing Message Specification"

U.S. Air Force

- AF PAM 63-128, "Guide to Acquisition and Sustainment Life Cycle Management," 5 Oct 2009
- Air Force Materiel Command, Acquisition Sustainment (AS) Tool Kit, "AS Kneepad Checklist", 1 Aug 2009, various locations.
- AFI 63-101, "Acquisition and Sustainment Life Cycle Management,"
- Air Force Instruction 63-101 Acquisition and Sustainment Life Cycle Management (Para 3.21)
- Air Force Instruction 63-131, Modification Program Management
- USAF Technical Order (TO) 00-5-1 "AF Technical Order System (ATOS)"
- Air Force Policy Directive (AFPD) 21-3, Technical Orders
- Air Force Instruction (AFI) 21-303, "Technical Orders"

U.S. Army

- AR 750-10 The Army Modification Program

U.S. Navy

- NAVSO P-3687, "Producibility System Guidelines,"
- SECNAVINST 5000.2D Implementation and Operation of the Defense Acquisition Systems and the Joint Capabilities Integration and Development System
- OPNAVINST 4790.4E, "Ship's Maintenance and Material Management (3-M) System Policy"

4.0 Supply Support
4.0.1 Objective
4.0.2 Description

Product Support Manager Activities
Supply Support in the Life Cycle
A. Purpose
B. Data Item Description (DID) Deliverables
C. OSD Proponency, Policy, Regulations and Statutes
D. Who Develops, Delivers and Manages Supply Support
E. When Is Supply Support Delivered and Managed in the Life Cycle
F. How Supply Support Is Developed, Established and Managed
G. Communities of Interest and Practice
H. Lessons Learned / Best Practices
I. Training Resources
J. Key References

4.0.Supply Support

4.0.1. Objective

Identify, plan for, resource, and implement management actions to acquire repair parts, spares, and all classes of supply to ensure the best equipment/ capability is available to support the Warfighter or maintainer when it is needed at the lowest possible Total Ownership Cost (TOC).

4.0.2. Description

Supply support consists of the management actions, procedures and techniques necessary to acquire, catalog, receive, store, transfer, issue and dispose of spares, repair parts, and supplies. Supply support includes provisioning for initial support, as well as acquiring, distributing, and replenishing inventories as reflected in the supply chain management strategy. Proper supply support management results in having all the right spares, repair parts, and all classes of supplies available, in the right quantities, at the right place, at the right time, at the right price.

Product Support Manager Activities

4.1 Supply Chain Management

The primary objective of DoD supply chain management is to provide effective and efficient end-to-end customer service to meet operational requirements. To supply materiel to DoD units throughout the world, the DoD Components maintain a supply chain consisting of weapon system support contractors, retail supply activities, distribution depots, transportation channels including contracted carriers, wholesale integrated materiel managers (IMMs), weapon system product support integrators, commercial distributors and suppliers including manufacturers, commercial and organic maintenance facilities, and other logistics activities (e.g., engineering support activities, testing facilities, reutilization and marketing offices).

There is no best definition for the term supply chain management. Below are three accepted explanations.

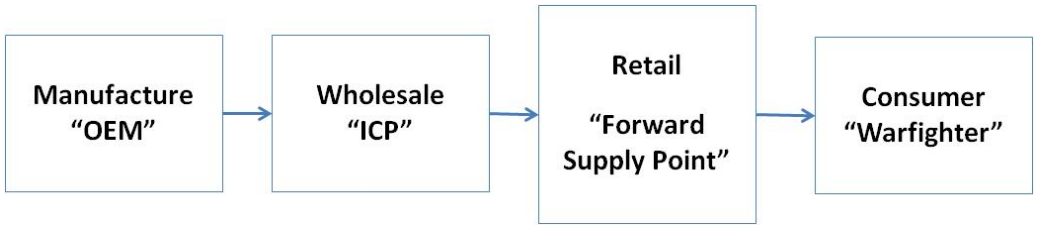
Per Joint Publication 1-02, supply chain management is a cross-functional approach to procuring, producing, and delivering products and services to customers. The broad management scope includes sub-suppliers, suppliers, internal information, and funds flow.

According to the DoD Product Support Manager Guidebook, "Supply chain management responsibility includes the distribution, asset visibility, and obsolescence mitigation for weapon system sustainment material. From a Warfighter's perspective, transportation and asset visibility have a substantial impact on high-level sustainment metrics and should be emphasized in the product support strategy. All the skilled labor, advanced technology, and performance of a modern weapon system mean little without
the ―right part, in the right place, at the right time. Of special concern to the PSM is the need to constantly look for and implement mechanisms to reduce and streamline the logistics footprint. This may involve continued collaboration with systems engineers but might just as easily involve using existing supply chains that are supporting other systems rather than developing a new supply chain, thereby minimizing redundancy and associated footprint."

According to the Council of Supply Chain Management Professionals (CSCMP), supply chain management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes the crucial components of coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. More recently, the loosely coupled, self-organizing network of businesses that cooperate to provide product and service offerings has been called the *Extended Enterprise*.

4.1.1 Wholesale versus Retail

A simple way of describing the supply chain may present itself as four entities: the manufacturer, the wholesaler, the retailer, and the end user or consumer.



In the commercial supply chain, a wholesale activity buys and stores goods in large quantities from their manufacturers or importers and then sells smaller quantities to retailers, who in turn sell to the general public. Thus, wholesalers form part of the supply chain as a consolidator linking manufacturers to retailers. In the military supply chain, the manufacturer is typically the Original Equipment Manufacturer (OEM) who sells systems or spare parts to a DoD "wholesale" activity such as DLA or Navy Inventory Control Point (ICP) who then "sells" or transfers the items to a forward supply point where the item is then issue to the Warfighter or "consumer".

This diagram is overly simplistic to describe the DoD complete wholesale and retail structure. The DoD supply system is predicated upon Wholesale and Retail supply processes, similar to the private sector. The wholesale portion of the system encompasses the procurement of items from the system developers and commercial suppliers the manufacturers or wholesale suppliers. Wholesale items are generally stored in distribution warehouses, sometimes called inventory control points, where they are held pending requisitions from the retail supply system. Wholesale warehouses are often collocated with Defense Depots or Integrated Materiel Management Centers or, in the case of Defense Logistics Agency (DLA) items may be stored in regional supply centers or forward located distribution points. In many cases (i.e., DLA) the assets are not even procured or owned by the military Services. The retail supply systems are owned and managed by the individual military Service Departments, and are usually located at operating locations, either in the Continental United States (CONUS) or outside the United States (OCONUS). As the retail system requires parts, it requisitions the needed items from the wholesale supply system, which constitutes a buy and sell transaction the wholesale system sells the item to the retail system, and is reimbursed accordingly. In general, all retail supply functions are operated by organic DoD personnel, including military personnel where applicable.

In general, the Military Departments have a strong preference for organic operation of the retail supply function, since many of these supply sources are located in forward battle theater areas. Conversely, there is no strong preference for ownership or management of wholesale supply activities. In PBL product support strategies, it is quite common to see contractor-managed wholesale supply support. There are inherent benefits to commercially managed wholesale supply functions, where industry flexibility, capability, and proprietary spares support can be utilized.

Additional information can be found in:

- DoD 4140.1-R, “DoD Supply Chain Materiel Management Regulation”
- Joint Publication 4-09, “Distribution Operations”
- US Air Force Supply Manual, AFMAN 23-110
- US Army Supply Policy Below the National Level, AR 710-2
- US Navy’s Supply Systems Command website at http://www.navsup.navy.mil/navsup
- DAU’s iCatalog, website @ http://icatalog.dau.mil/onlinecatalog/tabnav.aspx?tab=LOG

4.1.2 Classes of Supply

All of the items which must be distributed to the Warfighter have been divided into ten categories, or classes, based upon their respective requirements for procurement, packaging, storage, handling, transportation. These requirements may be in areas of safety, environmental, size, hazard category, end use, shelf life, etc. These categories are intended to facilitate supply management and planning. Each class is further broken down into subclasses to further delineate distribution requirements. DoD Joint Publication, JP 4-09, “Distribution Operations”, provides a detailed description of each class of supply and the unique requirements for each class as part of a “Commander’s Checklist for Distribution of Materiel and Movement of Forces” in Appendix C. The corresponding figure, found in JP 4-09 on page C-11, shows the symbols for each supply class and the subclasses.

The ten classes of supply are designated by Roman numerals as listed below:

I. Rations and gratuitous issue of health, morale and welfare items;
II. Clothing, individual equipment, tentage, tool sets, and administrative and housekeeping supplies and equipment;
III. Petroleum, oils, and lubricants;
IV. Construction materials;
V. Ammunition;
VI. Personal demand items;
VII. Major end items, including tanks, helicopters and radios;
VIII. Medical;
IX. Repair parts and components for equipment maintenance;
X. Nonstandard items to support nonmilitary programs such as agriculture and economic development.

The definitions for "classes of supply" may be found in Appendix 16 of DoD 4140.1-R.

4.1.3 Supply Chain Operational Reference Model (SCOR)

The SCOR model is a commercial based supply chain integration model used to describe business activities associated with all phases of satisfying a customer demand. The model is organized around the five primary management processes of Plan, Source, Make/Maintain, Deliver and Return. By describing supply chains using these building blocks, the model can be used to describe supply chains that are very simple or very complex using a common set of definitions. The DoD uses SCOR as the basis for DoD Regulation 4140.1-R, "Supply Chain Materiel Management Regulation".

The SCOR model was developed and is registered by the Supply Chain Council (SCC) with license for use by the DoD. The SCC website and more information on SCOR can be found at http://supply-chain.org/about.

4.1.4 Joint Supply Chain Architecture (JSCA)

The JSCA, which is based on and directly maps to the Supply Chain Operations Reference model (SCOR®), is a framework used by DoD to improve supply chain management performance. The PSM
may use the JSCA reference model in the initial definition and mapping of supply chains as well as in continuous process improvement efforts for managing existing supply chains. More

information on JSCA is found in Appendix E – Proposed Joint Supply Chain Architecture (JSCA) Supply Chain Management Metrics.

The Joint Supply Chain Architecture (JSCA) is a methodology developed by the Joint Chiefs of Staff and the ODUSD(L&MR) that uses a process reference model, metrics, and benchmarking to drive process improvements within a supply chain. It has been proven to be a viable methodology but is not policy. JSCA allows supply chain owners to understand the impact of decisions on their supply chain's speed, reliability, and efficiency. JCSA consists of three component parts: Benchmarking, Diagnostic Tools, and Metrics. The Weapon System Diagnostic (WSD) is a tool that was developed to examine and assess a supply chain using JSCA on joint and non-joint programs that have reached their Initial Operating Capability (IOC).

4.1.5 Supply Chain Assurance

The goals of supply chain assurance seek to reduce supply chain vulnerability via a coordinated holistic approach, involving all supply chain stakeholders, identifying and analyzing the risk of failure points within the supply chain. Mitigation plans to manage these risks can involve logistics, finance and risk management disciplines; the ultimate goal being to ensure supply chain continuity in the event of a scenario which otherwise have interrupted normal business and thereby profitability.

The topic of supply chain assurance typically addresses supply chain quality and inventory availability (approaches and metrics contained in the SCOR and JSCA models) as well as a new emerging area addressing security within the supply chain. Supply chain security combines traditional practices of supply chain management with the security requirements of the system, which are driven by threats such as terrorism, piracy, and theft. Supply chain security also includes the role of DEMIL coding as a security risk mitigation action identifying the degree of DEMIL and Trade Security Controls required before an item is released from DoD control during disposition and disposal processes.

Typical supply chain security activities include:

- Credentialing of participants in the supply chain;
- Screening and validating of the contents of cargo being shipped;
- Advance notification of the contents to the destination country;
- Ensuring the security of cargo while in-transit via the use of locks and tamper-proof seals.
- Inspecting cargo on entry.

4.1.5.1 Counterfeit Material Prevention

Infiltration of counterfeit parts and components into U.S. Defense and industrial supply chains is a critically important issue and of increasing concern to DoD acquisition and logistics professionals. In November 2009, the U.S. Department of Commerce Office of Technology Evaluation in the Bureau of Industry and Security issued a comprehensive report on the issue entitled "Defense Industrial Base Assessment: Counterfeit Electronics." Subsequently, in March 2010, the GAO issued GAO-10-389 on the subject in a report entitled "DOD Should Leverage Ongoing Initiatives in Developing Its Program to Mitigate Risk of Counterfeit Parts".

In September 2009, Victoria Espinel was appointed by the President to serve as the first Intellectual Property Enforcement Coordinator (IPEC) in developing and implementing the

Administration's overall strategy for enforcement of intellectual property. More recently, the White House established a U.S. Government-Wide Working Group to Prevent the US Government Purchase of Counterfeit Products.

In February 2011, IPEC sent to Congress the 2010 U.S. Intellectual Property Enforcement Coordinator Annual Report on Intellectual Property Enforcement. Some of the significant accomplished activities from the annual report are:

- Voluntary Private Sector Action: Companies to form a non-profit organization to take voluntary enforcement action against illegal online pharmacies;
- Anti-Counterfeiting Trade Agreement (ACTA): In November 2010, the U.S. Trade Representative concluded the negotiations of the Anti-Counterfeiting Trade Agreement (ACTA) with 38 countries, representing over 50% of global trade. ACTA is the first international agreement entirely focused on intellectual property enforcement;
- Increased Law Enforcement Action: In June/July 2010–DOJ, HSI, and ICE, had two of the largest counterfeit cases in U.S history, each involving $100M of counterfeit goods. Also, DOJ, FBI, HSI, ICE continued prosecuting defendants which targeted the sale of counterfeit computer network hardware.

The Defense Acquisition University, DAU, working with key stakeholders in the Navy, has deployed a new continuous learning module on the subject entitled **"**CLL032 Preventing Counterfeit Parts from Entering DoD Supply System**"** to assist in educating the DoD and industry acquisition and logistics communities.
http://icatalog.dau.mil/onlinecatalog/courses.aspx?crs_id=1729

4.1.5.2 Malicious Hardware and Software Prevention

Malicious hardware and software prevention is closely tied to the counterfeit and intellectual property protection measures discussed above. The term, "malicious", refers specifically to acts intentionally committed to cause damage or harm to the equipment itself, operation of the equipment, or the collection of information intended for future harm or damage. Malicious alterations of Commercial Off the Shelf (COTS) electronic parts pose major concern in terms of their reliability and trusted field operation. It is extremely difficult to discover such alterations, also referred to as "hardware Trojans" using conventional structural or functional testing strategies. The DoD, as well as most manufacturers of electronics in the United States, are currently funding research and development initiatives to address this problem.

Per DODI 5200.39, "Critical Program Information (CPI) Protection Within the Department of Defense", it is DoD policy:

- To provide uncompromised and secure military systems to the Warfighter by performing comprehensive protection of CPI through the integrated and synchronized application of CI, Intelligence, Security, systems engineering, and other defensive countermeasures to mitigate risk. Failure to apply consistent protection of CPI may result in the loss of confidentiality, integrity, or availability of CPI, resulting in the impairment of the Warfighter's capability and DoD's technological superiority;
- To mitigate the exploitation of CPI, extend the operational effectiveness of military systems through application of appropriate risk management strategies, employ the most effective protection measures, to include system assurance and anti-tamper, and

document the measures in a Program Protection Plan (PPP) (see Glossary and Reference (f));

- To conduct comparative analysis of defense systems' technologies and align CPI protection activities horizontally throughout the Department of Defense;
- To identify CPI early in the technology development, acquisition, and sustainment process; refine at each milestone or as directed by the Milestone Decision Authority (MDA); and to initiate and maintain the appropriate protection of CPI throughout its military life cycle;
- To require all RDA programs with CPI to submit a PPP for review and approval by the appropriate MDA or science and technology (S&T) equivalent per Reference (e);
- To assure federally funded products of fundamental research remain unrestricted to the maximum extent possible according to National Security Decision Directive 189 (Reference (j));
- To minimize the chance that the Department's warfighting capability will be impaired due to the compromise of elements or components being integrated into DoD systems by foreign intelligence, foreign terrorist, or other hostile elements through the supply chain or system design;
- To require that contracts supporting RDA programs where CPI has been identified shall contain contractual terms requiring the contractor to protect the CPI to the standards articulated in this Instruction.

4.1.5.3 Unauthorized Technology Transfer Prevention

Per DoDI 5240.6, it is DoD policy that Active and Reserve military personnel and DoD civilian employees are to report to an appropriate authority any contact information or circumstances that could pose a threat to the security of U.S. Personnel, DoD resources, and classified national security information (hereafter referred to as "classified information"), or unclassified controlled information under E.O. 12598, DoD Directive 5230.24, DoD 5400.7-R, and DoD Directive 5210.83 (references (f), (g), (h), and (i)). An appropriate DoD authority is the individual's security officer, supervisor, commander, or servicing CI agency. Similarly, cleared DoD contractors are to report to an appropriate authority any contact information or circumstances that could pose a threat to the security of U.S. Personnel, DoD resources and classified information. An appropriate authority for DoD contractors is their Facility Security Officer, the Federal Bureau of Investigation, or other Federal authorities, to include the Defense Investigative Service (DIS) as required by DoD 5220.22-M (reference (j)), the terms of a classified contract, and U.S. Law. All DoD personnel shall receive a periodic briefing on the threats posed by foreign intelligence, foreign commercial enterprises, terrorists, computer intruders and unauthorized disclosures. This reinforces the requirements of DoD Directive 2000.12 (reference (k)) and reflects DoD personnel's responsibility to report any such information to an appropriate authority. Judicial and/or administrative action may be taken when personnel fail to report such required information.

The DoD's Defense Security Service runs a program called National Industrial Security Program (NISP). The NISP was established by Executive Order 12829 to ensure that industry safeguards the classified information in their possession or to which they have access while performing work on contracts, programs, bids or research and development efforts. The Defense Security Service (DSS) administers the NISP on behalf of the Department of Defense as well as 23 non-

DoD federal agencies. Presently, DSS has Industrial Security oversight responsibility for over 13,000 cleared companies participating in the NISP. To have access to U.S. Classified information and participate in the NISP, a company or other designated operating entity in private industry or at a college/university, must have a legitimate U.S. Government or foreign government requirement for such access. Once this requirement has been established, a company can be processed for a Facility Security Clearance (FCL). An FCL is an administrative determination that the company is eligible to access classified information at the same or lower classification category as the FCL being granted. The FCL may be granted at the Top Secret, Secret or Confidential level. When a determination has been made that a company meets the eligibility requirements for a FCL, the company must execute a Defense Security Agreement which is a legally binding document that sets forth the responsibilities of both parties and obligates the company to abide by the security requirements of the National Security Industrial Program Operating Manual (NISPOM).

4.1.5.4 Impacts of Environmental Policy

The term, environmental, as defined in the Defense Acquisition Guidebook, includes systems threats, usage environment, support environment, doctrine, and operational concepts (including installation/range Environmental, Safety and Occupational Health asset requirements).

Executive Order (EO) 12114 requirements include different levels of analysis and documentation for evaluating potential environmental impacts that may result from a proposed Federal action occurring outside the United States and its territories. As with NEPA, the acquisition Program Manager (PM) is responsible for determining the appropriate level of analysis depending on the proposed action and the potential environmental impact(s) resulting from specific program activities. EO 12114 documentation includes:

- Overseas Environmental Assessment (OEA)
- Overseas Environmental Impact Statement (OEIS)
- Environmental Review
- Environmental Study.

Per the Defense Acquisition Guidebook, para. 4.4.7.2, the required NEPA/EO 12114, "Environmental Effects Abroad of Major Federal Actions" Compliance Schedule, presented in the Programmatic Environment, Safety, and Occupational Health Evaluation and summarized in the Acquisition Strategy, should include the following:

- Events or proposed actions (such as, but not limited to T&E and fielding/basing activities) throughout the life cycle of the program that may require preparation of formal NEPA/EO 12114 documentation;
- The anticipated initiation date for each proposed event or action;
- Proponent responsible for preparing the NEPA/EO 12114 documentation for each proposed event or action;
- The anticipated type of NEPA/EO 12114 document (e.g., Categorical Exclusion, Environmental Assessment and Finding of No Significant Impact, Environmental Impact Statement, Record of Decision, Overseas Environmental Assessment, and Overseas Environmental Impact Statement) which the proponent should complete prior to the proposed action start date;
- The anticipated start and completion dates for the final NEPA/EO 12114 document; and

- The specific approval authority for the documents. DoD Instruction 5000.02, E12.5.2, establishes the following: The CAE (or for joint programs, the CAE of the Lead Executive Component) or designee, [as] the approval authority for system-related NEPA and E.O. 12114 documentation.

More information is at the DAU website, https://acc.dau.mil/CommunityBrowser.aspx?id=234112.

4.2 Forecasting

Forecasting is the process of conducting analysis and making statements about events whose actual outcomes (typically) have not yet been observed. There is no single right forecasting method to use. Methods can vary widely from purely qualitative to highly quantitative and statistical. Selection of a method should be based on your objectives and your conditions (data etc.). Forecasting is required in supply chain management to assist in planning for the right product delivered at the right place at the right time. Accurate forecasting will reduce excess inventory and therefore reduces life cycle cost.

4.2.1 Market Analysis and Benchmarking

The requirement to conduct market research and analysis is not policy; it's required as described in FAR Part 10. Benefits of effective market research include reducing acquisition costs and cycle times, and providing greater access to advanced technologies.

The Defense Acquisition University (DAU) provides a continuous learning course on conducting market research, CLC 004, found on their iCatalog at http://icatalog.dau.mil/onlinecatalog/courses.aspx?crs_id=283.

According to SD-5, "Market Research", market research is a continuous process for gathering data on product characteristics, suppliers' capabilities and the business practices that surround them—plus the analysis of that data to make acquisition decisions. This requires one to collect and analyze information about the market that subsequently can be used to determine whether the need can be met by products or services available in the commercial market; whether commercial practices regarding customizing, modifying products or tailoring services are available to meet customer needs; what are the customary terms and conditions, including warranty, buyer financing, and discounts under which commercial sales are made; and whether the distribution and logistics support capabilities of potential suppliers are sufficient to meet the needs of the government. Market research information can be used to shape the acquisition strategy, to determine the type and content of the product description or statement of work, to develop the support strategy, the terms and conditions included in the contract, and the evaluation factors used for source selection.

Also see SD-2 Handbook, "Buying Commercial &Non-developmental Items," which contains general guidance on buying NDI, including conducting market research.

When organizations want to improve their performance, they benchmark. That is, organizations, from both the same and different industries and organizational types, can compare and measure their policies, practices, philosophies, and performance measures against those of high-

performing organizations anywhere in the world. Outcomes of benchmarking can be very valuable and include:

- Identifying where potential cost cutting opportunities exist;
- Quantifying the return on investment of improvement initiatives;
- Setting performance goals;
- Analyzing year over year performance trends;
- Measure performance against best-in-class organizations to identify improvement opportunities and areas of process or product advantage;
- Helping to define targets for major operations parameters such as cost, inventory, and customer service and aligning goals within the organization;
- Providing a scale upon which to measure the opportunities associated with achieving target levels of performance.

A typical benchmarking methodology may consist of:

- Selecting the topic to be studied;
- Defining the process;
- Identify potential organizations to be studied;
- Identify data sources to be studied and the data to be collected;
- Collecting the data;
- Evaluating the gaps;
- Establish process differences;
- Targeting future performance;
- Communicating results;
- Adjust goals;
- Implement improvements;
- Review and recalibrating to determine if desired outcomes are achieved.

4.2.2 Demand Forecasting

Demand forecasting is the activity of estimating the quantity of a product or service that users will require or purchase. Demand forecasting involves techniques including both informal methods, such as educated guesses, and quantitative methods, such as the use of historical sales data or current data from test markets.

Per a GAO report issued in May 2010, http://www.gao.gov/highrisk/risks/dod-management/supply_chain_management.php, DOD's ability to match supply inventories with requirements has been a continuing challenge due, in part, to difficulties in accurately forecasting demand. The military departments and DLA have accumulated and retained billions of dollars in spare parts inventories that are excess to current requirements. Key factors include:

- Inaccurate demand forecasting;
- Ineffective or inefficient inventory management practices; and
- A lack of goals and metrics for assessing and tracking the cost efficiency of inventory management.

GAO found in May 2010 that DLA had substantial amounts of spare parts inventory beyond current needs and projected demand, including an annual average inventory excess (spare parts identified for potential reutilization or disposal) of about $1 billion from fiscal year 2006 to

2008. In 2010, DOD submitted to Congress a plan for improving inventory management practices and reducing excess inventory. This plan, found at http://www.gao.gov/new.items/d11240r.pdf, is an important step for improving DoD's inventory management, but effective implementation will be of critical importance.

PSM's and LCL's should check with their respective organizations for the demand forecasting tools available to their program via enterprise resource programs, the capabilities listed in section 4.6 of this Guidebook, or other local resources and capabilities.

4.2.3 Readiness Based Sparing (RBS)

Spares that are required frequently in sufficient quantities to generate reliable predictions of future requirements are called demand based spares. Readiness Based Sparing (RBS) is the practice of using advanced analytics to forecast spares levels and locations to maximize system readiness. RBS has been part of Department practice since the 1960's, when it was used to optimize aircraft availability, and is incorporated into DoD Supply Chain Materiel Management Regulation (DoD 4140.1-R) as the preferred method for calculating inventory levels.

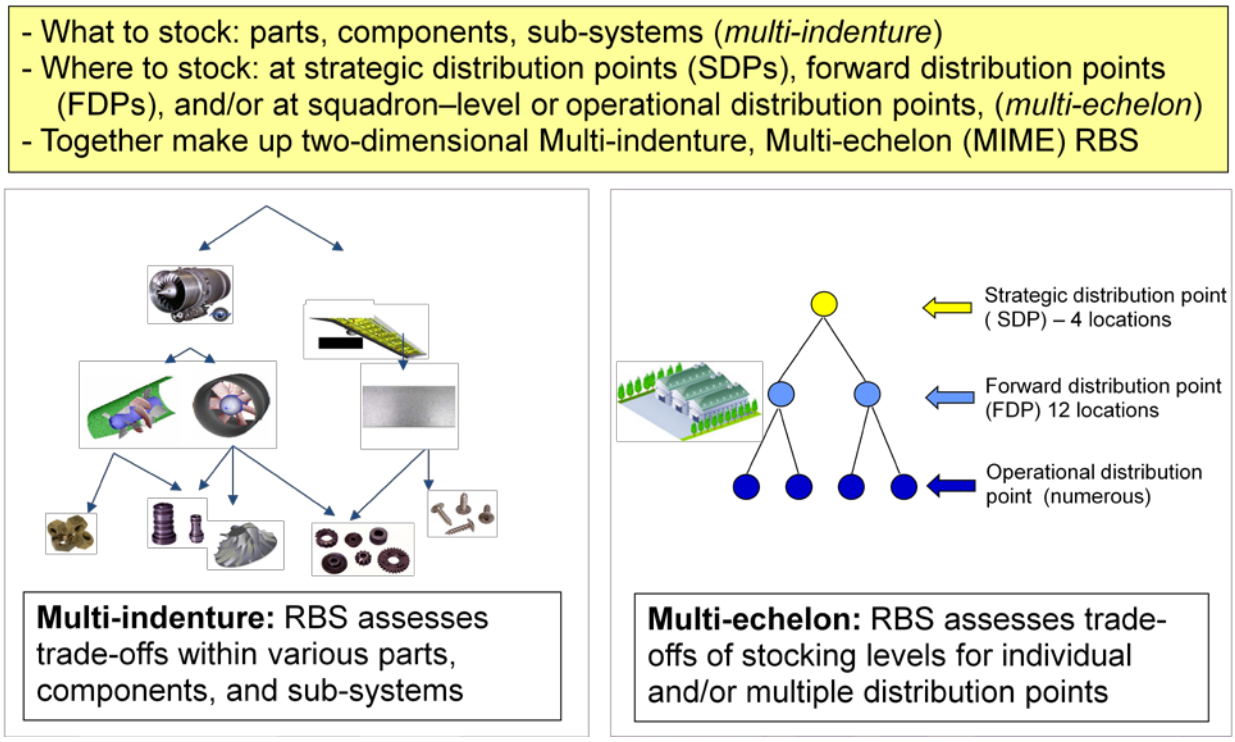


Figure 4.3.2.3.F1. Readiness-Based Sparing determines the inventory requirements for achievement of readiness goals. Source, http://www.acq.osd.mil/log/sci/rbs.htm.

There is a Readiness Based Sparing DoD Roadmap, published in 2008 and still current which provides DoD guidance on this topic. http://www.acq.osd.mil/log/sci/rbs/DL739C1-V1_report_final_10Oct08.pdf

Each of the DoD Services is addressing their respective needs through policy and standards. For example, the Navy has recently issued instruction NAVY OPNAV 4442.5: (N4) READINESS BASED SPARING. This instruction is described below and is found on the IHS Inc. Standards website at http://engineers.ihs.com/document/abstract/LYHINAAAAAAAAAAA. DoD employees can obtain this document free of charge through their DTIC account. The below is an excerpt from this document.

"a. This instruction describes the application of readiness based sparing (RBS) methodology to spares and repair parts allowance determination to ensure that prescribed readiness thresholds and objectives are achieved at the lowest possible cost. Readiness thresholds are expressed as either Operational Availability (Ao) or Full Mission Capable (FMC) and or Mission Capable (MC) rates. The term "RBS" applies to single echelon and single indenture systems, as well as their multi-echelon (ME) and multi-indenture (MI) extensions. RBS applies to organic (Department of Navy (DON) and or Department of Defense) practices, as well as performance based logistics (PBL) practices.

b. RBS is to be utilized for all new acquisition programs and equipment modification programs in acquisition categories (ACATs) I, II, or III, with the exception of nuclear and fleet ballistic missile submarine (SSBN) programs. It should be applied, as appropriate, to existing weapon systems and other new systems (i.e., ACAT IV) when it provides an optimal method for attaining the required readiness objective and or cost constraint. RBS is to be applied to both aviation and maritime allowance package development, aviation consolidated allowance lists (AVCALs) , shore-based consolidated allowance lists (SHORCALs) , all Marine aviation logistics support packages (MALSPs) , and coordinated shipboard allowance lists (COSALs).

c. New acquisition programs (ACATs I, II, or III) in the system development and demonstration phase or at the end of the technological development phase will apply the RBS process . This includes programs that require tailored interim supply support assistance to achieve full logistic support capability. The RBS assessment and sparing processes must be completed in time to allow for sufficient administrative and production lead time before the material support date (MSD) . RBS is an ongoing process and should be reviewed at least annually over the life of the weapon system or other acquisition program.

d. RBS will generally apply to commercial best practices like PBL or time definite delivery (i.e., use of premium transportation). RBS will also be applied, as appropriate, in the procurement and support of commercial and non-developmental item spares, subsystems, or systems, and in support of alternative approaches such as pre-positioned spares.

e. RBS is critical in the life cycle of any system requiring supply support and plays an important role in the provisioning for initial support, as well as an equally important and ongoing role in subsequent replenishment support. Readiness and performance metrics, such as Ao and customer wait time (CWT), help indicate how well the system's integrated logistics support is fulfilling its purpose during the production and deployment phase of a system's life cycle. A robust RBS effort over the system's life cycle is vital to supply support effectiveness and its effect on Ao and CWT."

4.2.4 Availability Based Sparing (ABS)

Availability Based Sparing (ABS) was mandated by DoD policy in the mid-1980's and implemented by the Services. The premise is that sparing is directly linked to an item's availability rating, not to historical demand. Implementation of readiness based sparing process is now synonymous with availability based sparing.

4.2.5 Long Lead Time Items

Lead time refers to the period of time from the point when the order is placed to the time of delivery of the product to the customer. Long lead items are those products which need a longer than usual period of time to manufacture or source than the customer has built in to his or her desired delivery schedule. Long lead items present risk to both the customer and the manufacturer. For the customer, a long lead item has a delivery date that may be weeks or months, or even years, beyond the required date once the order has been placed. For the manufacturer, the decision to build a long lead item in advance of a confirmed order means if the customer changes any specification of the product, there is minimal opportunity to react since the product has already entered the manufacturing process.

Long lead items are often complex, high cost, and contain difficult to acquire materials or components. Manufacturing processes themselves may be time consuming and constrained by external environmental factors.

The PSM and Life Cycle Logistician should work with suppliers to identify any long lead items early in the acquisition cycle and plan to order them well in advance of standard lead time items.

4.3 Initial Provisioning

Initial provisioning is the process of determining the range and quantity of items (i.e., spares and repair parts, special tools, test equipment, and support equipment) required to support and maintain an item for an initial period of service. Its phases include the identification of items of supply, the establishment of data for catalog, technical manual, and allowance list preparation, and the preparation of instructions to assure delivery of necessary support items with related end articles.

Initial provisioning is intended to support initial operations for one to two years. Engineering data is required to support the development of provisioning data lists and is delivered at this time. Use of the DLA Logistics Information Services (DLIS) should be part of the initial provisioning process. DLIS is the cataloguing agency for DoD. Provisioning guidelines are contained in DoD Services' policy and regulations.

4.3.1 Provisioning Guidance Conference

Provisioning is the process of determining the range and quantity of specific items of supply necessary to operate and maintain an end item for an initial period of operation. Initially, a DoD Component (Army, Navy, Air Force, Marine Corps) awards a contract for a required end item. The end item can range from a small instrument to a complex major item or weapon system. After contract award, a guidance conference is held. The purpose of the guidance conference, normally scheduled 60-90 days after contract award, is to ensure that the Contractor and the Government have a firm understanding of the contractual requirements, to establish funding, and

to assign responsibilities, actions and timelines for all stakeholders in support of the provisioning spares conference. The results of the guidance conference are published as minutes of the conference and are signed by representatives from the government and the contractor. These minutes become part of the contract. For further information, see the DLAH 5000.6, "Guidelines For DLA Representatives at Provisioning/Guidance Conferences".

4.3.2 Provisioning Technical Documentation

Provisioning documentation is required for all systems and equipment acquired or modified under the acquisition program unless all supply support will be provided by the contractor for the life of the system. Planning for supply support and initial provisioning is required to begin concurrently with the development of performance requirements for the system or as early as possible in the Technology Development phase. Services may require that initial stockage quantities of support items be provided prior to or concurrent with the initial distribution of the system.

Provisioning is the process of determining and acquiring the range and quantity of support items (e.g., spares, repair parts, bulk materiel, tools and test equipment) necessary to operate and maintain a system for an initial period of time. Provisioning data is accumulated and documented during the system engineering process and continues to be updated in each lifecycle phase as the Logistics Management Information (LMI) is updated.

The standard used for provisioning technical documentation is usually the GEIA-STD-0007 Interface: H Entities, Provisioning and Cataloging Requirements. The "H" data Entities are used to document packaging/provisioning data requirements. Included in these entities are static parts data (non-application dependent) related to provisioning screening and cataloging, packaging, and common maintenance data. Also included under these data entities are application data of items used to document the data required for initial support requirements determination, repair parts manuals, and design change information. For Department of Defense (DOD) provisioning technical documentation, there is a specific format for delivery of provisioning data through the use of style sheets. The results of the style sheets produce the data required for review at various provisioning meetings and conferences (e.g., long-lead time items conference, provisioning conference, etc.) and are used in the selection procedures to identify repair parts requirements in support of the equipment to be fielded.

Sources include DoD 4140.1-R, MIL-PRF-49506, MIL-HDBK-502, and GEIA-STD 0007.

4.3.3 Cataloging

A supply chain manager begins the inventory planning process by identifying the discrete items managed in the supply chain. This process is called cataloging. Cataloging in the private sector is a basic process in managing inventory. It supports logistics functions from the procurement of an item to its disposal. Cataloging uses a standardized language to name, classify, describe and number supply items. Standardized cataloging procedures (including naming structures) allow companies to collaborate with each other in operating a supply chain. In DoD, cataloging provides the same function. DoD is responsible for the Federal catalog of supply items used by all the Military Services, DLA, all Federal agencies that manage inventories, and a number of allied countries. Many private sector companies also use the DoD catalog to do business with

the Government. Today, nearly all item-oriented logistics information systems in DoD use the automated Federal catalog database to identify items of supply, including their physical characteristics. DoD purchases, repairs, stores, and delivers items in the supply chain using the standard item catalog numbering system and identification procedures.

The DLA Logistics Information Service (DLIS) Cataloging Directorate (DLIS-K) is the cataloging activity for DoD. Centralization and consolidation of all DoD cataloging under one Directorate in DLIS was completed in Jan 00 with the transition of Navy cataloging to Battle Creek. DLIS performs the twelve DoD cataloging functions listed below, and provides cataloging services in support of our Warfighters, DoD agencies (both at the wholesale and retail levels), and approximately 50 NATO and other allied nations. They are responsible for operational assignment, life cycle maintenance and collaboration with each of the Services for the 7.4 million National Stock Numbers and the descriptive data associated with each item of supply. DLIS-K provides day-to-day cataloging support (143K new item reviews and over 1.2M maintenance actions last year) to their customers, implements cataloging policies, develops cataloging procedures.

With the consolidation and co-location of cataloging, twelve of the thirteen cataloging tasks are now performed at DLIS. Although Item Management Coding (determining whether items of supply qualify for management by the Military Services or by DLA/GSA) remains a Service/Agency responsibility, the following tasks transferred to the DLIS Directorate of Cataloging (DLIS-K). Successful completion of these tasks helps to ensure the integrity of information in the Federal Logistics Information System (FLIS) database.

1. Accomplishing Item Name Assignment by designating a commonly-recognized noun or noun phrase to an item of supply. Based on subsequent availability of technical data and ongoing tool development, the item name may be refined later.
2. Determining the Federal Supply Class (FSC) of an item of supply by establishing its relationship with other items, based on assigned item name and/or physical and performance characteristics. The FSC may be refined later, based on subsequent availability of technical data and ongoing tool development.
3. Preparing and Maintaining an Item Identification (II) by recording the characteristics data (in accordance with the Military Standard Item Characteristic Coding Structure (MILSTICCS)) to describe the physical and performance attributes of an item of supply.
4. Accomplishing Item Entry Control (filtering and scrutinizing a candidate for inclusion in the Federal Catalog System (FCS)) by manually and mechanically comparing a candidate to existing items and recognized standards.
5. Performing Technical Data Validation by confirming the quality of technical data used for item name assignment, FSC determination, and item identification.
6. Providing Provisioning Support by taking actions to assist the best selection, procurement, and cataloging of items of supply required to sustain weapon systems and other government requirements (data calls; provisioning; guidance and Logistics Support Analysis (LSA) conferences; technical data validation; etc.).
7. Performing Data Recordation and Maintenance actions necessary to ensure complete, accurate, and current logistics data records (excluding item characteristics data) for an item of supply. These actions are normally accomplished as a result of item manager

requests, system incompatibility notices, technical data revisions, interchangeability and substitutability (I&S) decisions, and periodic record reviews.

8. Initiating and enhancing Cataloging Tools documents and procedures required to research, record, and organize item logistics information. Cataloging Tools include item names, definitions, FSC Structure, Federal Item Identification Guides (FIIGs), and other publications.
9. Performing Supply Support Request (SSR) Processing (resulting from a request by a Service to be a user of a consumable item managed by another Service or Agency) by accomplishing cataloging actions which record user interest, assign management data, and review/accept substitutes offered.
10. Performing Data Dissemination functions, which provide logistics information (written, telephonic, or electronic) to customers who need it at every level of the supply system.
11. Developing Cataloging Procedures and Systems to implement cataloging policies. This includes written directives, manual methods, and automated information systems in various combinations, including FLIS.
12. Developing Cataloging Policy to support the general principles governing the relationship of all cataloging elements/functions to each other as well as to other logistics disciplines.

4.3.3.1 National Item Identification Number (NIIN) and National Stock Number (NSN) Assignment

In the Federal Catalog System, the concept of each item of supply is expressed in, and fixed by, item identification. The item identification will consist of the minimum data required to establish characteristics of the item. They give the item its character and differentiate it from every other item of supply. New items introduced into the supply system result in the preparation and submission of an item identification for the assignment of a NIIN by DLIS. Once assigned, the NSN (i.e., the Federal Supply Class (FSC) and NIIN) identifies the item for all logistics functions.

DoD 4100.39-M, Volume 4, "Federal Logistics Information System, FLIS Procedures Manual Item Identification May 2010", contains specific instructions on NIIN and NSN assignments. Suggested reading: "The National Stock Number (NSN) - The Gear that Keeps the Supply Chain Running", https://acc.dau.mil/adl/en-US/372300/file/50475/The%20National%20Stock%20Number%20(NSN)%20-%20The%20Gear%20that%20Keeps%20the%20Supply%20Chain%20Running.pdf, issued by the DLA Defense Logistics Information Service (DLIS), provides an overview of the National Stock Number (NSN), and answers questions and provides information such as:

- What is a National Stock Number (NSN)?
- Why Was The Concept of a NSN Created?
- What Does a NSN Structure Look Like?
- Who Can Request a NSN Assignment?
- Who Assigns a NSN?
- Who Uses NSNs?
- What's the Real Value of a NSN?
- The Bottom Line
- DLIS Products and Services that Support NSNs
- Defense Cataloging and Standardization Act

- DLIS Contact Information

4.3.3.2 Source Maintenance and Recoverability (SM&R) Codes

Source, Maintainability and Recoverability (SM&R or SMR) codes are used to communicate maintenance and supply instructions to the various logistic support levels and the Using Commands for the logistic support of systems, equipment, and end items. Using Commands can quickly discern whether an item is stocked, to what level and degree maintenance can be performed and the disposal authority.

These six digit codes are divided into three sections that tell where a part comes from, who does maintenance on it, and what is done with the part when it can't be repaired. SM&R codes are made available to their intended users by means of technical publications such as allowance lists, Illustrated Parts Breakdown (IPB) manuals, Repair Parts, and Special Tools Lists (RPSTLs), maintenance manuals and supply documents. These codes are assigned to each support item based on logistics analysis and consideration of the cost, design, manufacture, application, maintenance, and supply practices and capabilities as related to each support item and the operational missions of the end item.

The primary objective is to establish uniform policies, procedures, management tools, and means of communication that will promote inter-Service and integrated material support within and among the military Services and participating agencies. Thus, the establishment of uniform source maintenance and recoverability codes is an essential step toward improving overall capabilities for more effective inter-Service and integrated support. The Product Support Manager should consult joint regulation AR 700-82 / OPNAVINST 4410.2A / MCO 4400.120 for more information.

Per NAVAIR's Standard Work Package SWP6712-015A, "Standard Work for Source, Maintainability and Recovery (SMR) Codes", 6 Jan 2011, NAVAIR promulgates policy and guidance for, and delineates requirements pertaining to, the SMR Code assignment/change process as part of the Maintenance Planning process to ensure logistics supportability. Uniform SMR Codes identify if an item should be repaired or discarded, and the maintenance level where this repair/discard action will be accomplished. These codes are assigned following LORA analysis which begins during the Materiel Solution Analysis Phase and is iteratively developed and updated throughout the acquisition program to identify optimum repair strategies. Operational experience or other analysis may indicate that a change to an item's support strategy is required (e.g. change in level of repair or discard criteria.) This change must be reflected by an SMR Code Change Request so that all levels of support correctly process items requiring repair or replacement.

4.3.4 Bill of Material (BOM)

A bill of materials (sometimes bill of material or BOM) is a list of the raw materials, sub-assemblies, intermediate assemblies, sub-components, components, parts and the quantities of each needed to manufacture an end product. No physical dimension is described in a BOM. It may be used for communication between manufacturing partners, or confined to a single manufacturing plant.

A BOM can define products as they are designed (engineering bill of materials), as they are ordered (sales bill of materials), as they are built (manufacturing bill of materials), or as they are maintained (service bill of materials). The different types of BOMs depend on the business need and use for which they are intended. In process industries, the BOM is also known as the *formula*, *recipe*, or *ingredients list*. In electronics, the BOM represents the list of components used on the printed wiring board or printed circuit board. Once the design of the circuit is completed, the BOM list is passed on to the PCB layout engineer as well as component engineer who will procure the components required for the design. BOMs are hierarchical in nature with the top level representing the finished product which may be a sub-assembly or a completed item. BOMs that describe the sub-assemblies are referred to as modular BOMs.

Bill of Materials are described in FAR Table 15-2. A bill of materials is a listing of all the materials, including the part numbers and quantities of all the parts required to complete the contract. When the contract is complex, there may be individual bills of material for different contract tasks or line items. Service contracts may not include drawings and specifications, but direct material quantity estimates will still be based on an analysis of contract requirements and offerors experience. These quantity estimates may be based on a detailed analysis of contract requirements or on comparisons with the material quantities actually required to complete similar contracts.

4.3.5 Special Topic: Support Equipment Provisioning

Support equipment acquisition and provisioning may be its own separate process as determined by acquisition or procurement processes for each support equipment item. It includes the provisioning of IPS Element documentation for the support equipment.

4.4 Procurement

The Department of Defense (DoD) operates 11 primary logistics and acquisition management centers to equip and sustain its global operations. The Army and Air Force each operate three of these centers, while the Navy and Marine Corps operate one apiece. The remaining three centers are elements of the Defense Logistics Agency (DLA), which manages inventory items, as well as the procurement of new depot level repairables, common to multiple military services. The dollar value of the repair parts inventories that the 11 centers manage is over $80 billion. The inventories are constantly in motion, flowing from manufacturers to storage locations, to military units, to repair facilities, and then finally to disposal activities. This large and expensive network of personnel, facilities, and repair parts is DoD's logistics supply chain, and it is critical to the operational success of the U.S. Military.

The actual procurement of reparables, repair parts and consumables is dependent upon many factors such as appropriation type, source of supply, DoD Component and Agency procedures governing procurement activities, etc. The Product Support Manager should review its respective DoD Component and Agency procurement practices for each item needing to be procured.

4.4.1 Spares

Spare and repair parts management is an important part of the overall performance based life cycle product support strategy and starts early in the requirements and design interface phases of the acquisition. Important considerations of this strategy related to spares include:

- Long lead item management;
- Funding plans for initial spares (procurement) and replenishment (operations & support);
- Sourcing;
- Design Interface to minimize, standardize and simplify maintenance and spares requirements;
- Obsolescence and DMSMS;
- … and many other considerations as captured in DoD policy and guidance.

4.4.1.1 Repairables

Unique Reparable Items: These are reparable (subject to repair) parts that are unique to the system (not common with other DoD systems). They are usually sourced by the Prime Vendor/Original Equipment Manufacturer (OEM) of the system. Strong consideration should be given to allocating responsibility for wholesale support of these items to the Prime Vendor, who has readily available technical data and identified sources at their disposal.

Common Reparable Items: These parts are common with other systems and may have a variety of sources. They are usually managed organically within the DoD materiel management process but are also candidates for corporate PBL contracts

4.4.1.2 Consumables

Unique Consumable Items: These are consumable (discarded after use) items that are used only on the target system, and are usually sourced by the Prime Vendor/OEM of the system. Strong consideration should be given to allocating responsibility for acquisition of these items to the Prime Vendor, which may elect to use the Defense Logistics Agency (DLA) as the preferred source of supply.

Common Consumable Items: These are consumable items used across more than a single system, and are generally managed and provided by DLA. It may be viable to allow the Prime Vendor to procure these items should DLA be unable to meet time, cost, or quantity requirements, as appropriate. If needed, the PM should encourage establishing a PBA between DLA and the vendor when total private support is chosen.

4.4.2 Material Pricing

Material pricing is dependent upon a number of factors such as type of contract, incentivizations, cost per item, method of procurement and funding source.

The DoD Defense Procurement and Acquisition Policy group (website at http://www.acq.osd.mil/dpap/cpf/contract_pricing_reference_guides.html) publishes pricing guidebooks for contracting personnel. The Product Support Manager should discuss pricing with their respective contracting office.

4.4.3 Parts Obsolescence

Defense Microelectronics Activity (DMEA) document entitled "DMSMS Acquisition Guidelines: Implementing Parts Obsolescence Management Contractual Requirements", http://www.dmea.osd.mil/docs/acquisition_guidelines.pdf, provides the program manager and the integrated product team (IPT) with suggested contractual language that could be used to prepare a request for proposal (RFP) or to modify an existing contract to include cost effective DMSMS practices.

4.4.4 Warranty

Federal Acquisition Regulation (FAR) 46.7 states that "the use of warranties is not mandatory." However, if the benefits to be derived from the warranty are commensurate with the cost of the warranty, the Contracting Officer (CO) should consider placing it in the contract. In determining whether a warranty is appropriate for a specific acquisition, FAR Subpart 46.703 requires the Contracting Officer to consider the nature and use of the supplies and services, the cost, the administration and enforcement, trade practices, and reduced requirements. The rationale for using a warranty should be documented in the contract file.

The following steps are the crux of the warranty process:

- Establishing a Warranty Team;
- Selecting one or more Essential Performance Requirements (EPRs);
- Selecting a warranty type to adequately cover the selected EPRs;
- Performing a Cost Benefit Analysis (CBA) to evaluate the warranty type; and
- Documenting the process in a Warranty Plan.

Additional guidance is found in the DoD Warranty Guide, Sep 2009, found at http://www.acq.osd.mil/dpap/pdi/uid/docs/departmentofdefensewarrantyguide%5B1%5D.doc

4.5 Inventory Management

Inventory is materiel, titled to the U.S. Government, held for sale or issue, held for repair, or held pending transfer to disposal. Management is conducted typically by a DoD organization such as an Inventory Control Point (ICP). An ICP is an organizational unit or activity within the DoD supply system that is assigned the primary responsibility for the materiel management of a group of items either for a particular Military Service or for the DoD as a whole (Joint Pub 1-02, reference (bq)). In addition to inventory materiel management functions, an ICP may perform other logistics functions in support of a particular Military Service or for a particular end item (e.g., centralized computation of retail requirements levels and engineering tasks associated with weapon system components). The key to inventory management is to accumulate and maintain a sufficient historical database to compute the days of supply of a spare that should be stocked to satisfy customer demands.

PSMs should be familiar with their Service Component's regulations for inventory management below the wholesale level. For the Army, the applicable regulation is AR 710-2, Supply Policy below the National Level.

4.5.1 Receiving

All actions taken by a receiving activity from the physical turnover of materiel by a carrier until the on-hand balance of the accountable stock record file or in-process receipt file is updated to

reflect the received materiel as an asset in storage, or the materiel is issued directly from receiving to the customer.

4.5.2 Issuance

The DoD has issue transaction processes to ensure information regarding all items transferred from one organization to another is documented. DoD 4000.25-M, "Defense Logistics Management System", governs issue of material. The Product Support Manager should review their respective DoD Component and Agency guidelines for specific processes regarding material issue.

4.5.3 Transfer

PMs/PSMs should understand procedures for the transfer or acceptance of deliverables form their contractor. DD FORM 250, "Guidance For Using The Material Inspection and Receiving Report" (17 DEC 2006), is usually filled out by the contractor and this guidance is to allow the responsible individual, usually the Contracting Officers Representative (COR), to understand what the form is used for and what each block means. This form will help ensure the Government is getting what is required. The COR is normally required to sign the DD Form 250 as proof of acceptance that the supplies or services were received. One of the major questions is whether to use a DD Form 250 or a DD Form 1149. Generally, a DD Form 250 is the primary document for shipping and contractor invoicing for Government contracts. It is also for receiving, and for evidence of Government contract quality assurance at origin or destination. The DD Form 1149 is general used for: Return of Government-Furnished Property (GFP), except for material obtained through the Military Standard Requisitioning and Issue Procedures (MILSTRIP) and Real Property; Shipment of Industrial Plant Equipment; Internal transfer of Government property accountability for one contract to another (e.g., when authorized by contract modification; or Shipment of Government Property to other contractors and subcontractors. One of the key differences between the DD Form 250 and the DD Form 1149 involves acceptance. The DD Form 250 is the only form for documenting Government acceptance of contractor deliverables.

Further information is found at
http://www.everyspec.com/DoD/DoD+FORMS/DD_FORM_250_GUIDANCE_2006_30419/ .

4.5.4 Redistribution

Excess defense property goes to DLA's Disposition Services (Formerly called Defense Reutilization and Marketing Service (DRMS)) for redistribution within DoD or transfer to other federal agencies; property not transferred or redistributed is deemed surplus and donated to eligible state and local governments, as well as among other qualified organizations; finally, property that remains is sold to the general public, some as scrap metal.

4.5.5 Routine Replenishment

Routine replenishment includes post-fielding resupply of all supply classes to support on-going operations.

4.5.5.1 Buffer Stock or Safety Stock

Safety stock (also called buffer stock) is a term used by logisticians to describe a level of extra stock that is maintained to mitigate risk of stock-outs (shortfall in raw material or packaging) due to uncertainties in supply and demand. Adequate safety stock levels permit business operations to proceed according to their plans. Safety stock is held when there is uncertainty in the demand level or lead time for the product; it serves as an insurance against stock-outs.

With a new product, safety stock can be utilized as a strategic tool until the organization can evaluate how accurate their forecast is after the first few years, especially when used with a material requirements planning worksheet. The less accurate the forecast, the more safety stock is required. With a Material Requirements Planning (MRP) worksheet an organization can judge how much it will need to produce to meet forecasted demand without relying on safety stock. However, a common strategy is to try and reduce the level of safety stock to help keep inventory costs low once the product demand becomes more predictable. This can be extremely important for organizations with a smaller financial cushion or those trying to run on lean manufacturing, which is aimed towards eliminating waste throughout the production process.

The amount of safety stock an organization chooses to keep on hand can dramatically affect their operations. Too much safety stock can result in high holding costs of inventory. In addition, products which are stored for too long a time can spoil, expire, or break during the warehousing process. Too little safety stock can result in higher end item down time and, thus, a higher rate of customer complaints. As a result, finding the right balance between too much and too little safety stock is essential.

Commonly used commonly used methods to calculate safety stock are based on the following factors:

- Demand rate: the amount of items consumed by customers, on average, per unit time;
- Lead time: the delay between the time the reorder point (inventory level which initiates an order) is reached and renewed availability;
- Service level: the desired probability that a chosen level of safety stock will not lead to a stock out. Naturally, when the desired service level is increased, the required safety stock increases as well;
- Forecast error: an estimate of how far actual demand may be from forecasted demand. Expressed as the standard deviation of demand.

PSM's and Life Cycle Logisticians should check with their organizations on processes regarding safety stock.

4.5.5.2 Munitions

Ammunition management is a complex area with the DoD and each Component publishing their respective policy and guidance. The Defense Acquisition University (DAU) has a community of practice for ammunition management across all Components at https://acc.dau.mil/CommunityBrowser.aspx?id=237220&lang=en-US. Primary links are to the Components or to logistics above company or at unit/company level. This figure is taken

from the DAU Munitions community of practice homepage.

4.5.5.3 War Reserve

DoD's current policy calls for each military service to determine its requirements and acquire sufficient war reserve materiel for the execution of current wartime scenarios and to be able to sustain these operations until being re-supplied.4 Thus, in developing their plans, the services must consider the availability of spare parts in their peacetime operating stocks, their war reserve spare parts inventories, and from the industrial base, and then estimate what additional materiel they need to buy.

DoD maintains stocks of supplies and equipment called war reserves to support military units in a time of war or mobilization. War reserves stored within the continental United States (CONUS) are distributed as needed by airlift or sealift. War reserves are also stored, or prepositioned, overseas on land or ships near an area of potential conflict. Some supplies and equipment stored in central Europe, which include combat weapon systems, such as tanks and howitzers, are configured in a way to support deploying combat units and are called POMCUS. Afloat prepositioning involves keeping ships continuously loaded with supplies, combat equipment, and/or support items. These ships are intended to respond more quickly than if they had to be deployed from the United States.

References include DoD Directive 3110.6, "War Reserve Materiel Policy", November 9, 2000 and DoD 4140.1-R, "DoD Materiel Management Regulation", May 1998.

4.5.5.4 Warstopper Program

The Defense Logistics Agency Warstopper Program is to preserve the industrial base for critical warfighting items, the demand for which during peacetime is insufficient to meet wartime needs. Investments are for accelerating production of critical items and maintaining critical industrial capabilities. Furthermore, investments are intended as a cost-effective alternative to the procurement and storage of war reserve materiel. The investments include items that meet the Warstopper criteria as spelled out in the 1998 Defense Logistics Support Command Memorandum or are congressionally required. In general, these items are mission critical and have low peacetime and high wartime demand, a long lead time, or a short shelf life. The program has been recently reviewed in GAO Report No. D-2007-116 August 15, 2007.

4.5.5.5 Perishables

Shelf life is the length of time that food, drink, medicine, chemicals, and many other perishable items are given before they are considered unsuitable for sale, use, or consumption. In some regions, a best before, use by or freshness date is required on packaged perishable foods. Shelf life is the recommendation of time that products can be stored, during which the defined quality of a specified proportion of the goods remains acceptable under expected (or specified) conditions of distribution, storage and display.

A category named "semi-perishable" applies when a long shelf life is possible under environmentally controlled conditions; one example is Meals-Ready-to-Eat (MREs).

Most shelf life labels or listed expiration dates are used as guidelines based on normal handling of products. Use prior to the expiration date does not necessarily guarantee the safety of a food or drug, and a product is not always dangerous or ineffective after the expiration date.

The DoD Shelf-Life Program operates under the DoD Regulation 4140.1-R, DoD Materiel Management Regulation. There are items in the Department of Defense (DoD) and the Federal Supply System that require special handling due to certain deteriorative characteristics. These items are to be properly maintained to ensure that the customer is provided fresh, useable materiel. The purpose of this Manual is to establish a shelf-life program and process, with special emphasis on those items having these known deterioration characteristics, to mitigate the risk of shelf-life expiration and lapses of shelf-life items/materiel beyond their inspect/test dates.

Class I perishable subsistence, Class III bulk petroleum, Class V ammunition, and Class VIII-B blood, are excluded from this Manual and shall continue to be managed in accordance with existing regulations. Commodities excluded from this Manual may be represented by their respective DoD Component to the DoD Shelf-Life Board.

International Air Transport Association has published a guidebook of best practices for distribution of perishable goods based on the experience of a number of major airlines and the scientific data supplied by research institutions. Found at http://www.iata.org/whatwedo/cargo/Pages/perishables.aspx.

4.5.6 Total Asset Visibility

Total asset visibility entails more than just automated information technology. The overall goal is to have the capability to provide users with timely and accurate information on the location, movement, status, and identity of units, personnel, equipment, materiel, and supplies. It also includes the capability to act upon that information to improve overall performance of Department of Defense's logistic practices. The overall goal is to have actionable information available to the Product Support Manager at all times about the location, quantity and state of their material assets in order to optimize inventory posture and minimize unnecessary procurement of assets.

4.5.6.1 Serialized Item Management

DoDI 4151.19, Dec 26, 2009 establishes a serialized item management program where the Military Departments and Defense Agencies:

- Identify populations of select items (parts, components, and end items);
- Mark all items in each population with a unique item identifier (UII);
- Generate, collect, and analyze maintenance, logistics, and usage data about each specific item.

4.5.6.2 Item Unique Identification

The Defense Procurement and Acquisition Policy group is the proponent for DoD unique identification policy, processes and tools. IUID requires that qualifying DoD items, as specified in Defense Federal Acquisition Regulation Supplement (DFARS) 211.274-2, are marked with a two-dimensional data matrix that is encoded with a Unique Item Identifier (UII). The UII is an unambiguous identification assigned for the life of the item that is globally unique and

permanent. It allows visibility of individual items throughout their life cycles and across information systems, which allows DoD to consistently locate, control, and value its assets to improve both DoD data and asset management. UIIs are registered in the DoD IUID Registry, along with pedigree data associated with the item. See DoD Instruction 8320.04, Item Unique Identification (IUID) Standards for Tangible Personal Property,

The PM/PSM must ensure mandatory IUID requirements are met for all qualifying property items delivered to the Government under contract, in inventory, in-use, or legacy items, if one or more of the following criteria apply:

- All items for which the Government's unit acquisition cost is $5,000 or more;
- Items for which the Government's unit acquisition cost is less than $5,000, when identified by the requiring activity as DoD serially managed, mission essential or controlled inventory;
- When the Government's unit acquisition cost is less than $5,000 and the requiring activity determines that permanent identification is required;
- Regardless of value, (a) any DoD serially managed subassembly, component, or part embedded within an item and, (b) the parent item that contains the embedded subassembly, component or part.

The Program Manager/PSM is responsible for implementation of IUID and documents the items to be marked in the IUID Implementation Plan. This Plan is required at Milestone A (summarized in Systems Engineering Plan (SEP)) and will be updated at Milestones B and C (annex to the SEP). The IUID Implementation Plan lists items to be marked, the priority and method of marking, and funding necessary to accomplish marking. Additional information on IUID Implementation Plans can be found at http://www.acq.osd.mil/dpap/pdi/uid/guides.html, PSMs should be familiar with the basic requirements as found on the website at http://www.acq.osd.mil/dpap/pdi/uid/index.html.

4.5.6.3 Bar Coding

Bar coding is a key tool for the accomplishment of Configuration Management. A barcode is an optical machine-readable representation of data, which shows data about the object to which it attaches. Originally, barcodes represented data by varying the widths and spacing of parallel lines, and may be referred to as linear or 1 dimensional (1D). Later they evolved into rectangles, dots, hexagons and other geometric patterns in 2 dimensions (2D). Although 2D systems use a variety of symbols, they are generally referred to as barcodes as well.

4.5.6.4 Radio Frequency Identification (RFID)

RFID technology addresses key DoD challenges of lacking asset visibility and transportation process inefficiency between nodes in the DoD supply chain. Alone and when combined with other Automatic Identification Technology (AIT) capabilities, RFID is a key technology enabler for the DoD logistics business transformation by facilitating accurate, hands-free data capture within an integrated end-to-end supply chain enterprise. RFID tags are generally grouped into two categories: passive and active.

Passive tag: An RFID tag without its own power source and transmitter. When radio waves from the reader reach the chip's antenna, the energy is converted by the antenna into electricity that can power up the microchip in the tag. The tag is able to send back information stored on the chip. Today, simple passive tags cost from U.S. 20 cents to several dollars, depending on the amount of memory on the tag, packaging and other features.

Active tag: An RFID tag that has a transmitter to send back information, rather than reflecting back a signal from the reader, as a passive tag does. Most active tags use a battery to transmit a signal to a reader. However, some tags can gather energy from other sources. Active tags can be read from 300 feet (100 meters) or more, but they're expensive (typically more than US$20 each). They're used for tracking expensive items over long ranges. For instance, the U.S. Military uses active tags to track containers of supplies arriving in ports.

The proponent organization is the Office of the Undersecretary of Defense for Supply Chain Integration, website at http://www.acq.osd.mil/log/rfid/index.htm.

4.5.7 Disposal / Returns

Per DoDI 4140.1-R, the DoD Components shall establish criteria and implementing procedures and systems for managing and authorizing materiel returns to the wholesale supply system based primarily on the contribution of such returns to improvement of inventory performance. The DoD Components shall utilize the in-transit asset visibility capabilities, whenever possible as the basis for identification and selection of materiel to be returned from organizational echelons below the wholesale system to wholesale locations.

U.S. Government activities returning materiel are cautioned that the returning activity may be held responsible for costs incurred by the receiving activity when discrepancies are reported and validated. Recoupment action by the IMM against the initiator may include all cost reimbursable actions performed by the receiving activity such as repackaging, marking, and/or disposal. The IMM shall pay the packing, crating, handling, and transportation costs associated with all directed returns. The retail owner of materiel should consider retaining, disposing, or consolidating assets to limit returns where the shipping costs exceed the value of the assets. The wholesale manager shall also pay storage costs for assets identified by the manager for temporary retention. The IMM may set dollar thresholds to avoid uneconomical reporting and return of assets above retail retention limits. For assets below the threshold, the owning activity should consider retaining, disposing, or consolidating those assets where the reporting costs exceed the value of the assets.

4.6 Selected DoD and DoD Component-Unique Supply Systems and Tools

Note that the below list is not inclusive of all tools used by the DoD for supply support but represents many of the commonly used tools which are readily available through DoD organizational websites. PSMs and Life Cycle Logisticians should check with their respective Components to determine the optimal tool set to use for their respective programs.

4.6.1 US AMC Logistics Support Activity (LOGSA)

The U.S. Army Materiel Command (AMC) Logistics Support Activity (LOGSA) homepage is found at https://www.logsa.army.mil/index.cfm?fuseaction=home.startSite . The supply systems

and tools are maintained by the Logistics Engineering Center. The Logistics & Engineering Center (LEC) consists of the Acquisitions Logistics Division, the Logistics Engineering Division, the Packaging, Storage, and Containerization Center, and the Technical Publications Division. A list of all LOGSA tools is found at https://www.logsa.army.mil/lec/products.cfm.

4.6.1.1 Systems Planning and Requirements Software (SYSPARS)

SYSPARS has been available since the early 1990s to assist DoD personnel with the complicated task of logistics planning and document generation. The latest version, called SYSPARS 2010, includes an updated **Transportability Report** that conforms to the format published in TEA PAM 70-1 Transportability for Better Deployability, an updated **Test and Evaluation Master Plan (TEMP)** that adheres to the newest template published in Chapter 9 of the Defense Acquisition Guidebook (DAG), an updated **Diminishing Manufacturing Sources and Material Shortages (DMSMS) Management Plan** that follows guidance published in the most recent DoD DMSMS Guidebook, and an updated **IUID Implementation Plan** with more robust help files, an improved plan layout, and enhanced questions. SYSPARS still contains an established suite of document generating modules. The SYSPARS website is found at https://www.logsa.army.mil/lec/syspars/.

4.6.1.2 Cost Analysis Strategy Assessment (CASA)

The Cost Analysis Strategy Assessment (CASA) model is a Life Cycle Cost (LCC)/Total Ownership Cost (TOC) decision support tool. CASA can present the total cost of ownership depending on user selections: including cost of RDT&E, acquisition/production, operating/support, and disposal. CASA covers the entire life of the system, from its initial research costs to those associated with yearly maintenance, as well as spares, training costs, and other expenses. CASA 9.2.0 offers extensive capabilities to Program Managers and PEOs by extending their ability to mine data from mature data sets, providing multiple mechanisms for data interchange, improved reports, and a more robust graphical user interface. CASA 9.2.0 is capable of running on Windows XP, Vista, and Windows 7. The CASA website is found at https://www.logsa.army.mil/lec/casa/.

4.6.1.3 Computerized Optimization Model for Predicting and Analyzing Support Structures (COMPASS)

COMPASS is a PC-based computer model designed to assist in conducting a Level of Repair Analysis (LORA) study. A LORA is an analytical methodology used to determine the maintenance level where the removal and replacement, repair, or the discard of an item should be performed. COMPASS is the Army approved system level LORA model. Its website is at https://www.logsa.army.mil/lec/compass/ . Also, note that CECOM has two tools known as Time Phased (TP) COMPASS and the Logistics Cost Estimating Tool (LCET). TP COMPASS and LCET are products of CECOM that while separate from COMPASS, work on the COMPASS input and output files in order to make the outputs more useful to cost analysts conducting Total Ownership Cost (TOC) studies. COMPASS 3.0xx or later includes a file export routine that converts a COMPASS input file into a file that is compatible with TP COMPASS. Through an agreement with CECOM, the LCET and TP COMPASS tools are now available for download in the LOGSA downloads section.

4.6.1.4 Power Logistics – Java (PowerLOG-J)

PowerLOG-J is an acquisition logistics data management tool that satisfies requirements for the Logistics Management Information (LMI), and logistics data transfer requirements of Government Electronics and Information Technology Association (GEIA) Standard 0007. It is used to develop, evaluate, review, and integrate logistics data for materiel systems. PowerLOG-J can be used to produce over 50 logistics support summaries and reports such as the Repair Parts and Special Tools Lists (RPSTL), Maintenance Allocation Chart (MAC), Task Analysis, Provisioning Technical Documentation, Bill of Materials; and, Failure Modes Effects and Criticality Analysis.

PowerLOG-J is designed to assist government agencies and their contractors in developing and integrating their supportability analysis data bases. It will load MIL-STD-1388-2B, 2A LSA-036, 2B LSA-036, and MIL-STD-1552 (Provisioning Master Record) data formats. The primary purpose of this tool is Acquisition Logistics Data Management. PowerLOG is a logistics support analysis database application used by the materiel developer to create and deliver Integrated Logistics Support (ILS), Logistics Support Analysis (LSA), and Logistics Product Data. Government agencies use PowerLOG to review contractor submittals, and to send data to logistics systems like the Army's Logistics Modernization Program (LMP), Federal Logistics Information System (FLIS), Interactive Authoring Display System (IADS), Navy Interactive Cataloging and Provisioning System (ICAPS), Air Force D220 Provisioning system, and Marine Corps ICAPS (MICAPS). PowerLOG-J integrates logistics data associated with weapon system configuration, provisioning/spares, packaging, maintenance tasks, support equipment, manpower, facilities, transportability, cataloging, reliability, maintainability, failure modes effects and criticality analysis and the drawings associated with these areas. Allowing many functional processes to work off one database enables life cycle logistics data to be more easily managed and used. PowerLOG was developed in Java and runs on most JDBC compliant RDBMS including Mac, Windows, Linux, UNIX, and other operating systems and uses XML, HTML, and PDF. It can be run in a client/server setup or as a stand-alone application. PowerLOG works on Windows, OS X, LINUX, Solaris, or any other operating system with a 1.6 or higher Java Virtual Machine. PowerLOG's client/server mode has been tested against Oracle 10g2, PostgreSQL 8.3 and Firebird. Firebird and PostgreSQL are free for download and commercial use. The stand-alone version comes with the Derby embedded Java database from the Apache Foundation. The PowerLOG website is at https://www.logsa.army.mil/lec/powerlog/.

4.6.1.5 Post-Fielding Support Analysis (PFSA)

PFSA is a "Re-engineering Logistics" initiative that was developed to improve communication and logistics support between the PEO/PM and MSC communities for the Army combat systems. It provides a statistical method for tracking logistics metrics throughout the life cycle. PFSA uses data captured in field performance databases such as the Logistics Integrated Data-base, acquisition databases, and other user-owned data sources. This data is used to create an analysis capability for Army PEO/PM, MSC's and field organizations to better manage and solve logistics and readiness problems. The PFSA itself keeps track of data availability and level of fidelity (fleet, organizational, serial numbered item) of the data to ensure related metrics and drilldowns are consistent. The PFSA website is found at https://www.logsa.army.mil/lec/pfsa/.

4.6.1.6 Packaging, Storage and Containerization Center (PSCC)

The Packaging, Storage, and Containerization Center (PSCC) provides worldwide technical and specialized staff assistance in the fields of packaging, storage, hazardous materials, containerization, automatic identification technology, distribution facilities modernization, international and domestic standardization, and packaging application testing to AMC, other Army commands, DoD components, and other Federal agencies. Website is https://www.logsa.army.mil/pscc/PSCC_WebDev/PSCC/psccindex.htm.

4.6.2 Defense Logistics Agency (DLA) Logistics Information Service Tools

The DLA Logistics Information Service (DLIS) maintains many electronic tools to manage information. The tools are accessible through various links which arrange the tools by either business areas (Cataloging , Disposal, Distribution/Storage , Emergency Response , Engineering/Technical , Environmental , Federal Government Suppliers , Maintenance , Procurement/ Contracting , Quality Assurance , Safety and Health , Standardization , Supply , Transportation), by data type, by web-enabled capabilities, and other categories. There is also a help desk. The homepage is found at http://www.logisticsinformationservice.dla.mil/. Below is a list of many, but not all, of the tools which DLIS offers the community. Many of these tools also have on-line training available at no cost. The governing regulation DoD 4100.9-M Vol 3 is found at http://www.dtic.mil/whs/directives/corres/pdf/410039m/410039m_vol03.pdf.

4.6.2.1 Asset Visibility (AV)

The mission of the Asset Visibility (AV) To provide global visibility of assets in all classes of supply to the Warfighters of the Department of Defense, Military Services, Combatant Commands, and Joint Task Forces to optimize the effectiveness and efficiency of the DoD logistics pipeline. AV ensures a Total Asset Visibility (TAV) capability is provided to the Combatant Commanders (COCOMs), Joint Task Force (JTF) Commanders, the Services, and other DoD Organizations. The AV application is organized by asset categories, and each pre-defined query is categorized into one of six sections: In-Process, In-Storage, In-Transit, Total Asset Visibility, Reference Data, or Quick Queries. Website is found at http://www.logisticsinformationservice.dla.mil/av.asp.

4.6.2.2 Commercial and Government Entity (CAGE) Code Search

DLA Logistics Information Service is the only source for the assignment/maintenance of CAGE Codes. A CAGE code is a five (5) position unique identifier for entities doing or wishing to do business with the Federal Government. The format and character position of the code vary based on country. The code is used to support a variety of mechanized systems throughout the government. The code provides for a standardized method of identifying a given facility at a specific location. The code may be used for a Facility Clearance, a Pre-Award survey, automated Bidders Lists, pay processes, source of supply, etc. In some cases, prime contractors may require their sub-contractors to have a CAGE Code also. The DLA Logistics Information Service lookup service of the Commercial and Government Entity (CAGE) Code system is at http://www.logisticsinformationservice.dla.mil/cage_welcome.asp.

4.6.2.3 Catalog Tools Extracts

These tables contain the data required to maintain the characteristics portion of the Federal Catalog System. We have categorized each file as primarily oriented to Item Names; Federal Supply Class (FSC) / Federal Supply Group (FSG); Edit Guides; Master Requirements

Directory(MRD); MRD Traditional Version; Drawing Cross Reference files; Reference Drawing Group (RDG) files; FIIG Edit Guides; NATO H6 file; Item Identification Guides; or the ISO 22745 Compliant Data File .

The data in each Table file is updated monthly including RDGs. Table files are updated around the 15th of each month and RDGs are updated around the 1st. These files may be downloaded free of charge at any time. Each Zip File contains a data file and a record layout file. Website found at http://www.logisticsinformationservice.dla.mil/extracts/.

4.6.2.4 DoD E-Mall

The DoD E-Mall is a single entry point for DoD and Federal government customers to find and acquire off-the-shelf items, finished goods and services from the commercial marketplace and government sources. The DoD EMALL offers cross-store shopping to compare prices and other best value factors. The DoD EMALL suppliers are government approved sources and comply with Federal Acquisition Regulation requirements.
http://www.logisticsinformationservice.dla.mil/emall.asp.

4.6.2.5 Federal Logistics Data (FEDLOG)

It can be used by engineering, technical research, provisioning, procurement/contracting, supply, cataloging, maintenance, distribution, storage, transportation, quality assurance and disposal personnel to retrieve management, part/reference number, supplier, Commercial and Government Entity (CAGE), freight, Interchangeability and Substitutability (I&S) and characteristics information recorded against National Stock Numbers (NSNs). FED LOG also provides service unique data for additional search capabilities.
http://www.logisticsinformationservice.dla.mil/FedLog/default.asp.

4.6.2.6 Federal Item Identification Guides (FIIGS)

FIIGS are self-contained documents using a machine-oriented coding format to collect item logistics data. A complete listing and access to FIIGS is found at
http://www.logisticsinformationservice.dla.mil/FIIGs/default.asp.

4.6.2.7 Federal Item X-Reference (FIXR)

Federal Item X-Reference (FIXR) is the web application for the FLIS Portfolio Data Warehouse (FPDW). Source systems include the Federal Logistics Information System (FLIS), the Hazardous Material Information Resource System (HMIRS), and the Enterprise Business System (EBS) Bill of Materials (BOM) data. FLIS Historical data is available for the change date and Segment changed. FIXR allows users to perform a variety of searches to obtain logistics data. Website is at http://www.logisticsinformationservice.dla.mil/FIXR/Default.asp.

4.6.2.8 Hazardous Material Information Resource System (HMIRS)

The Hazardous Materials Information Resource System (HMIRS) is a Department of Defense (DoD) automated system developed and maintained by the Defense Logistics Agency. HMIRS is the authoritative source for Material Safety Data Sheets (MSDS) for the United States Government military services and civil agencies, per DoDI 6050.05. It also contains government unique value-added information input by the service/agency focal points. This value-added data includes HAZCOM warning labels and transportation information. The system assists Federal

Government personnel who handle, store, transport, use, or dispose of hazardous materials. Website is at http://www.logisticsinformationservice.dla.mil/hmirs/default.asp.

4.6.2.9 Interactive Government/ Industry Data Mart (GIDM)

GIDM is a portal for government/industry data exchange. Through these pages, you have access to:

- CCR - The Central Contractor Registration (CCR) System a repository of all companies and agencies registered to do business with all agencies of the Federal Government.
- JCP - The U.S./Canada Joint Certification Program System assists in the identification of companies that have been assigned a Certification Number under the Joint Certification Program. The data reflected in this application is for informational purposes only. Points of contact are provided to facilitate updates and (or) corrections to the system.
- BINCS - The Business Identification Number Cross-reference System Identifies foreign and domestic government/commercial contractors, manufacturers and suppliers. The system contains information on half a million businesses worldwide. Information in the system is cross-referenced to permit inquiry by CAGE, DUNS, company name, phone number, country, SIC code and ZIP code.
- iGIRDER - The Interactive Government Industry Reference Data Edit and Review program works with Government manufacturers and suppliers to maintain the correct relationship between the CAGE code, manufacturer part number and National Stock Number. Companies receive a Federal Catalog extract of their products and identify obsolete, incomplete, or inaccurate information. The program serves as a direct link between government and private industry to insure the flow of items needed to support DoD logistic requirement worldwide. Registration for User ID and Password is required or send a request for an extract by CAGE code to: iGIRDER@dla.mil
- Federal Business Opportunities - FedBizOpps.gov is the single government point-of-entry (GPE) for Federal government procurement opportunities over $25,000. Government buyers are able to publicize their business opportunities by posting information directly to FedBizOpps via the Internet. Through one portal - FedBizOpps (FBO) - commercial vendors seeking Federal markets for their products and services can search, monitor and retrieve opportunities solicited by the entire Federal contracting community.
- QDB - The Quality Data Base System is a purity tool used to maintain data integrity of the Federal Logistics Information System (FLIS) data. QDB tracks changes to FLIS data and assists in identifying discrepancies. Data Integrity Challenge Program provides a way to challenge any action or information in FLIS and QDB.
- Webflis - Federal Logistics Information System Web Inquiry Public Query searches are: NSN/NIIN, CAGE Code, Part Number, CAGE Code/Part Number combination. Only the NIIN, Part Number and CAGE Code/Part Number combination inquiries provide the related NSN data.

4.6.2.10 Joint Certification Program (JCP)

The United States and Canada share a unique, long-standing military and economic relationship. The two countries are partners in the joint defense of North America and have established a bilateral common structure (NORAD) for mutual defense. Canadian industry is a part of the North American Defense Industrial Base. The United States and Canada consult and cooperate

on the development of common industrial security procedures and technology controls. The two governments have entered into numerous bilateral agreements that codify and support this relationship.

In 1985, the United States and Canada signed a Memorandum of Understanding (MOU) that established the U.S.-Canada Joint Certification Program (JCP). As stated in the MOU's "Joint Terms of Reference for the United States-Canada Joint Certification Program," the program was established "to certify contractors of each country for access, on an equally favorable basis, to unclassified technical data disclosing critical technology" controlled in the U.S. by Department of Defense Directive 5230.25 and, in Canada, by the Technical Data Control Regulations. Under each nation's laws, the U.S. Department of Defense (DoD) and Canada's Department of National Defence (DND) may withhold such technical data from public disclosure. Website is found at http://www.logisticsinformationservice.dla.mil/jcp/.

4.6.2.11 DLA Map Catalog

The Map Catalog function is to provide quality and innovative geospatial product logistics data, DLA Map Catalog support, and technical assistance to all military services and federal government agencies. The DLA Map Catalog allows customers to order Aeronautical, Digital, Hydrographical, and Topographical products needed for mission planning and navigation. Website is found at https://www.logisticsinformationservice.dla.mil/mapcatalog/default.asp.

4.6.2.12 Military Engineering Data Asset Locator System (MEDALS)

The MEDALS program is an interactive on-line system that is accessed globally and indicates quickly and easily where engineering drawings or documents reside. It provides the user with the technical drawing information and further provides the capability to order it if needed. The MEDALS program is a research tool, or first discovery mechanism, for those who do not know where engineering documents might reside, or where all revision levels are located. It also contains information on which repositories are holding specific engineering documents. Website is at https://www.logisticsinformationservice.dla.mil/medals/.

4.6.2.13 NATO Codification Control (NCC)

The NATO Codification Control (NCC) system is the tracking system for international codification/ maintenance actions. The status and latest action against a request for codification/ maintenance can be retrieved using certain information in the request. This information may be the Document Control Number (DCN), Part Number or NSN. Website found at **http://www.logisticsinformationservice.dla.mil/ncc/default.asp**.

4.6.2.14 Universal Data Repository (UDR) Medical Web

The UDR Medical Catalog on CD-ROM is a Defense Medical Logistics Standard System (DMLSS) sponsored catalog product that consolidates medical and pharmaceutical information from a variety of federal government sources as well as commercial/industry sources. It provides the user (mostly U.S. Military Medical Treatment Facilities - MTFs) a single entry point to current product data so personnel in clinical and materiel management departments can compare products and sources (price/characteristics, etc.) in making "informed" business and budget decisions. Website is https://www.logisticsinformationservice.dla.mil/udr/Default.aspx?Form=cd/Default.ascx.

4.6.2.15 Web Federal Logistics Information System (WEBFLIS)

WebFLIS provides essential information about supply items including the National Stock Number, the item name, manufacturers and suppliers (including part numbers), through a web interface connected to FLIS data. This information will be primarily used by DLA, military services, and United States Government sponsored contractors doing business with the U.S. Government. Website found at http://www.logisticsinformationservice.dla.mil/WebFlis/default.asp.

4.6.3 U.S. Army Logistics Modernization Program (LMP)

The Logistics Modernization Program (LMP) is the Army's core initiative to totally replace the two largest, most important warfighting support National-level logistics systems; the inventory management Commodity Command Standard System (CCSS), and the depot and arsenal operations Standard Depot System (SDS). LMP is a backbone for achieving Army Log Domain Strategic IT Plan and the Single Army Logistics Enterprise (SALE) vision. LMP leverages an international industry standard application, SAP, which provides integrated logistics management capability to manage supply, demand, asset availability, distribution, and maintain data, financial control and reporting. LMP supports the Core Business Mission strategic capabilities specifically in the areas of weapon system life cycle management, materiel supply and service management while supporting financial management. LMP has a phased implementation. Website is at https://www.po.lmp.army.mil/_site/index.html.

4.6.4 U.S. Navy Readiness Based Sparing (RBS) Policy

Reference OPVAVINST 4442.5A, N4, 15 Aug 2011, “Readiness Based Sparing”, extracts of text follows: “RBS is to be utilized for all new acquisition programs and equipment modification programs in acquisition categories (ACATs) I, II, or III, with the exception of nuclear and fleet ballistic missile submarine (SSBN) programs. It should be applied, as appropriate, to existing weapon systems and other new systems (i.e., ACAT IV) when it provides an optimal method for attaining the required readiness objective and or cost constraint. RBS is to be applied to both aviation and maritime allowance package development, aviation consolidated allowance lists (AVCALs) , shore-based consolidated allowance lists (SHORCALs) , all Marine aviation logistics support packages (MALSPs) , and coordinated shipboard allowance lists (COSALs) RBS will generally apply to commercial best practices like PBL or time definite delivery (i.e., use of premium transportation) . RBS will also be applied, as appropriate, in the procurement and support of commercial and non-developmental item spares, subsystems, or systems, and in support of alternative approaches such as pre-positioned spares. RBS is critical in the life cycle of any system requiring supply support and plays an important role in the provisioning for initial support, as well as an equally important and ongoing role in subsequent replenishment support. Readiness and performance metrics, such as Ao and customer wait time (CWT), help indicate how well the system's integrated logistics support is fulfilling its purpose during the production and deployment phase of a system's life cycle. A robust RBS effort over the system's life cycle is vital to supply support effectiveness and its effect on Ao and CWT.”

4.6.5 U.S. Navy Interactive Computer Aided Provisioning System (ICAPS)

The Navy requires the Provisioning Technical Data (PTD) to be delivered in a format accepted by the Interactive Computer Aided Provisioning System (ICAPS). The ICAPS software is

designed to support and accept data in various provisioning LMI formats. LMI summaries contain information that the Government needs in order to assess design status, conduct logistics planning and analysis, influence program decisions, and verify that contractor performance meets system supportability requirements. The LMI summaries can be delivered as stand-alone reports or as an integral part of other systems engineering documentation. The Provisioning Performance Schedule is a non-technical schedule of events occurring during the provisioning process. It is the only provisioning requirement that varies in NAVSEA contracts. The Provisioning Parts Data (PPD) identifies all support items that can be disassembled, reassembled, and, when combined, that constitute the end item. The PPD contains data required to catalogue an item in the Navy/DoD Supply System, build Allowance Part Lists (APL), and provide for inventory management. Reference found at SUPSHIP Operations Manual (SOM) (NAVSEA S0300-B2-MAN-010), Chpt 14, Integrated Logistics Support, http://www.navsea.navy.mil/supship/SOM/SOM%20Home.aspx

Supply Support in the Life Cycle

A. Purpose

The primary objective of DoD Supply Support is to provide effective and efficient end-to-end customer service to meet operational requirements for all classes of supply. To supply materiel to DoD units throughout the world, the DoD Components and Agencies maintain a supply chain consisting of weapon system support contractors, retail supply activities, distribution depots, transportation channels including contracted carriers, wholesale integrated materiel managers (IMMs), weapon system product support integrators, commercial distributors and suppliers including manufacturers, commercial and organic maintenance facilities, and other logistics activities (e.g., engineering support activities, testing facilities, reutilization and marketing offices).

Supply Support is one of the twelve Integrated Product Support Elements.

The activities occurring within the scope of this area should be integrated with other product support element areas in keeping with KPP and KSA optimization goals and constraints.

Historically, Supply Support activities were the primary responsibility of the manufacturing group, with Supply Support during sustainment being planned and implemented often under separate contract line items and separate management. The current view of integrated product support requires that the Life Cycle Sustainment Plan include and implement an integrated strategy, inclusive of all the Product Support Elements and Program functional areas, that is reviewed and reported on throughout the acquisition life cycle.

The current view represents supply support activities being heavily influenced prior to system deployment by the design interface activities which focus on ensuring that the program KPP's are achieved through a design to optimize availability and reliability at reduced life cycle cost.

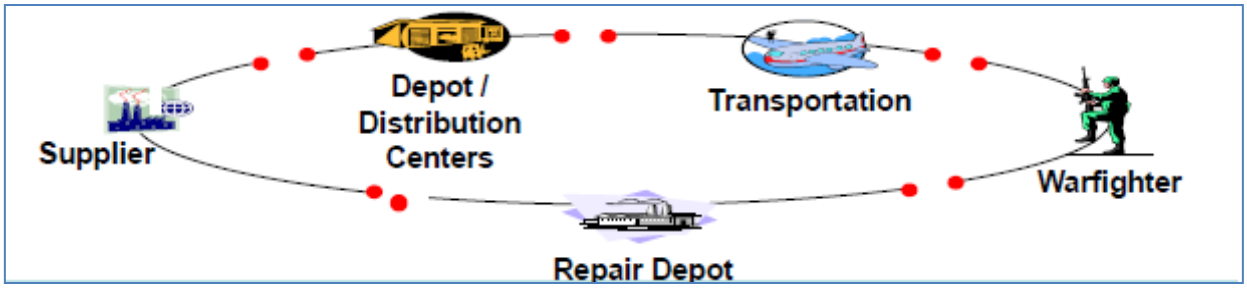
a. Why Supply Support is Important

Support extends across the DoD logistics enterprise. The DoD logistics enterprise encompasses global logistics capabilities provided by Combatant Commands, Military Services, Defense Agencies, designated process owners, the national industrial base, non-defense U.S. Government agencies, multinational governments and military forces, non-governmental organizations, and both domestic and international commercial partners.

Understanding, clarifying, and institutionalizing the diverse roles, relationships, and responsibilities of all these enterprise partners are essential to planning, executing, controlling, and assessing logistics enterprise operations. Enterprise partners, stakeholders, and process owners must collaborate to optimize use of resources and capabilities from all available sources and to integrate and synchronize logistics processes to support the Warfighter.

A Supply Chain Management (SCM) strategy addressing all stakeholders is critical to the success of any Performance Based Life Cycle Product Support (PBL) effort. Materiel support is a critical link in weapons systems supportability. All the skilled labor, advanced technology, and performance mean little without the 'right part, in the right place, at the right time.' The supply chain is also a primary venue for utilizing industry flexibility, capability, and proprietary spares support.

The interfaces or "touch points" between and among all the stakeholder organizations with the program's supply chain must be identified and understood in order to determine how best to manage each part of the supply chain and what the impacts of decisions might be.



Interface	Impact
Inventory and transportation planning	▪ Inventory positioning decisions ▪ Higher transportation costs ▪ Longer customer wait times
DoD Logistics IT systems	▪ Lack of information exchange ▪ Little visibility into assets
Repair capacity and new inventory procurement	▪ Higher materiel costs – buying new instead of fixing old
Maintenance planning and technical data/RBOMs	▪ Depot inefficiencies – consumables are not available when needed
Collaboration between supplier and customer in predicting demand	▪ Demand plan accuracy not uniformly captured ▪ Lack of necessary parts ▪ Longer customer wait times
Customer wait time information not always captured at each node	▪ Internal processes contributing to CWT – without nodal data it is difficult to drive focused improvement ▪ Higher inventory requirements – high CWT leads to higher safety stock requirements
DoD supply chain not fully leveraged	▪ Based on historical performance, DoD losing sales opportunities needed to take full advantage of economies of scale

Figure 4.1.2.F1. Functional Interfaces Impact and are Impacted by Supply Chain Performance

b. Summary of Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

Note that the Logistics Analysis (LA), also known as an independent logistics analysis, is part of each Milestone Decision Package and is a requirement for type classification.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Supply Support IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, includes in the left column a listing of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	**Supply Support Activities**
User Need / Technology Opportunities & Resources	Performance-based life-cycle product support implementation begins in the JCIDS process with the exploration of capabilities. Every system is acquired to provide a particular set of capabilities in a specific concept of operations and sustained to an optimal level of readiness. Understanding user needs in terms of performance is an essential initial step in developing a meaningful product support strategy because changes to the CONOPS or the sustainment approach may impact the effectiveness, suitability, or cost of the system. The Product Support Manager must be able to understand and forecast supply support requirements to achieve actual product support sustainment activities and outcomes. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Key Products:

	• Requirements • Metrics • Supply support mission need determination
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. The supply support strategy is developed. Market analysis is performed to assess the availability of qualified suppliers to meet specific sustainment requirements. While not officially designated until Milestone B, the outcomes of a PSM perspective should be introduced at this point to include appropriate trade-off studies to validate and forecast product support sustainment outcomes for supply support as a result of design of the system and its intended sustainment footprint. Supply Support should emphasize standardization of parts early in the process to increase interoperability, reduce supply footprint, promote reutilization of existing assets, and reduce Total Ownership Costs. Refer to the Defense Acquisition Guidebook (DAG), Chapters 3.3 and 5 for more information. Note that The requirement for standardization is also stated in TITLE 10, Subtitle A, PART IV, Chapter 145, Section 2451, Defense Supply Management. Specific analysis focuses on the supply chain management approach for implementing the product support strategy and achieving the sustainment metrics. Risks should be identified and a mitigation strategy outlined. The specific enabling support technologies should be identified along with the corresponding plan to technically mature the supply support element. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of how Milestone Decision Review required documents are impacted by each Product Support Element Key Products: • Supply Chain Management strategy • Results of market research of the supplier base
Technology Development	The primary document incorporating supply support plans and outcomes is the LCSP. After Milestone A the LCSP evolves from a strategic outline to a management plan describing the sustainment efforts in the system design and acquisition processes to achieve the required performance and sustainment outcomes necessary to ensure required Warfighter capabilities. A detailed outline for the LCSP can be found in the Defense Acquisition Guidebook, Chapter 5.1.2.2. and at the DAU community of practice at https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3303/USA005157-11_SignedLCSPMemo_14Sep2011.pdf. At Milestone B, the LCSP evolves into a detailed execution plan for how the product support package is to be designed, acquired, sustained, and how sustainment will be applied, measured, managed, assessed, modified, and reported from system fielding through disposal. The LCSP is submitted as a stand-alone document prior to Milestone B. The Product Support Manager is required to also provide supply support

	information for many other acquisition documents as listed on the DAU site, https://dag.dau.mil/Pages/Default.aspx. Key Products: • Supply Chain Management plan • Provisioning Technical Documentation to include SMR codes • Long lead items identified and provisioning started
Engineering & Manufacturing Development	During this phase, The Product Support Manager goal is to influence design for supportability. Supportability requirements designed earlier in the acquisition process should be validated and those that were not defined are assessed for impact. Any final engineering changes as a result of supply support analysis must be implemented no later than this phase to achieve maximum benefit. By Milestone C, the LCSP describes the content and implementation status of the product support package (including any sustainment related contracts, e.g., Interim Contractor Support, Contractor Logistics Support) to achieve the Sustainment KPP/KSAs. In addition to sustaining the system performance capability threshold criteria and meeting any evolving user readiness needs, the LCSP details how the program will manage O&S costs and reduce the logistics footprint. After the Full Rate Production Decision Review update, the LCSP describes the plans for sustaining affordable materiel availability as well as accommodating modifications, upgrades, and re-procurement. It should be updated for any Post-IOC Sustainment Reviews and shall be updated, at a minimum every 5 years, or when subsequent increments are approved and funded to reflect how the product support strategy will evolve to support multiple configurations. Significant changes may be required to the product support package to achieve the objective sustainment metrics including major support provider changes. As the program matures, the LCSP is updated to reflect increasing levels of detail as they become available. The detail and focus will vary depending on the life-cycle phase but in all cases the supply support information should be in sufficient depth to ensure the acquisition, design, sustainment, and user communities have an early common understanding of the supply support requirements, approach, and associated risks. Key Products: • Initial Spares List • Determine Provisioning Method and Statement of Work • Develop Interim Allowance Lists • Establish Material Support Date • Supply Chain Management Plan • Initiate Interim Support
Production & Deployment	Supply support activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, taking part in planning activities that may be on-going already for product improvement, and developing long

	term plans for supply chain management improvements for both the system and its support infrastructure as part of the LCSP. Fielding occurs during this phase and proof of early planning is now being validated as the system deploys to the operational site. Supply chain management strategies for manufacturing and spare parts are often integrated to maximize efficiencies. Key Products: • Procure Spares • Spares Delivery Package • Support for Initial Site Stand-ups • DLA / Inventory Control Point Support Begins • Depot Planning for Depot Level Repair
Operations & Support	Supply support continues throughout the system's operations and support phase. The Product Support Manager 's responsibility is to continue reviewing system performance while looking for opportunities to improve supply support of both the system itself and the support infrastructure to optimize cost versus availability. Key Products: • Full implementation of supply chain management strategies • Updates to the LCSP to improve the supply chain • Post Production Planning • System End of Life Planning • Retirement and Disposal

Table 4.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DI-ALSS-81544, "Provisioning Data Cover Page"
DI-ALSS-81545, "Interactive Computer Aided Provisioning System (ICAPS) Data Exchange
DI-ALSS-81557, "Supplemental Data for Provisioning (SDFP)
DI-ALSS-81529, "Logistics Management Information (LMI) Data Product"
DI-ALSS-81530, "Logistics Management Information (LMI) Summaries"
DI-SESS-81639, "Warranty Performance Report"
DI-SESS-81712, "Provisioning Parts List Index"
DI-SESS-81713, "Provisioning Performance Schedule (PPS)"
DI-SESS-81714, "Provisioning Screening Data"
DI-SESS-81715, "Provisioning Parts List (PPLs)
DI-SESS-81716, "Supplementary Provisioning Technical Documentation"
MIL-PRF-49506, "Logistics Management Information (LMI)"

Note that MIL-PRF-49506 has been cancelled as of 31 Mar 2011. (http://assistdocs.com/search/document_details.cfm?ident_number=123615&StartRow=1&PaginatorPageNumber=1&doc%5Fid=MIL%2DPRF%2D49506&search%5Fmethod=BASIC) It has been superseded by GEIA-STD-0007, Logistics Product Data. Also, there are two new DIDs associated with the GEIA-STD-0007, which are:

DI-SESS-81758, Logistics Product Data
DI-SESS-81759, Logistics Product Data Summaries

These two new DIDs facilitate obtaining the same products and summaries that could previously

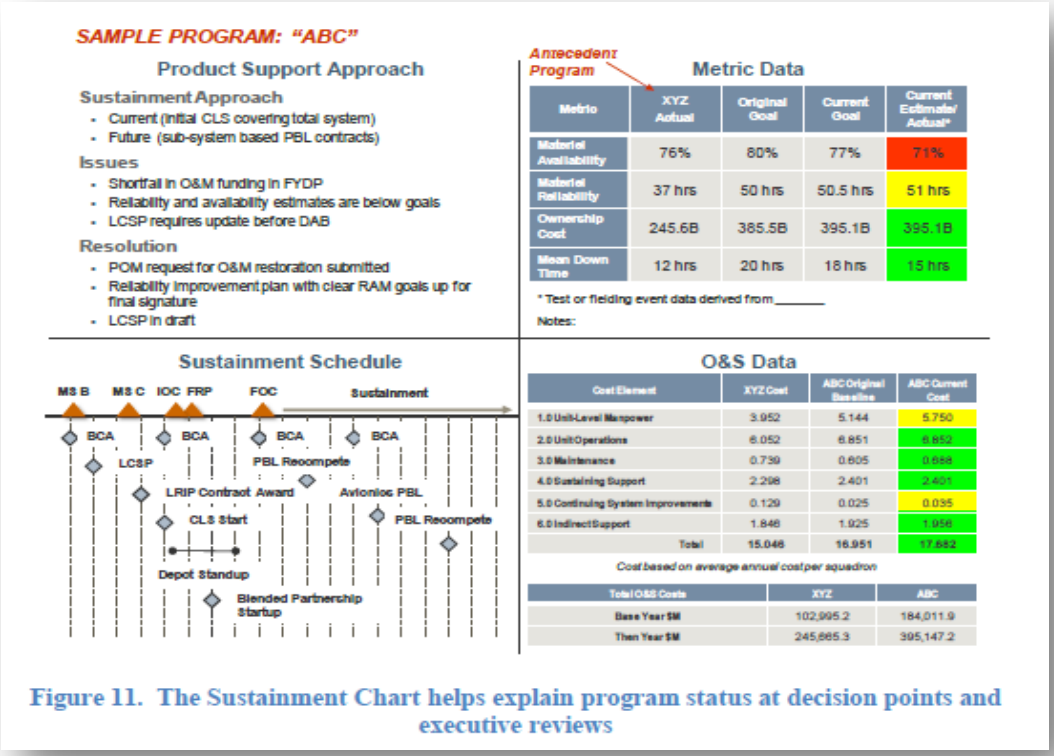


Figure 11. The Sustainment Chart helps explain program status at decision points and executive reviews

be requested using the LMI related DIDs, DI-ALSS-81529/81530.

Figure 4.4.2.F1. DoD Product Support Sustainment Chart for Reporting Status

An important new scorecard that reflects supply chain performance is the "Sustainment Chart" used for program reviews. On April 5, 2010, the USD(AT&L) issued the memorandum, "Strengthened Sustainment Governance for Acquisition Program Reviews'" instructing the DoD to improve program life cycle management using a more standardized approach. This memorandum called for the incorporation of sustainment factors during early acquisition phases and is promoting visibility of these factors through the establishment and use of the "Sustainment Chart" during Weapon System program reviews. The Sustainment chart is a new tool for program reviews that standardizes the format and gives specific visibility of key sustainment factors to leadership. These sustainment factors are material availability, material reliability,

ownership cost and mean down time. To organize the information, the Sustainment Chart is divided into four quadrants: strategic approach, metric status, schedule of sustainment related milestones and O&S cost data element results. The intention is that this chart will be updated for each program review with the most current information.

C. OSD Proponency, Policy, Regulations and U.S. Statutes

a. Proponency

The Office of the Assistant Deputy Undersecretary of Defense for Supply Chain Integration (ADUSD(SCI)), http://www.acq.osd.mil/log/sci/about_us.htm, has primary responsibility within the Logistics and Material Readiness secretariat for the following:

- Leads the development of modern supply chain policies in the DoD, including the integration of acquisition logistics and e-commerce capabilities;
- Develops and maintains DoD policy regarding Materiel Management and Supply Distribution, including supply depot operations, storage and issue processing;
- Ensures improved visibility, accountability and control of all critical assets across supply chains;
- Ensures proper disposition of Foreign Excess Personal Property (FEPP) upon redeployment and drawdown;
- Improves forecasting and demand planning so as to ensure synchronization with maintenance and transportation capacity planning;
- Adopts enterprise-wide metrics that promote common goals and interoperability across the supply chain;
- Minimizes costs by implementing a streamlined positioning process and eliminating unneeded inventory while fully accounting for inventory and OM&S in-storage, in-transit and in-use;
- Ensures end-to-end integration of support within commodities across the supply chain strategy;
- Implements a process to ensure skill sets to meet mission needs are maintained by logisticians across the DoD and Supply Workforce Category;
- Institutionalizes an effective, efficient end-to-end Joint Supply Chain Architecture and ensures improvement efforts across the enterprise are integrated;
- Develops a process for analysis of resources to capabilities within the logistics portfolio to identify logistics issues to the DAWG;
- Develops and maintains DoD policy for Inventory Control, including item accountability, physical inventories, reconciliations and security;
- Develops and maintains DoD policy regarding Petroleum Resource Management;
- Monitors Base Realignment and Closure (BRAC) supply, storage and distribution implementation;
- Acts as the DoD focal point for Defense Logistics Agency (DLA);
- Monitors implementation of the DoD Logistics Strategic Plan including Guidance to Develop the Force (GDF) and Quadrennial Defense Review (QDR);
- Acts as the DoD Logistics focal point for international cooperation.

DoD Awards Programs. The Department of Defense (DoD) Award for Supply Chain Operational Excellence honors organizations that have made exceptional progress through innovative development or adoption of best supply chain practices. It also provides a showcase for innovative management and technology tools being used to improve supply chain efficiency and effectiveness to enhance support to the Warfighter. http://www.acq.osd.mil/log/sci/afe.html

The DoD Packaging Awards program is found at http://www.acq.osd.mil/log/sci/DoD_Packaging_Awards.htm

b. Policy and Regulation

Note: please see the References at the end of this section for a more complete list of relevant materials.

DoDD 4140.1, "Supply Chain Materiel Management Policy", dtd April 22, 2004 contains an exhaustive list of DoD and Service policy and regulations regarding supply chain management to include management of specific classes of supply.

Defense Acquisition Guidebook (DAG), Chapter Five; Life Cycle Logistics in Acquisition. There are extensive references to Supply Chain management included in this Chapter. DoD Components and Agencies are required to follow the below procedures:

- Structure materiel management to provide responsive, consistent, and reliable support to the war fighter during peacetime and war. This should be done within the framework of total life cycle systems management;
- Size secondary item inventories to minimize the Department's investment while providing the inventory needed to support peacetime and war requirements. For newly acquired acquisition programs, this shall be accomplished through performance agreements with the acquisition program manager detailing the selection of a product support integrator. The product support integrator shall be responsible for establishing the initial range of product support functions, including materiel management support;
- Consider all costs associated with materiel management, including acquisition, transportation, storage, and maintenance, in making best value logistics materiel and service provider decisions central to total life cycle systems management;
- Implement materiel management functions with commercial off-the-shelf (COTS) systems or DoD standard data systems, wherever possible, or where they are not available, with non-standard systems and/or standard manual data collection. This goal encompasses the implementation of continuous supply chain management capabilities, within an Integrated Knowledge Environment (IKE); to accomplish the end-to-end distribution of required materials and related services from point of acquisition to point of delivery to the using customer;

- Maintain materiel control and visibility of the secondary inventory down to and including retail inventories. This involves the incorporation of commercial and government best business practices to continuously improve DoD supply chain processes and instill user confidence in the materiel management system.

Note that in TITLE 10, Subtitle A, PART IV, Chapter 145, Section 2451, Defense Supply Management:

- Each item recurrently used, bought, stocked, or distributed by the DoD is to be cataloged;
- Items are to be standardize throughout the DoD by developing and using single specifications, eliminating overlapping and duplicate specifications, and reducing the number of sizes and kinds of items that are generally similar.

With contractors providing expanded supply chain support, the requirement for cataloging is often overlooked. Also, with the push for the latest technological advancements, the use of existing items already in the supply chain can often be overlooked.

D. Who Develops, Delivers and Manages Supply Support

a. DoD Component Responsibility

During a program's acquisition life cycle, the responsibilities for supply chain will start with the program manager/PSM and prime contractor, then transition during fielding and sustainment to the designated support servicing organizations.

To achieve the policy requirements as identified in DoD 4140.1-R, the DoD Components shall:

- Use performance based logistics (PBL) strategies and performance agreements between war fighters and program managers to structure supply chain processes and systems to provide flexible and timely materiel support response during crises and joint operations;
- Focus processes on satisfying operational customer requirements at the point of need;
- Link customers directly to the source of support whenever practical;
- Balance the use of all available logistics resources to accomplish timely and quality delivery of customer-determined materiel and service requirements at the lowest cost;
- Measure total supply chain performance based on timely and cost-effective delivery of products and services to operational customers;
- Make maximum, effective use of competitive, global commercial supply chain capabilities;
- Accomplish common requirements cooperatively whenever practical;
- Implement consistent structure, content, and presentation of logistics information, particularly when supporting common interfaces among the military services, Defense agencies, and international partners;
- As early as possible in the acquisition cycle of a new program, work with the acquisition program manager and product support integrator to address logistics requirements and related costs within the concept of total life cycle systems management;

- Include all logistics requirements in planning and program baselines and develop them initially without any internally or externally imposed financial constraints;
- Implement and use the concept of information stewardship (e.g., shared data);
- Provide for visibility of the quantity, condition and location of in-storage, in-process and in-transit assets as well as orders placed on organic and commercial sources of supply;
- Provide effective, up-to-date, training and supporting technology to logistics organizations and personnel.

b. The Defense Logistics Agency and its Centers

The DoD Defense Logistics Agency (DLA) reports to the ADUSD(SCI) and is responsible for sourcing and providing most of the repair parts and virtually all fuel and troop support consumable items used by our military forces worldwide. DLA procures Service-managed depot level reparables. In addition, DLA provides a broad array of supporting supply chain management services including storage and distribution, reutilization or disposal of surplus military assets, managing Defense strategic materials, document services and providing catalogs and other logistics information. DLA supports U.S. allies through Foreign Military Sales and is a vital player whenever our nation supports humanitarian relief efforts at home or abroad. DLA also provides human resources management and workforce development services to other DoD components.

DLA Headquarters provides a list of all HQ organization Web sites.

DLA Web Gateway is a web application that provides access to major DLA web sites. The DLA sites are sorted alphabetically, by organization, by category, or via a keyword search.

DLA Aviation is the lead center for aviation weapon systems and environmental logistics support and is the primary supply source for nearly 930,000 repair parts and operating items.

DLA Land and Maritime is the lead element for supplying and sustaining land and maritime weapon systems and helping the military services plan for future demand.

DLA Troop Support supplies and services U.S. Service members by providing them food, clothing, textiles, medicines, medical equipment, general and industrial supplies, and supports U.S. Humanitarian and disaster relief efforts.

DLA Distribution depots stores, issues, packs, preserves and provides worldwide transportation of supplies and parts.

DLA Energy purchases and manages DoD energy products.

DLA Disposition Services provides DoD with worldwide reuse, recycling and disposal solutions that focus on efficiency, cost avoidance and compliance.

DLA Strategic Materials is an international commodity broker of strategic and critical materials that sells and maintains strategic and critical materials to reduce the U.S. Dependence on foreign supply sources.

DLA Logistics Information Service is involved in the creation, management and dissemination of logistics information to military and government customers using the latest technology and functions as the single consolidated, centralized agency for all DoD cataloging.

DLA Document Services is the single manager for all DoD printing and duplicating, provides automated information products and services to DoD and designated federal activities.

DLA Transaction Services receives, edits, validates and routes logistics transactions.

DLA Logistics Management Standards Office facilitates continuous enterprise integration process improvements to logistics management and operations.

DLA Europe and Africa serves as a DLA world presence and focal point for DLA matters in Europe and Africa and for common support serving customers in the U.S. European Command and Africa Command.

DLA Pacific is a focal point within the Pacific, directly services DLA by providing customer assistance, liaison, services, war planning interfaces, and logistics support to the U.S. Pacific Command.

DLA Central serves as DLA's primary focal point for coordinating DLA support to forces in the U.S. Central Command area of responsibility.

E. When Is Supply Support Delivered and Managed in the Life Cycle

Supply support is not a collection of independent events but should be a continuous process starting as an important part of acquisition strategy development to include all stakeholders of the program, from the Warfighter back to the Prime contractor and all tiers of the supply base.

All stakeholders, in an Integrated Product Team (IPT) environment, should ensure the management of the supply chain reflects program and user requirements.

F. How Supply Support Is Developed, Established and Managed

a. Implementation Guidance.

The DoD Components shall use the basic framework of the Joint Supply Chain Architecture (JSCA) for developing, improving, and conducting materiel management activities. The figure below summarizes the concept of JSCA. More implementation guidance can be found in the Product Support Management Guidebook.

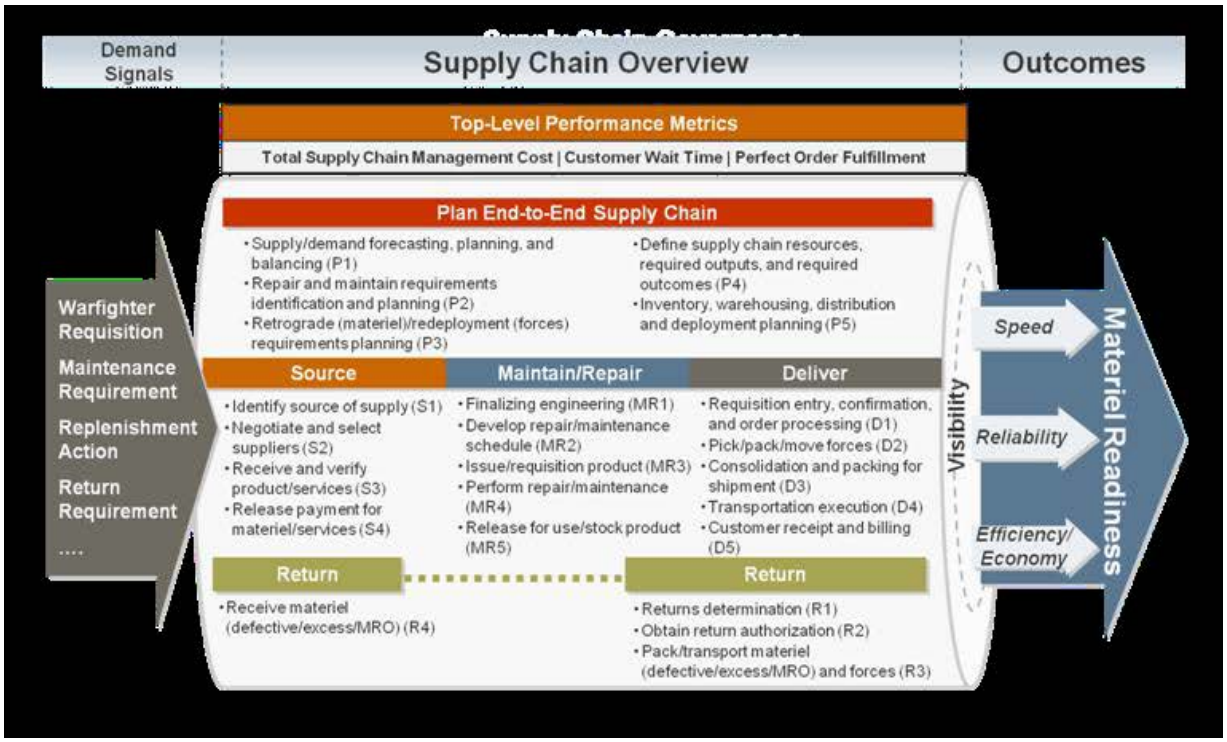


Figure 4.8.1.F1. Overview of the JSCA, the DoD Implementation of Supply Chain Best Practices.

b. Implementation Procedures.

Per DoD 4140.1-R, the DoD Components shall adopt and/or adapt best commercial business practices when such practices will contribute to increased supply chain performance and/or reduced total life cycle systems cost. Processes and technologies such as Enterprise Resource Planning (ERP), Automated Planning System (APS), Maintenance Requirements Planning (MRP) and balanced score card, represent business practices that are either referenced in, or have potential application to, the supply chain procedures presented in this regulation.

c. Usage of Supply Chain Metrics.

Per DoD 4140.1-R, to ensure efficient and effective supply chain management, the DoD Components shall use metrics to evaluate the performance and cost of their supply chain operations. Metrics shall provide quantifiable, measurable outputs or outcomes that address all

classes of supply and describe all supply chain processes or functions from acquisition through final disposition of end items and materiel.

The DoD Components should adopt metrics that:

- Support program performance agreements and the policy requirements in paragraph C1.1.1.2 in DoD 4140.1-R;
- Monitor the efficient use of DoD resources;
- Provide a means to assess costs versus benefits of supply chain operations;
- Support the establishment of comparison benchmarks.

The DoD Components shall develop and maintain metrics that address these levels of supply chain operations:

- Enterprise level. Enterprise metrics are cross-functional measures that describe the overall effectiveness of the supply chain. The DoD Components may develop additional internal enterprise-level metrics as required;
- Functional level. Functional metrics support at least one enterprise metric and measure a major function's internal performance;
- Program or process level. Program or process metrics support functional metrics and are diagnostic and internal in nature.

The DoD Components should balance their metrics across customer service, cost and readiness, and sustainability performance objectives. This approach allows the Components to meet both their strategic needs and the needs of customers, and to address performance and process improvement initiatives.

The DoD Components shall develop data collection capabilities that support the following enterprise-level supply chain metrics:

- Customer Wait time: The time between the issuance of a customer order to the satisfaction of that order. Policies and procedures specific to customer wait time are in DoDI 4140.61 (reference (b));
- Weapon System Not Mission Capable (NMC) Rates: Maintenance and supply support shortfalls that directly impact weapon system readiness;
- Wholesale Logistics Response Time (LRT): The time it takes to complete an order placed on the wholesale level of supply from the date a requisition is generated until the date materiel is received. LRT metrics shall be part of the Logistics Metrics Analysis Reporting System (LMARS).

Whenever possible, the DoD Components should develop and use a flexible, real-time, on-line capability to interrogate metrics by supply source, customer, weapon system, or other supply chain support characteristics.

This capability enables the DoD Components to:

- Monitor daily operations and trends in weapon system readiness support;
- Assess and evaluate the results of completed logistics improvements involving materiel reliability, maintainability, and/or supportability;

- Assess and evaluate the progress of on-going logistics improvement initiatives such as system modernization.

Additional discussion and examples of specific supply support recommended metrics is found in the DoD Product Support Management (PSM) Guidebook in Appendix B.

G. Communities of Interest and Practice

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- PM e-Tool Kit Performance Learning Tools found at https://pmtoolkit.dau.mil/
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, ACQuire Search)
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook)
- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02)
- Web enabled new JCIDS Instruction and Guidebook
- Best Practices Clearing House (With addition of Multimedia Assets – video, audio)
- ACQuipedia Articles
  - Supply Chain Management (SCM)
  - Item Unique Identification (IUID)
  - Radio Frequency Identification (RFID)
  - RFID Tagging Principles
- Acquisition Community Connection (CoPs and Special Interest Areas)
- PM Certification Course materials and PM Continuous Learning Modules
- Probability of Program Success (PoPS) Model and Service Implementations
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation)
- DoD IG Audit Guides for Acquisition and Contracting
- Service and Agency PMO support sites
- Contract Management Processes Guide
- Leadership Support Center (Requires ACC log-in)

The Defense Logistics Agency (DLA) provides a website called “Assist Online” which is a search engine for Data Item Deliverables, found at https://assist.daps.dla.mil/online/start/
Several leading Professional Associations include:

- Supply Chain Council, http://supply-chain.org/
- Council of Supply Chain Management Professionals (CSCMP)
- Institute for Supply Management (ISM)
- The Association for Operations Management (APICS)

H. Lessons Learned / Best Practices

*The Defense Acquisition University's Best Practices Clearinghouse. T*his clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;
- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

I. Training Resources

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

Supply support topics are primarily covered under the Life Cycle Logistics courses. Below are a few selected courses.

LOG 101 Acquisition Logistics Fundamentals
LOG 235 Performance-Based Logistics
CLL 002 DLA Support to the PM
CLL 032 Preventing Counterfeit Parts from Entering the DoD Supply System
CLL 206 Parts Management Executive Overview

J. Key References

- Defense Acquisition Guidebook (DAG), Chapter 5
- DoDI 4151.19, Serialized Item Management (SIM)
- DoDI 5200.39, "Critical Program Information (CPI) Protection Within the Department of Defense"
- DoDI 8320.04, Item Unique Identification (IUID)
- DoD 4000.25-1-M, "Military Standard Requisitioning and Issue Procedures (MILSTRIP)
- DoD 4140.1-R, DoD Supply Chain Materiel Management Regulation, Draft, September 2002, Office of the Under Secretary of Defense for Acquisition and Technology. Also see the References section of this regulation for a listing of approximately 75 supply support references.
- "DoD Warranty Guide", Sep 2009
- CJCSM 3170.01G, updated 31 July 2009.
- Product Support Management Guidebook
- AR 700-82, OPNAVISNST 4410.2A, and MCO 4400.120, "Joint Regulation Governing the Use and Application of Uniform Source Maintenance and Recoverability Codes"
- QSTAG-1152 ED.1, "Bar Code Symbology"
- MIL-STD-1339C, "Fitting Out Procedures – Ships"
- Air Force Materiel Command's Acquisition Sustainment (AS) Tool Kit, AS KNEEPAD Checklist Appendix A pg. 136-137; 42 4.19, 50 5.14, 53 5.19, 60 5.49; 7.2.4;
- Air Force Pamphlet, AFPAMPHLET 63-128, Guide to Acquisition and Sustainment Life Cycle Management, 3.6/pg. 41;
- AR 700-18, "Provisioning of U.S. Army Equipment"
- AR 700-127, Integrated Logistics Support, Table 3-1 pg. 15;
- NAVAIR Handbook S006
- The Supply Chain Operational Reference Model (SCOR)®, The Supply Chain Council, 2010.
- TITLE 10, Subtitle A, PART IV, Chapter 145, Section 2451, Defense Supply Management
- GEIA-STD-0007, Logistics Product Data
- DoD 4100.39-M, Federal Logistics Information System (FLIS) Procedures Manual
- AFMCI 23-101, 30 April 1999, Air Force Provisioning Instruction

5.0 Maintenance Planning and Management
5.0.1 Objective
5.0.2 Description
Product Support Manager Activities
Maintenance Planning and Management in the Life Cycle
A. Purpose
B. Data Item Description (DID) Deliverables
C. OSD Proponency, Policy, Regulations and Statutes
D. Who Develops, Delivers and Manages It
E. When Is It Delivered and Managed in the Life Cycle
F. How It Is Developed, Established and Managed
G. Communities of Interest and Practice
H. Lessons Learned / Best Practices
I. Training Resources
J. Key References

5.0. Maintenance Planning and Management

5.0.1. Objective

Identify, plan, resource, and implement maintenance concepts and requirements to ensure the best possible equipment/capability is available when the Warfighter needs it at the lowest possible TOC.

5.0.2. Description

Maintenance Planning and Management establishes maintenance concepts and requirements for the life of the system for both hardware and software. It includes, but is not limited to:

- Levels of repair
- Repair times
- Testability requirements
- Support equipment needs
- Training and Training Aids Devices Simulators and Simulations (TADSS)
- Manpower skills
- Facilities
- Inter-service, organic and contractor mix of repair responsibility
- Deployment Planning/Site activation
- Development of preventive maintenance programs using reliability centered maintenance
- Condition Based Maintenance Plus (CBM+)
- Diagnostics/Prognostics and Health Management
- Sustainment
- PBL planning
- Post production software support

Maintenance planning and management is the process to develop, implement and manage the maintenance concept, requirements and procedures for a system along with who will perform the required maintenance tasks and where they will be accomplished. It includes the identification of all the resources and funding required to develop and implement the maintenance and modernization plan.

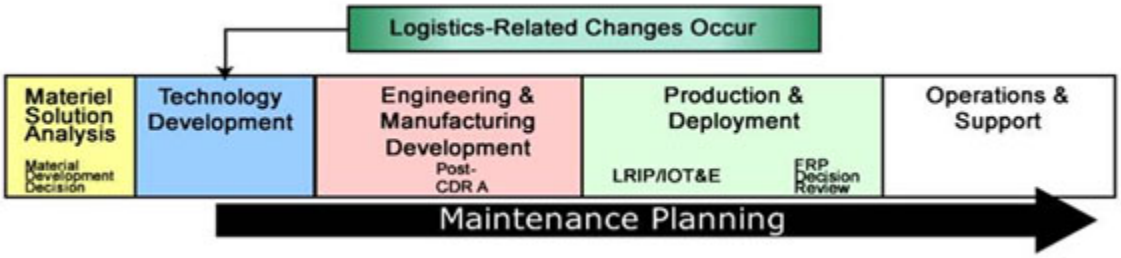
Product Support Manager Activities

5.1. Maintenance Planning and Management

Maintenance planning and management is the development process that defines the repair and upkeep tasks, schedule, and resources required to care for and sustain a weapons system with the focus being to define the actions and support necessary to attain the system's operational availability (Ao) objective. It is considered part of the LCSP development starting as early as the Technology Development Phase in the system's acquisition.

Maintenance planning utilizes concepts such as Reliability Centered Maintenance (RCM), Condition-Based Maintenance Plus (CBM+), and Total Ownership Cost (TOC) to create a plan that will lead to an efficient maintenance concept. Once the maintenance concept is derived, level of repair analysis (LORA), maintenance task analysis (MTA) and related technical data are used to build the foundation to establish the maintenance plan.

Maintenance Planning and Management should be initiated as soon as design alternatives are defined, to influence the design for supportability; and continue throughout the life cycle whenever logistics-related changes occur.



Maintenance (materiel) - as defined by DoD is:

- All action taken to retain materiel in a serviceable condition or to restore it to serviceability. It includes inspection, testing, servicing, and classification as to serviceability, repair, rebuilding, and reclamation;
- All supply and repair action taken to keep a force in condition to carry out its mission;
- The routine recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such condition that it may be continuously used at its original or designed capacity and efficiency for its intended purpose.

Planning for maintenance involves two very broad concepts in the type maintenance performed; corrective and preventive. Together they work to balance operational readiness required by the Warfighter and economical operation required by DoD.

More information can be found at the DAU website at https://acc.dau.mil/CommunityBrowser.aspx?id=385280., and also

[1] DoD Joint Publication 1-2, DoD Dictionary of Military and Associated Terms, dtd 12 April 2001, as amended through April 2010.
[2] NAVSO P-3692 Department of the Navy, Independent Logistics Assessment Handbook, September 2006

5.1.1. Maintenance Strategy

Strategies are business and technical management approaches designed to achieve program objectives within the resource constraints imposed. A strategy is the framework for planning, directing, contracting for, and managing a program. It provides a master schedule for research, development, test, production, fielding, modification, postproduction management, and other activities essential for program success. The maintenance strategy focuses on those approaches which will best allow the achievement of program key performance parameters and key system attributes.

5.1.1.1. Preventative

The concept of corrective maintenance is to "fly it 'til it breaks". This is acceptable as long as the failure does not result in the potential loss of equipment and/or human life. The primary benefit of corrective maintenance is the reduction of support costs since non-critical systems aren't needlessly monitored. The downside is the unknown timing of a failure and the impact to system availability and mission completion. The LCL must understand the impact corrective maintenance will have on all ILS elements; i.e., Sparing, test equipment, personnel, etc.

5.1.1.2. Corrective

The care and servicing by personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects. The concept of preventive maintenance (PM) is to "fix it before it breaks". PM attempts to prevent critical failures by determining potential failure rates. These failure rates could be based on operating hours, calendar days, landings, takeoffs, etc. Condition Based Maintenance (CBM+) is one of the tools that have been developed to identify component service life so that preventative maintenance intervals can be established to replace the component before it fails. Better than "fly it 'til it breaks", but more expensive in development and support costs, CBM+ is still cheaper than buying extra aircraft to compensate for anticipated losses/attrition.

The benefit is the obvious inverse to corrective maintenance; the elimination of surprise failures with associated enhanced operational availability and the ability to forecast future maintenance. Without the enhancement of CBM+, RCM or other prognostic health management systems, traditional PM drove removing and replacing components based on generic, worst-case operating intervals which, in most cases, were much too frequent. Very few components are used in a "worst-case" environment but in the absence of technology to predict failure, designers had little choice but to err on the side of safety. Traditional PM has the potential for increasing sustainment costs by removing and inducting components for repair that aren't really broken. Such initiatives as CBM+, RCM, and health monitoring technology (e.g., the Prognostics and Health Management sub-system on the Strike Talon) are intended to reduce this impact, but require up-front investment to achieve future savings. Preventive maintenance schedules drive

logistics requirements and those requirements must be translated into resources during the budget process.

The maintenance planning and management process is built on the concept of operation and forms the foundation for developing the Warfighter's prescribed level of system availability. The outputs of the maintenance planning and management process, e.g., maintenance plans and associated maintenance task requirements, drive associated logistics requirements and LCC levels that may make an unaffordable system affordable or vice versa. The maintenance planning and management process is critical element in the development of the LCSP performed during the Integrated System Design phase of EMD. It should be accomplished prior to the Post CDR A review.

The focus of the maintenance planning and management process is to:

- Delineate accessibility, diagnostics, repair and sparing requirements;
- Identify requirements for manpower factors that impact system design utilization rates (e.g., maintenance man-hours per maintenance action, maintenance ratios, etc.);
- Identify life cycle supportability design, installation, maintenance and operating constraints and guidelines;
- Confirm that maintenance planning and management analyses are consistent with the requirements of Title 10 United States Code (USC) regarding Core Logistics Capability (i.e., CORE) and public/private partnering; and
- Provide economic and non-economic LORA.

As a result of the maintenance planning and management process, specific criteria for repair and maintenance at applicable levels of maintenance are identified as discrete measures related to time, accuracy, repair levels, built-in-test (BIT), testability, reliability, maintainability, support equipment requirements (including automatic test equipment), manpower skills, knowledge and abilities, and facility requirements for peacetime and wartime environments. The results of the maintenance planning and management process are then incorporated into a maintenance plan.

5.1.1.3. Condition-Based Maintenance Plus (CBM+)

In accordance with Department of Defense (DoD) Instruction 4151.22, dated December 2, 2007, Condition Based Maintenance Plus (CBM+), is the application and integration of appropriate processes, technologies, and knowledge based capabilities to improve the reliability and maintenance effectiveness of DoD systems and components. The CBM+ goal is to provide near real-time data to the DoD supply system so parts can be rapidly requisitioned, located prior to the replacing the failing part. At its core, CBM+ is maintenance performed on evidence of need provided by reliability centered maintenance (RCM) analysis and other enabling processes and technologies such as embedded sensors for systems health monitoring and management, etc. CBM+ uses a systems engineering approach to collect data, analyze trends, and support the decision-making processes for maintenance based on condition prior to failure for system acquisition, sustainment, and operations.

CBM+ focuses on inserting, into both new and legacy weapon systems, technology to support improved maintenance capabilities and business processes. It also involves integrating and changing business processes to dramatically improve logistics system responsiveness. Under consideration are capabilities such as enhanced Prognostics & Health Management (PHM) and Enhanced Diagnostics techniques, failure trend analysis, electronic portable or point of

maintenance aids, serial item management, automatic identification technology and data-driven interactive maintenance training. The ultimate intent of this initiative is to increase operational availability and readiness throughout the weapon system life cycle at a reduced cost. CBM+ will help predict a system's remaining operational life span, support operator decision-making, interface with control systems, aid maintenance repairs, and provide feedback to the logistics support and system design communities.

More information can be found at the DAU website at https://acc.dau.mil/cbm.

5.1.2. Maintenance Concept

The maintenance concept defines the intended maintenance levels of repair and workload distribution within the Services' maintenance system and the force structure required to maintain the end item or weapon system.

The maintenance concept for a system is first described in the Initial Capabilities Document (ICD). The ICD is prepared by the using command during the Materiel Solution Analysis (MSA) phase of the acquisition cycle. This concept is gradually updated and refined through the succeeding acquisition phases as more information becomes available. The maintenance concept is a general statement that sets the broad parameters in which a support system must be designed. It is the initial description of maintenance requirements, considerations, and constraints for a proposed new system, equipment or a modification. The concept provides guidance for the formulation of maintenance design characteristics needed to achieve the optimum balance of operational effectiveness and life cycle cost. The maintenance concept is the framework upon which systems engineering and logistics planning are developed. Concepts developed and communicated prior to the procurement of new or modified systems help logisticians and engineers focus their efforts on operational and maintenance requirements.

5.1.3. Core Logistics Analysis (CLA)

The CLA defines the degree to which the program meets 10 USC 2460, 10 USC 2464, 10 USC 2466, 10 USC 2474. The PM conducts a core logistics analysis (CLA) prior to Milestone B and document the results in the Product Support Strategy to meet the requirements of 10 USC 2464 and DODI 5000.2. (Conduct the CLA prior to Milestone C for those systems that enter after Milestone B.)

The PM uses information derived from the CLA to make programmatic decisions that affect supportability planning and resource allocation. These decisions are translated into actions and are reflected in the product support strategy in the LCSP and the acquisition strategy. The PM uses analogous, engineering or parametric estimates to develop the CLA of a system under development and associated maintenance workload prior to a design being developed for formal analyses.

5.1.4. Depot Source of Repair (DSOR)

Department of Defense (DoD) policies require that program managers seek best value in depot maintenance support and that the department maintains organic core depot maintenance capabilities. These policies are implemented through the Depot Source of Repair (DSOR)

decision process. The DSOR decision process has the potential to substantially reduce program costs. Its use helps ensure effective use of commercial and organic depot maintenance resources.

The guidebook, “"Depot Source of Repair (DSOR): A Guide for Acquisition Personnel"”, DSOR Acquisition Guide DTD Oct 05.pdf”, provides guidance on two elements of the DSOR decision process: (1) the contract versus organic source selection and (2) the Depot Maintenance Interservice (DMI) review. This booklet is recommended for all acquisition and logistics personnel who plan or provide depot maintenance support.

5.1.5. Level of Repair Analysis (LORA)

Level of Repair Analysis (LORA) is a prescribed procedure for defense logistics planning. Level of Repair Analysis (LORA) is an analytical methodology used to determine where an item will be replaced, repaired, or discarded based on cost considerations and operational readiness requirements. For a complex engineering system containing thousands of assemblies, sub-assemblies, and components organized into several levels of indenture, and with a number of possible repair decisions, LORA seeks to determine an optimal provision of repair and maintenance facilities to minimize overall life-cycle costs. Logistics personnel examine not only the cost of the part to be replaced or repaired but all of the elements required to make sure the job is done correctly. This includes the skill level of personnel, tools required to perform the task, test equipment required to test the repaired product, and the facilities required to house the entire operation.

Oftentimes, the LORA process discovers that replacing a $3.00 part actually costs hundreds of times that amount, when all costs are considered. The LORA determines if it is more cost effective to discard an item than attempt to repair it. This analysis drives the maintenance support for each repairable unit analyzed. It also establishes who and where each unit will be repaired.

Level-of -Repair Analysis (LORA) is the most important physical supportability analysis business decision made during acquisition of a system. LORA produces the final answer as to how a system will be supported. LORA is performed in two steps: (1) using non-economic decision criteria to make the initial support decisions and (2) using an economic model to determine the most cost effective alternative to provide support for the system.

The LORA process produces the final support solution for the system. It determines where each required maintenance action will be performed, the physical resources that must be available to support performance of maintenance, and what the support infrastructure must be capable of sustaining throughout the operational life of the system. The results of LORA are documented and used as the basis for development of the physical resources for support of the system.
The LORA process starts by identification of the options where maintenance can be performed. It is common for systems to use 2 or 3 levels of maintenance. LORA produces a decision for each item within the system, indicating where each maintenance action for the item will be performed.

Non-economic LORA decision criteria are a list of rules or guidelines that are used to determine if there is an overriding reason why maintenance should be performed. Some organizations have

policies that any item costing less than a predetermined price level will be discarded and replaced rather than be repaired.

Other decisions are addressed using cost models that calculate the possible costs of all support options and then identify the least cost solution. Then the total cost of each option can be compared to determine the lowest option in terms of long-term support over the life of the system.

5.1.6. Critical Safety Items

CSIs are parts whose failure could cause loss of life, permanent disability or major injury, loss of a system, or significant equipment damage. Special attention has been placed on CSIs because of the potential catastrophic or critical consequences of failure and because DoD has experienced problems in the past, particularly when CSIs were purchased from suppliers with limited knowledge of the items' design intent, application, failure modes, failure affects, or failure implications. Public law 108-136, sec 802 was enacted to address aviation CSIs, and Public Law 109-364, sec 130 was enacted to address ship CSIs. Portions of these laws were codified in 10 U.S.C. 2319.

Department of Defense and Service policies also have been issued to address CSIs. DoD 4140.1-R, "DoD Supply Chain Materiel Management Regulation," establishes top-level procedures for the management of aviation CSIs. Additionally, a joint Military Service/Defense Agency instruction on "Management of Aviation Critical Safety Items" was issued on 25 January 2006. This instruction (SECNAVINST 4140.2, AFI 20-106, DA Pam 95-9, DLAI 3200.4, and DCMA INST CSI (AV)) specifically addresses requirements for identifying, acquiring, ensuring quality, managing, and disposing of aviation CSIs. The Joint Aeronautical Logistics Commanders also issued the Aviation Critical Safety Items (CSIs) Handbook. This guidance establishes standard user-level operating practices for aviation CSIs across the Services, the Defense Logistics Agency, the Defense Contract Management Agency, and other federal agencies. Additional Service and agency-specific aviation CSI implementing policies and guidance have been issued. Similar policies, procedures, and guidance are being developed and/or revised to address ship CSIs as defined by public law.

The public laws address three specific issues. First, they establish that the Design Control Activity (DCA) is responsible for processes concerning the management and identification of CSIs used in procurement, modification, repair, and overhaul of aviation and ship systems. The DCA is defined in law as the systems command of a military Service responsible for the airworthiness or seaworthiness certification of the system in which a CSI is used. Second, the laws require that DoD only enter into contracts involving CSIs with sources approved by the DCA. Finally, the laws require that CSI deliveries and services performed meet all technical and quality requirements established by the DCA.

The Defense Federal Acquisition Regulation Supplement (DFARS) was amended to implement the contractual aspects of the public law regarding aviation CSIs. Comparable DFARS amendments are in the works to address ship CSIs. DFARS 209.270 states that the DCA will:

- Identify items that meet aviation CSI criteria;
- Approve qualification requirements; and

- Qualify suppliers.

This section states that the contracting activity will contract for aviation CSIs only with suppliers approved by the DCA. DFARS 246.407 was amended to state that only the DCA can authorize acceptance of nonconforming aviation CSIs; however, DCA authority can be delegated for minor nonconformance. DFARS 246.504 requires DCA concurrence before certificates of conformance are used to accept aviation CSIs. Because contractors may uncover problems with products after items are delivered, DFARS 246.371 and 252-246.7003 requires contractors to notify the procuring and contracting officers within 72 hours after discovering or obtaining credible information that a delivered CSI, or a subsystem or system, may have discrepancies that affect safety.

The intent of CSI laws, regulations, policies, and guidance is to mitigate hazards from the receipt of defective, suspect, improperly documented, unapproved, and fraudulent parts having catastrophic potential. CSI policies ensure that items of supply that are most critical to operational safety are rigorously managed and controlled in terms of supplier capability; conformance to technical requirements; controls on changes or deviations; and inspection, installation, maintenance, and repair requirements, etc.

To ensure adequate management of CSIs throughout a system's Operations and Support phase, program managers should ensure CSIs are identified and documented in sufficient time to influence critical down-stream processes such as initial provisioning, supply support, and manufacturing planning. Prior to the Critical Design Review (CDR): the program office, with support from the DCA and prime/Original Equipment Manufacturer (OEM) contractors, should ensure that there is a clear understanding of CSI processes, terms, and criteria. Provisions should be made for prime/OEM contractors to deliver an initial list of recommended CSIs that are available for review at CDR. As the design, product baseline, production processes, and supportability analyses mature, the CSI list should continue to evolve. Throughout Low-Rate Initial Production (if applicable), conduct of the Physical Configuration Audit, and establishment of the final product baseline, the CSI list should be updated and reviewed to ensure it reflects the current situation. Before the Full-Rate Production Decision Review, a final CSI list should be documented and approved by the DCA.

5.1.7. Maintenance Task Analysis (MTA)

MTA is the identification of the steps, spares and materials, tools, support equipment, personnel skill levels as well as any facility issues that must be considered for a given repair task. Also included in the MTA are estimated times required for the performance of each task. MTAs cover both corrective and preventative maintenance tasks and, when complete, identify all physical resources required to support a system. Performing an MTA begins with identifying each step of the repair process. The steps are analyzed and a description written as to how they would be physically performed. After the description, resources to perform that task are identified. These resources include:

- Person or persons participating in each step including a narrative description of what they are doing;
- Time duration of each person’s participation;
- Tools or support equipment required;
- Parts and materials needed for the step.

Once the above activities are complete, the results are analyzed to determine the following:

- The total estimated time for the task; start to completion;
- The skill level of the person (or persons) required to perform the task based on their minimum technical capabilities, knowledge and experience;
- Any additional training that must be provided to ensure proper task performance;
- Any facility implications such as space limitations, environmental controls, health hazards or minimum capacity requirements.

Finally, the MTA results must be analyzed to assess the items compliance with all supportability issues such as ease of maintenance or accessibility and standardization that may have been established by earlier analytical tools or functional analyses. The source for comparison of the physical support requirements for acceptability should be the requirements documents (ICD/CDD/CPD). Many of these design limitations may be derived from actual state requirements. Any shortfalls or noncompliant features must be reported back to the design organization (vendor) for correction. This closes the loop between requirements for the design and the actual results of the design process.

5.1.8. Reliability Centered Maintenance (RCM)

Reliability Centered Maintenance (RCM). RCM is a logical, structured process used to determine the optimal failure management strategies for any system, based upon system reliability characteristics and the intended operating context. RCM defines what must be done for a system to achieve the desired levels of safety, operational readiness, and environmental soundness at best cost. RCM is a continuous process which requires sustainment throughout the life cycle of a system. RCM utilizes data from the results achieved and feeds this data back to improve design and future maintenance. Note that each DoD Component maintains specific instructions on the implementation of RCM.

On March 23, 2011, OSD AT&L issued new action memo approving the new DoD Manual 4151.22M, “Reliability Centered Maintenance”. Per the manual, RCM is used to determine what failure management strategies should be applied to ensure a system achieves the desired levels of safety, reliability, environmental soundness, and operational readiness in the most cost-effective manner. This document can be found at http://www.dtic.mil/whs/directives/corres/pdf/415122m.pdf .

5.1.9. Prognostics and Health Management (PHM)

Prognostics and Health Management (PHM) is a key enabler of improved system uptime and serves as a key component of the "Plus" portion of Condition Based Maintenance Plus (CBM+) by providing the ability to predict future health status of a system or component, as well as providing the ability to anticipate faults, problems, potential failures, and required maintenance actions.

5.1.9.1. Enhanced Diagnostics

Enhanced Diagnostics is the process of determining the state of a component to perform its function(s) with a high degree of fault detection & fault isolation capability and very low false alarm rate.

5.1.9.2. Prognostics

Prognostics are the actual material condition assessment which includes predicting & determining the useful life & performance life remaining of components by modeling fault progression. Prognostics include the process of predicting the future reliability of a product by assessing the extent of deviation or degradation of a product from its expected normal operating conditions. Health monitoring is a process of measuring and recording the extent of deviation and degradation from a normal operating condition.

5.1.9.3. Health Management

Health Management is the capability to make intelligent, informed, appropriate decisions about maintenance & logistics actions based on diagnostics/prognostics information, available resources & operational demand.

5.1.9.4. Integrated Vehicle Health Maintenance (IVHM)

Integrated vehicle health management (IVHM) is a collection of data relevant to the present and future performance of a vehicle system and its transformation into information can be used to support operational decisions. This design and operation concept embraces an integration of sensors, communication technologies, and artificial intelligence to provide vehicle-wide abilities to diagnose problems and recommend solutions.

5.1.10. Software Maintenance

Software maintenance is defined in the IEEE Standard for Software Maintenance, IEEE 1219, -- as the modification of a software product after delivery to correct faults, to improve performance or other attributes, or to adapt the product to a modified environment. The standard also addresses maintenance activities prior to delivery of the software product, but only in an information appendix of the standard. The IEEE/EIA 12207 standard for software life cycle processes essentially depicts maintenance as one of the primary life cycle processes, and describes maintenance as the process of a software product undergoing "modification to code and associated documentation due to a problem or the need for improvement. The objective is to modify the existing software product while preserving its integrity." ISO/IEC 14764, the international standard for software maintenance, defines software maintenance in the same terms as IEEE/EIA 12207 and emphasizes the pre-delivery aspects of maintenance, planning, for example.

Software maintenance sustains the software product throughout its operational life cycle. Modification requests are logged and tracked, the impact of proposed changes is determined, code and other software artifacts are modified, testing is conducted, and a new version of the software product is released. Also, training and daily support are provided to users. The software maintenance standard defines changes to the software process through a defined maintenance process that includes the following phases:

- Problem/modification identification, classification, and prioritization;
- Analysis;
- Design;
- Implementation;
- Regression/system testing;

- Acceptance testing; and
- Delivery.

5.1.11. Maintenance Plan Development

Once the maintenance concept is derived, the level of repair analysis (LORA), maintenance task analysis (MTA) and related technical data are used as the foundation of the maintenance plan. The maintenance plan describes how the maintenance concept will be implemented, prescribes actions for each significant maintenance task that will be required for the system/ equipment during its life cycle, explains technical requirements (where and how maintenance will be performed), incorporates detailed support concepts and resource requirements, lists the significant consumable items, and lists for each repairable item the supply, maintenance, and recoverability requirements/sources.

5.2. Maintenance Execution

5.2.1. Implementation and Management of Maintenance

5.2.1.1. Approach

Maintenance planning and management is an essential product support element. It is the process of arranging in an orderly manner, all the elements of maintenance support necessary to keep systems and equipment ready to perform assigned missions. Maintenance planning and management is tied to the identification, selection, quantification, acquisition, testing, deployment and support of weapon systems (i.e., support equipment, spare parts, facilities and infrastructure, packaging, tech data, etc.). In the long run, maintenance planning and management is one of the more significant factors influencing support costs. The ultimate outcome of maintenance planning and management is the identification of the actions and support resource requirements necessary to maintain the designed system and equipment in its prescribed state of operation. It considers the various maintenance functions and levels at which maintenance will be performed, including organic versus contract maintenance. The execution of this planning and management requires integration of both organic and commercial capabilities to best meet program key performance outcomes.

5.2.1.2. Organizational Level Maintenance

Organizational level maintenance is maintenance normally performed by an operating unit on a day-to-day basis in support of its own operations. The organizational-level maintenance mission is to maintain assigned equipment in a full mission-capable status while continually improving the process. Organizational-level maintenance can be grouped under categories of "inspections," "servicing," "handling," and "preventive maintenance."

Field-level maintenance comprises shop-type work as well as on-equipment maintenance activities at maintenance levels other than depot. Intermediate or shop-type work includes: limited repair of commodity-oriented assemblies and end items (e.g., electronic “black boxes” and mechanical components); job shop, bay, and production line operations for special requirements; repair of subassemblies such as circuit boards; software maintenance; and fabrication or manufacture of repair parts, assemblies, and components. On-equipment or organizational maintenance is normally performed by an operating unit on a day-to-day basis to

support operations of its assigned weapon systems and equipment. Organizational maintenance encompasses a number of categories, such as inspections, servicing, handling, preventive maintenance, and corrective maintenance. Although no set of financial management systems captures the total cost of field-level maintenance, it is currently estimated to be in the range of $54 billion annually.

Additional discussion on organizational level maintenance is found in this guidebook under "How Maintenance Planning & Management Is Developed, Established and Managed" at the OSD website at http://www.acq.osd.mil/log/mpp/definitions.html and DoDD 4151.18.

5.2.1.3. Intermediate Level Maintenance

Intermediate level maintenance is that level of maintenance/repair of items that do not have to go to depot level for major work and are incapable of maintenance/repair at the organizational level.

Intermediate Level Maintenance is the responsibility of, and performed by, designated maintenance activities in support of using organizations. The intermediate-level maintenance mission is to enhance and sustain the combat readiness and mission capability of supported activities by providing quality and timely materiel support at the nearest location with the 1owest practical resource expenditure. Intermediate level maintenance includes limited repair of commodity-orientated components and end items, job shop, bay, and production line operations for special mission requirements; repair of printed circuit boards; software maintenance; and fabrication or manufacture of repair parts, assemblies, components, including jigs and fixtures when approved by higher levels.

Additional discussion on intermediate level maintenance is found in this guidebook under "How Maintenance Planning & Management Is Developed, Established and Managed" and at the OSD website at http://www.acq.osd.mil/log/mpp/definitions.html and DoDD 4151.18.

5.2.1.4. Depot Level Maintenance

Per 10 USC 2460, the term "depot-level maintenance and repair" means (except as provided in subsection (b)) material maintenance or repair requiring the overhaul, upgrading, or rebuilding of parts, assemblies, or subassemblies, and the testing and reclamation of equipment as necessary, regardless of the source of funds for the maintenance or repair or the location at which the maintenance or repair is performed. The term includes:

(1) All aspects of software maintenance classified by the Department of Defense as of July 1, 1995, as depot-level maintenance and repair, and

(2) Interim contractor support or contractor logistics support (or any similar contractor support), to the extent that such support is for the performance of services described in the preceding sentence.

Depot level maintenance includes the repair, fabrication, manufacture, rebuilding, assembly overhaul, modification, refurbishment, rebuilding, test, analysis, repair-process design, in-service engineering, upgrade, painting and disposal of parts, assemblies, subassemblies, software, components, or end items that require shop facilities, tooling, support equipment, and/or personnel of higher technical skills, or processes beyond the organizational level capability. Depot level maintenance can be independent of the location at which the maintenance or repair is

performed, the source of funds, or whether the personnel are government or commercial (contractor) employees.

Additional discussion on depot level maintenance is found in this guidebook under "How Maintenance Planning & Management Is Developed, Established and Managed" at also at the DAU website, https://acc.dau.mil/depot and at http://www.acq.osd.mil/log/mpp/definitions.html and DoDD 4151.18.

5.2.2. Operational Tempo (OPTEMPO)

The estimated useful life currently used in the depreciation calculation for military equipment assets is provided by the Program Management Office (PMO) and is based on engineering estimates, historical experience, or warranty information. This information typically does not factor increased usage rates during combat and contingency operations or environment (e.g., harsh weather, rocky terrain, asphalt, sand, etc.). In addition, most of the estimated useful life projections are based on peacetime profiles.

Based on numerous studies and reviews, such as those conducted by the Office of the Secretary of Defense (Program Analysis and Evaluation) (OSD(PA&E)), Institute for Defense Analysis (IDA), and RAND Corporation (RAND), it was determined that the usage rate of assets used in combat and contingency operations is typically significantly greater than peacetime rates. In current combat operations, equipment usage rates have run two to eight times higher than comparable peacetime rates. For example, in April 2005, OSD PA&E reported that the usage rate for the Army's High Mobility Multipurpose Wheeled Vehicles (HMMWV) was up by a factor of 3.3. This increased usage typically results in accelerated wear and tear and overall accelerated maintenance cycles. Additionally, the House Committee on Appropriations reported that one to two months' worth of current combat operations is equivalent to roughly a year's worth of peacetime activity. More information is found at http://www.acq.osd.mil/pepolicy/pdfs/OPTEMPO/Ph1Rpt.pdf.

5.2.3. Reset

Reset includes those actions taken to restore units to a desired level of combat capability commensurate with the unit's future mission. It encompasses maintenance and supply activities and associated infrastructure that restore and enhance combat capability to unit and pre-positioned equipment that was destroyed, damaged, stressed, or worn out beyond economic repair due to combat operations, by repairing, rebuilding, or procuring replacement equipment. These maintenance and supply activities involve Depot (Sustainment) and Field Level (e.g., Organizational and Intermediate) repairs/overhauls centrally managed to specified standards and the maintenance infrastructure, i.e. Tools, test equipment, etc. Included are RDT&E, Procurement, and Operation and Maintenance funded major repairs/overhauls and recapitalization (Rebuild or Upgrade) that enhance existing equipment through the insertion of new technology or restore selected equipment to a zero-miles/zero-hours condition.

Note that the Marine Corps has an equivalent term to "reset", known as "recovery".

Per the OSD Report to Congress, Sep 2006, the three elements of equipment Reset includes:

- Repairing, at field or depot level, all equipment in or returning from the theater;

- Replacing combat losses and maintenance "washouts";
- Recapitalizing selected vehicle fleets to restore damage due to excessive wear.

Note that a "wash-out" represents equipment that is not economical to repair, as defined by a Maintenance Expenditure Limit, and is removed from the inventory. The Army publishes Maintenance Expenditure Limits (MEL) for each type of equipment in their technical bulletin. The USMC sets a flat MEL at 65 percent of new procurement costs for all equipment.

These Reset activities are funded primarily in supplemental legislation as they are generated s a result of contingency operations. Supplemental funds also go to maintaining equipment in theater. Though not expressly a part of Reset, all maintenance efforts in theater act to reduce the total cost of repair for equipment once it return from theater.

Each of the DoD Services has established policy and processes to address reset activities. PSMs should establish reset plans that are in accordance with their respective Services' guidelines. Additionally, reset requires review of depot capability and availability, both government and industry, and is subject to legislatively mandated compliance regarding "50-50" workload split, public private partnerships and inter-Service workload.

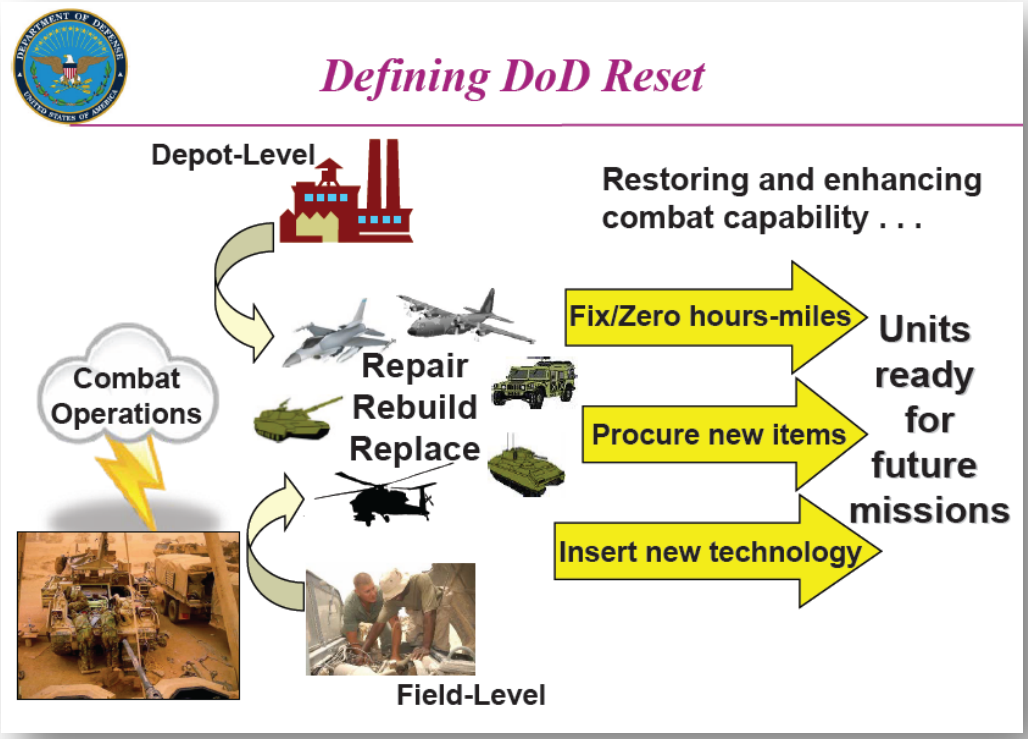


Figure 1.3.17.F1. Defining DoD Reset

The Product Support Manager should plan for reset as part of long term planning to ensure budgets are requested, programmed, work is prioritized, etc. Often the reset requirements are greater than the available budget will allow.

Taking the Army as an example, reset, one of the four Army Imperatives to restore balance to the Army is a six-month process that systematically restores redeployed units to a level of personnel and equipment readiness that permits resumption of training for future missions. Reset encompasses those tasks required to reintegrate Soldiers and Families, then organize, man, equip, and train a unit. Reset is predicated on the concept of allowing Soldiers and Families the opportunity to recover in order to reverse the cumulative effects of sustained operational tempo.

Reset consists of three phases: a six-month redeployment phase conducted during the last six months of the deployment ("In Theater"), an initial six month Active Component (AC) and twelve month Reserve Component (RC) reconstitution period ("At home station") to allow for Soldier and Family reintegration ("Reset"), and a collective training and unit preparation phase (Train-Ready Pool) leading to the Available Pool. The model is brigade-centric and its focus is on unit, not individual, reconstitution. A unit's return is based upon 51% of the unit's personnel return to home station.

Manning and equipping formation during Reset represents significant challenges. The Army is manning brigade-sized units through a policy called Army Force Generation (ARFORGEN) Focused Manning. The Army mans and prioritizes units based on priorities and metrics required to meet the unit's entry into the Available Pool.

Effective management of training to prepare for operations across the spectrum of conflict is challenging. For the present, unit commanders focus on achieving T1 readiness for their directed mission. As a unit's Dwell becomes longer (18 months or longer AC, 36 months or longer RC) the commander of it will be assigned an operational environment for training and reporting their Full Spectrum Operations (FSO) readiness. If the unit receives early notification of a directed mission, the deployed mission environment will become the basis for training and readiness reporting. AC units redeployed for less than 18 months, and RC units redeployed for less than 36 months, focus their training and report their readiness for FSO in their deployed mission environment.

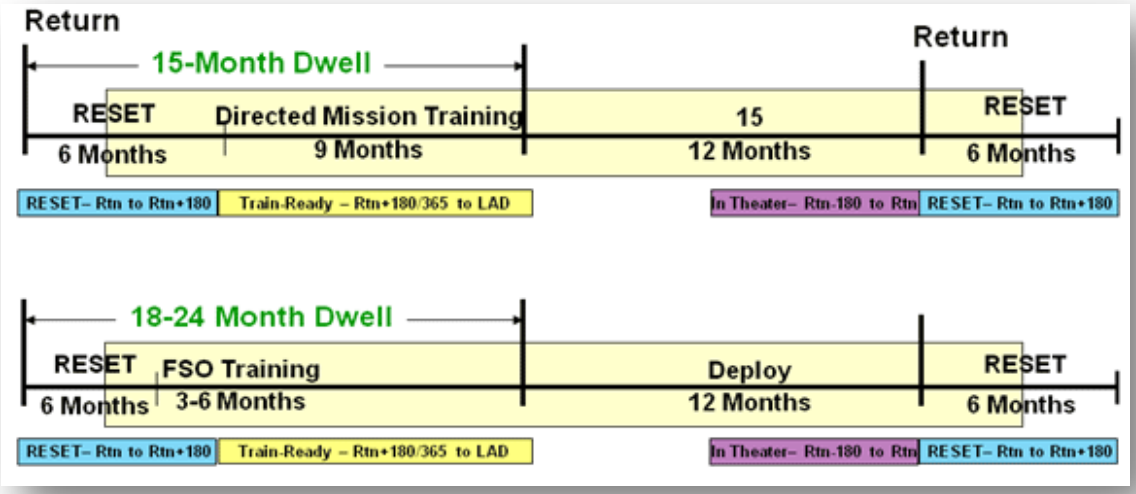


Figure 1.3.17.F2. Notional U.S. Army Plan for Unit Reset and Redeployment

In Fiscal Years 08 and 09, HQDA conducted a series of Reset Pilots. The test for FY 08 implemented the Reset Model on 13 redeploying Army units: eight AC, two ARNG, and three USAR units. In FY 09, HQDA expanded the test to 19 units: 13 AC, three ARNG, and three USAR units. The Reset Pilot was used to inform how Army institutional processes need to adjust to implement Reset and apply "best business practices."

The Army also has the aircraft Phase Maintenance and Special Test Inspection & Repair (STIR) program. STIR is a field level reset program involving extensive disassembly, inspection, and repair of combat aircraft designed to detect defects that less thorough inspections miss. STIR helps ensures air crew safety and longer aircraft service life.

A DoD memo defines RESET as agreed to by the Services and OSD, and outlines the linkage to Depot Maintenance Capacity and Utilization. Memo is found at https://acc.dau.mil/adl/en-US/171024/file/30693/L_MR%20Memo%20Resetting%20the%20Force%20(RESET)%20and%20Depot%20Mx%20Capacity%20_%20Utilization%20(26%20Jan%2007).pdf.

5.2.4. Battle Damage and Repair (BDAR)

BDAR is essential repair, which may be improvised, carried out rapidly in a battle environment in order to return damaged or disabled equipment to temporary service. Each DoD Component addresses battle damage assessment and repair to meet the needs of its infrastructure and weapon systems. For example, the U.S. Army's FM 4-30.31, "Recovery and Battle Damage Assessment and Repair", provides the authoritative doctrine guidance on using recovery and repair assets on the battlefield. Funding for battle damage and repair varies by situation and organization.

5.2.5. Corrosion Prevention and Control

The Department of Defense acquires, operates, and maintains a vast array of physical assets, ranging from aircraft, ground vehicles, ships, and other materiel to buildings, airfields, ports, and other infrastructure. Furthermore, in order to perform its mission, DoD must train and fight in all environments, including some of the most corrosively aggressive environments on Earth. Consequently, DoD assets are subject to significant degradation and deterioration due to corrosion, with specific effects in the following areas:

- Safety—A number of weapon system mishaps have been attributed to the effects of corrosion. For example, corroded electrical contacts on F-16s caused "uncommanded" fuel valve closures (with subsequent loss of aircraft), and corrosion-related cracking of F/A-18 landing gears resulted in failures during carrier operations;
- Readiness—Weapon systems are routinely out of commission due to corrosion deficiencies. For example, corrosion has been identified as the reason for more than 50 percent of the maintenance needed on KC-135 aircraft;
- Financial—The cost of corrosion to the DoD alone is estimated to be between $10 billion and $20 billion annually.

Program Managers are responsible for the development of Corrosion Prevention and Control Plans early on in the acquisition life cycle and for the budgeting, programming and funding of efforts needed to prevent and control corrosion throughout the product life cycle per DoDI 5000.02.

The DoD maintains a community of practice found at the website, https://www.corrdefense.org/CorrDefense%20WebPage%20Content/WhyDoDMustProtectItsAssets.aspx, which addresses policy, regulations and latest practices for corrosion prevention and control.

Maintenance Planning and Management in the Life Cycle

A. Purpose

Maintenance of DoD's weapon systems and military equipment is a critical element in the readiness and sustainability of combat forces. A maintenance program effectively aligned to deliver A_o will optimize life cycle cost and total ownership cost. The distribution of maintenance workloads among the public and private sectors is instrumental in maintaining a robust and viable industrial base. DoD materiel maintenance is big business, costing about $83 billion in FY 2009. This funding supports 653,000 military and civilian maintainers and thousands of commercial firms –all devoted to the maintenance of 290 ships, 14,000 aircraft,800 strategic missiles, 361,000 ground combat and tactical vehicles, and myriad other DoD weapon systems, components, and equipment items.

The activities occurring within the scope of this area should be integrated with other product support element areas in keeping with KPP and KSA optimization goals and constraints.

a. Why Maintenance Planning and Management is Important

Maintenance planning and management activities are heavily influenced prior to system deployment by the design interface activities which focus on ensuring that the program's KPPs are achieved through design that is focused on optimizing availability and reliability at reduced life cycle cost. After deployment and during Operations and Sustainment (O&S), the activities of sustaining engineering (including product improvement, reliability fixes, continuing process improvements and technology refresh) continue those of design interface and integrate both back with engineering and manufacturing activities and forward to collect and validate system operational performance with the user. The Product Support Manager is thus capable of implementing a total enterprise sustainment strategy.

Seeking to prevent, reduce and improve maintenance actions will have a direct impact on both availability outcomes and reduction of life cycle costs. There are many avenues to improve or prevent maintenance and many reasons why.

To use an example in the area of corrosion, corrosion-related costs as a percentage of total maintenance costs for DoD is determined to be 23 percent. This includes both infrastructure and facilities (15.1 percent) and weapon systems and equipment costs (24.0 percent). That means the corrosion cost for infrastructure and facilities is $1.768 billion, and the corrosion cost for weapon systems and equipment is $20.732 billion. Of the total cost of corrosion for DoD of $22.5 billion, $20.925 billion is derived from the maintenance records from the services' various databases, and $1.575 billion is outside normal reporting.
Source: http://corrdefense.nace.org/corrdefense_fall_2009/PDF/DoD_1.pdf

Historically, maintenance planning and management activities were the primary responsibility of engineering and product development, with maintenance execution activities being planned and implemented often under separate contract line items.

b. Summary of Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

Note that the Logistics Analysis (LA), also known as an independent logistics analysis, is part of **each** Milestone Decision Package and is a requirement for type classification.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Maintenance Planning & Management IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, includes in the left column a listing of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	**Maintenance Planning and Management Activities**
User Need / Technology Opportunities & Resources	Performance-based life-cycle product support implementation begins in the JCIDS process with the exploration of capabilities. Every system is acquired to provide a particular set of capabilities in a specific concept of operations, sustained to an optimal level of readiness. Understanding user needs in terms of performance is an essential initial step in developing a meaningful product support maintenance strategy because changes to the CONOPS or the sustainment approach may impact the effectiveness, suitability, or cost of the system. The Product Support Manager must be able to understand and forecast maintenance planning and management requirements to actual product support sustainment activities and outcomes. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Key Products: • Requirements

	• Metrics • Maintenance Strategy Forecasts
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. While not officially designated until Milestone B, the outcomes of a PSM perspective should be introduced at this point to include appropriate trade-off studies to forecast product support outcomes as a result of maintenance projections for the system and the intended sustainment footprint. The maintenance planning process to develop the product support strategy addresses events in which product support objectives are identified and their analytic relationships are defined for supportability, cost, and readiness drivers. An initial use study is performed, product support objectives are formulated, and the preferred maintenance strategy is identified. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of how Milestone Decision Review required documents. Key Products: • Maintenance Strategy
Technology Development	The primary document incorporating maintenance planning and management plans and outcomes is the LCSP. After Milestone A the LCSP evolves from a strategic outline to a management plan describing the sustainment efforts in the system design and acquisition processes to achieve the required performance and sustainment outcomes necessary to ensure required Warfighter capabilities. The Product Support Manager acts towards: the finalization of determination of the selected organic source of repair to be assigned primary responsibility for maintenance and repair of each system and each sub-system having a core capability requirement; estimating the ROM for the depot-level maintenance workload to be performed at organic facilities for the system and each subsystem; determining the technical data, facility and equipment requirements to ensure the capability to support these workloads; programming the resources for the technical data, facilitation, and equipment requirements. The Product Support Manager then summarizes the results of these actions in the LCSP submitted for Milestone B approval. A detailed outline for the LCSP can be found in the Defense Acquisition Guidebook, Chapter 5.1.2.2. and at the DAU community of practice site at https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3303/USA005157-11_SignedLCSPMemo_14Sep2011.pdf. Preventive and corrective maintenance tasks are identified, including design alternatives resulting from deficiencies uncovered during the identification of maintenance tasks. Product support alternatives are updated to optimize system

	readiness and reduce life cycle cost. Evaluations and trade-offs conducted earlier are updated based on more accurate data. IPS Element requirements are evaluated. An initial maintenance task analysis identifies new or critical logistics support resource requirements. A preliminary maintenance plan is developed. Competing contractors build system prototypes. At Milestone B, the LCSP evolves into a detailed execution plan for how the product support package is to be designed, acquired, sustained, and how sustainment will be applied, measured, managed, assessed, modified, and reported from system fielding through disposal. The LCSP is submitted as a stand-alone document prior to Milestone B. The Product Support Manager is required to also provide maintenance planning and management information on many other acquisition documents as listed below under deliverables and on the DAU site, https://dag.dau.mil/Pages/Default.aspx. Key Products: • Core Logistics Analysis • Final Maintenance Concept • Corrosion Prevention and Control Plan • Prognostics and Health Management Plan • Initial Maintenance Planning to include LORA and SMR codes
Engineering & Manufacturing Development	During this phase, the primary PSM inputs include detailed descriptions of maintenance / sustainment planning activities as well as materiel and data development and deliveries including but not limited to the following: Maintenance Plans (initial and final), depot maintenance core capabilities stand-up, Source of Repair Assignment Process (SORAP), and related considerations. Other key acquisition events and information such as maintainability demonstrations, prototypes, and plans to demonstrate product support capabilities and/or long lead contract activities should be developed. The PM/PSM will document depot maintenance planning actions in the Supportability Strategy that include the results of the Core Logistics Assessment (CLA) and Core Depot Assessment (CDA) prior to Milestone C. The MDA will document all deviations from this policy in the Acquisition Decision Memorandum (ADM) associated with the appropriate milestone. By Milestone C, the LCSP describes the content and implementation status of the product support package (including any sustainment related contracts, e.g., Interim Contractor Support, Contractor Logistics Support) to achieve the Sustainment KPP/KSAs. In addition to sustaining the system performance capability threshold criteria and meeting any evolving user readiness needs, the LCSP details how the program will manage O&S costs and reduce the logistics footprint. Significant changes may be required to the product support package to achieve the objective sustainment metrics including major support provider changes. As the program matures, the LCSP is updated to reflect increasing levels of detail as they become available. The information should be in sufficient depth to ensure acquisition, design, sustainment, and user communities have an early common understanding of

	the maintenance planning and management sustainment requirements, approach, and associated risks. Key Products: • Level of Repair Analysis • Reliability Centered Maintenance (RCM) Analysis • Draft Maintenance Plan • Core Depot Assessment • Depot Source of Repair Study

Production & Deployment	Maintenance planning and management activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, and taking part in planning activities that may be on-going already for product improvement. Key sustainment planning activities including but not limited to the following: Sustainment contract awards, maintenance plan updates and verification, depot maintenance core capabilities stand-up, Source of Repair Assignment Process (SORAP), and identification of the activation schedule for each site in the supply chain required to support the system including the maintenance sites (including depots) and training sites. Fielding occurs during this phase and proof of early planning is now being validated as the system deploys to the operational site.
	
	Key Products:
	• Validation of Maintenance Plan
	  o Final Maintenance Task Analysis
	  o Condition Based Maintenance Plan
	  o Reliability Centered Maintenance Plan
	  o Maintenance Procedures
	• Schedule for post-fielding reviews
	• Funding in place for interim support, maintenance transition planning and establishment of organic capability

Operations & Support	Maintenance planning and management activities focus on executing strategies and plans to support the fielded systems, seeking opportunities for improving maintenance process outcomes and reduction of ownership costs, and ensuring maintenance practices comply with applicable laws, policies, and regulations. Key Products: • Updates to maintenance procedures • Continuous improvement of maintenance plans • End of life plans • Service life extension plans

Table 5.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DI-ALSS-80728A, "Depot Maintenance Production Report"
DI-ALSS-81547, "Maintenance Data Record"
DI-CMAN-81121, "Functional and Allocated Baselines Inputs"
DI-ENVR-81378, "Environmental Operation and Maintenance (O&M) Plan"
DI-FNCL-80462, "Depot Maintenance Cost Report"
DI-FNCL-81789, "Cost Contract Continuous Maintenance and Emergent Work"
DI-ILSS, "Level of Repair Analysis (LORA) Report"
DI-ILSS-80111A, "Reliability-Centered Maintenance Analysis Data"
DI-ILSS-80234A, "Request for Programmed Depot Maintenance (PDM)"
DI-ILSS-80739, "Depot Maintenance Study"
DI-ILSS-81225, "Maintenance Support Plan"
DI-ILSS-81226, "Interim Contractor Support (ICS) Parts Usage and Maintenance Data Collection Report"
DI-IPSC-81431A, "System Specification"
DI-MGMT-80995A, "Maintenance Service Report"
DI-MISC-81371, "Maintenance Data Collection Record"
DI-MISC-81392, "Contractor Operation and Maintenance of Simulators / Equipment Management Status Report"
Di-MISC-81421, "Maintenance Training Activity Report"
DI-MNTY-80979, "Planned Maintenance System (PMS) Master System and Subsystem Index"
DI-MNTY-80980, "Planned Maintenance System (PMS) Failure Modes and Effects Analysis"
DI-MNTY-80981, "Planned Maintenance System (PMS) Functional Failure Analysis"
DI-MNTY-80982, "Planned Maintenance System (PMS) Functionally Significant Items Index"
DI-MNTY-80983, "Planned Maintenance System (PMS) Additional Functionally Significant Item (FSI) Index Selection Report"
DI-MNTY-80984, "Planned Maintenance System (PMS) Logic Tree Analysis with Supporting Rationale and Justification"
DI-MNTY-80985, "Planned Maintenance System (PMS) Servicing and Lubrication Analysis"
DI-MNTY-80986, "Planned Maintenance System (PMS) Requirement Index"
DI-MNTY-80987, "Planned Maintenance System (PMS) Procedure Evaluation Sheet"
DI-MNTY-80988, "Planned Maintenance System (PMS) Task Definition"
DI-MNTY-80989, "Planned Maintenance System (PMS) Inactive Equipment Maintenance (IEM) Requirement Analysis"
DI-MNTY-80990, "Planned Maintenance System (PMS) Reliability Centered Maintenance (RCM) Documentation Control Sheet"
DI-MNTY-80991, "Planned Maintenance System (PMS) Maintenance Requirement Card"
DI-MNTY-80992, "Planned Maintenance System (PMS) Maintenance Index Page"
DI-MNTY-80993, "Planned Maintenance System (PMS) Quality Assurance Check Sheet"
DI-MNTY-80994, "Planned Maintenance System (PMS) Functional Block Diagram
DI-SESS-80294B, "Maintenance Test and Support Equipment Requirements List"

DI-SESS-80979A, "Reliability-Centered Maintenance (RCM) Master System and Subsystem Index (MSSI)
DI-SESS-80980A, "Reliability Centered Maintenance (RCM) Failure Modes and Effects Analysis (FMEA) Report"
DI-SESS-80981A, "Reliability Centered Maintenance (RCM) Functional Failure Analysis (FFA) Report
DI-SESS-80982A, "Reliability-Centered Maintenance (RCM) Functionally Significant Item (FSI) Index
DI-SESS-80983A, "Reliability-Centered Maintenance (RCM) Additional Functionally Significant Item (AFSI) Selection Report"
DI-SESS-80984A, "Reliability-Centered Maintenance (RCM) Logic Tree Analysis with Supporting Rationale and Justification Report"
DI-SESS-81823, "Reliability-Centered Maintenance (RCM) Class Maintenance Plan"
DI-TMSS-81666B, "Maintenance Manual Changes"

C. OSD Proponency, Policy, Regulations and U.S. Statutes

a. Proponency

DoD Proponency lies with the Office of the Assistant Deputy Undersecretary for Maintenance Policy and Programs. The website is found at http://www.acq.osd.mil/log/mpp/index.html. The principal missions of the Office of the Deputy Assistant Secretary of Defense for Maintenance Policy and Programs (DASD(MPP)) are to:

- Serve as the principal advisor for policies and procedures for maintenance support of major weapon systems and military equipment;
- Provide the functional expertise for centralized maintenance policy and management oversight for all weapon systems and military equipment maintenance programs and related resources within the Department of Defense;
- Establish and maintain maintenance policies and programs that are managerially and technologically sound and adequately resourced to maintain the desired levels of weapon systems and military equipment readiness to accomplish the Department's missions.

Maintenance Policy and Programs (MPP's) functions also include:

- Promoting Congressional understanding of DoD maintenance; requirements and programs;
- Responding to provisions of law and of executive direction relating to weapon systems and military equipment maintenance by converting these requirements into coherent, effective policies and programs;
- Providing strong leadership for the execution of maintenance programs by the Military Services and Defense Agencies;
- Directing focused studies of new technologies and management approaches that offer significant potential to improve the productivity and effectiveness of DoD maintenance activities.

b. Policy and Regulations

Note: please see the References at the end of this section for a more complete list of relevant materials.

- DoD 7000.14-R, Vol. 6, Chapter 14 (Depot Maintenance Reporting)
- DoDI 4151.22, Condition Based Maintenance Plus (CBM+) for Materiel Maintenance, December 2, 2007
- DoDI 4151.21, Public-Private Partnerships for Depot-Level Maintenance, April 25, 2007
- DoD 4151.20, Depot Maintenance Core Capabilities Determination Process, January 5, 2007
- DoDI 4151.19, Serialized Item Management — December 26, 2006
- DoD 4151.18-H, Depot Maintenance Capacity and Utilization Measurement — March 10, 2007
- DoD 4151.18, Maintenance of Military Materiel — March 31, 2004
- DoDI 1348.30, Secretary of Defense Maintenance Awards Program — October 16, 2009
- DEPSECDEF Depot Maintenance Production Workforce memo — October 12, 2001
- Per DoD regulation 4151.18, "Maintenance of Military Materiel", it is DoD policy that maintenance programs for DoD materiel shall be structured and managed to achieve inherent performance, safety and reliability levels of the materiel. Maintenance tasks restore safety and reliability to their inherent levels when deterioration has occurred. Maintenance programs are structured for meeting readiness and sustainability objectives (including mobilization and surge capabilities) of national defense strategic and contingency requirements.

  In addition, maintenance programs shall:
  - Employ maintenance concepts that optimize process technologies, organizational structures and operating concepts to deliver efficient and effective performance to the operating forces;
  - Be clearly linked to strategic and contingency planning;
  - Provide organic maintenance for inherently Governmental and core capability requirements in accordance with Section 2464 of Title 10, United States Code (reference (e)). Non-core capability requirements shall be satisfied using competitive sourcing, as appropriate, and in accordance with Section 2462 of title 10, United States Code (reference *(f))* and Section 2466 of title 10, United States Code (reference (g)), to lower costs and improve performance across the full spectrum of maintenance activities;
  - Be designed for minimizing the total life-cycle cost of ownership. The programs shall effectively address all maintenance requirements whether afloat, at a fixed base, deployed site, centralized repair activity, in storage, or en route. Their design shall minimize the footprint of maintenance capabilities employed in an area of operation;
  - Adopt business practices and quality management processes to continuously improve maintenance operations and maintenance production, achieve cost savings and avoidance, and realize process cycle time reduction;
  - Invest in the development of new technologies to improve the reliability, maintainability and supportability of DoD materiel, including the cost, schedule effectiveness, and quality of maintenance tasks and processes;
  - Employ the full spectrum of maintenance support structures available to sustain military materiel, including organic or unique military capabilities, performance-

based logistics arrangements, commercial sector support, partnering, and competition, as applicable. The programs shall appropriately use corporate contracting techniques for depot maintenance of secondary items;

- Ensure access to support and support-related technical information is consistent with the planned support concept to cost effectively maintain fielded systems and foster competition for sources of support throughout the life of the fielded systems;
- Take steps to minimize and prevent Environmental, Safety, and Occupational Health hazards in maintenance activities. The use, generation, storage and disposal of hazardous material at maintenance locations shall be minimized. Design of maintenance tasks and processes shall give consideration to environmental and human factors to allow for safe, efficient, and effective task accomplishment;
- Comply with periodic and as-required reporting requirements.

D. Who Develops, Delivers and Manages Maintenance Planning & Management

Maintenance Planning and Management is developed and delivered by the acquisition team prior to actual delivery of the system to the using organization. It is during the fielding process that implementation transfers to designated maintenance organizations per the LCSP. The below graphics represent the numbers of persons and locations where maintenance occurs. Maintenance is a "global" activity impacting all items, even if the maintenance philosophy is simply "throw away".

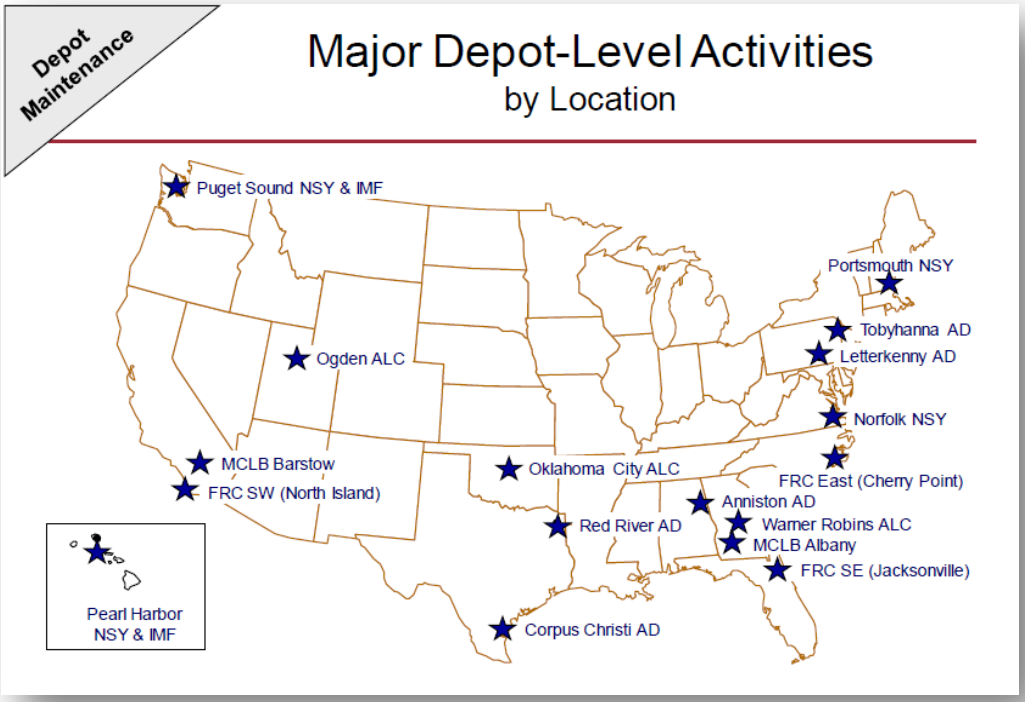


Figure D.F1. Major Depot-Level Activities by Location

ORGANIC DEPOTs

In keeping with the statutory responsibility to equip their forces, each military service operates two or more major organic maintenance depots to perform depot-level maintenance and associated activities for its primary weapon systems and equipment. DoD traditionally considers depot maintenance activities as "major" if they employ 400 or more personnel and perform depot-level maintenance.

As of September 10, 2001, and after the depot closings recommended by several rounds of Base Closure and Realignments, five Army depots (ADs), two Marine Corps maintenances centers (MCs), four naval shipyards (NSYs), three Navy fleet readiness centers (FRCs), and three Air Force air logistics centers (ALCs) constitute the sum of DoD's major organic depot maintenance universe.

ARMY

The Army's five major organic maintenance depots operate under the authority of the U.S. Army Materiel Command. These maintenance installations also fall under the direct command and control of one of three lifecycle management commands, and each depot is aligned in accordance with its mission.

- Anniston AD, Anniston, Alabama—Combat vehicles, artillery systems, bridge systems, small arms, and secondary components
- Corpus Christi AD, Corpus Christi, Texas—Helicopters and associated components
- Letterkenny AD, Chambersburg, Pennsylvania—Tactical missiles and ammunition, related ground support and radar equipment, and HMMWVs
- Red River AD, Texarkana, Texas—Light tracked combat vehicles, tactical wheeled vehicles, electronic systems, missile systems, towed and self-propelled artillery, and support equipment
- Tobyhanna AD, Tobyhanna, Pennsylvania—Communications-electronics systems, avionics, related equipment, and missile guidance systems.

MARINE CORPS

The two Marine Corps maintenance centers (MCs) operate under the authority of Marine Corps Logistics Command. Depot maintenance requirements for Marine Corps aircraft are supported by the Navy.

- MC Albany, Albany, Georgia—Combat and combat support systems (to include amphibious), combat and tactical vehicles, automotive and construction equipment, ordnance and weapons, general purpose equipment, and communications and electronics equipment
- MC Barstow, Barstow, California—Combat and combat support systems (to include amphibious), combat and tactical vehicles, automotive and construction equipment,

ordnance and weapons, general purpose equipment, and communications and electronics equipment.

NAVY

The Commander, Fleet Forces Command, and the Commander, Pacific Fleet, as budget submitting officers, "own" the shipyards. The Naval Sea Systems Command (NAVSEA) operates the shipyards and has technical authority for ship maintenance operations. For aviation, the Commander, Fleet Readiness Command (COMFRC),2 is aligned to the fleet through his or her subordinate relationships with the Commander, Naval Air Forces (CNAF), and Commander, Naval Air Systems Command (NAVAIR). Operationally, COMFRC responds to Warfighter requirements through CNAF; technical authority for maintenance resides with NAVAIR.
2 The 2005 BRAC decisions required the establishment of fleet readiness centers (FRCs), which integrated the former naval air depots (NADEPs) and the continental United States (CONUS) aircraft intermediate maintenance detachments (AIMDs) into a single organization.

- Norfolk NSY, Portsmouth, Virginia—Nuclear refueling and defueling, surface combatants, large deck ships, nuclear submarines, and craft

- Pearl Harbor NSY, Pearl Harbor, Hawaii—Nuclear refueling and defueling, nuclear submarines, surface combatants, and watercraft

- Portsmouth NSY, Kittery, Maine—Nuclear refueling and defueling, nuclear submarines, and deep submergence vehicle maintenance

- Puget Sound NSY, Bremerton, Washington—Nuclear refueling and defueling, nuclear submarines (including inactivation), large deck ships, surface combatants, and ship recycling.

- FRC East, Cherry Point, North Carolina—Marine Corps and Navy air-craft, jet and turbofan vectored engines, auxiliary power units, propeller systems, and related components

- FRC Southeast, Jacksonville, Florida—Airframes, propulsion, avionics, surveillance, countermeasure systems and associated components, and engineering and manufacturing services associated with aircraft maintenance, repair, and overhaul

- FRC Southwest, San Diego, California—Navy and Marine Corps fixed and rotary wing airframes, propulsion systems, avionics, command and control equipment, early warning and airborne battle management systems, and associated components.

AIR FORCE

Air Force Materiel Command has authority over the three air logistics centers. Depot maintenance is performed by the maintenance wing located at each ALC.

- Ogden ALC, Hill AFB, Utah—Combat aircraft, aircraft landing gear, wheels and brakes, composite repair, rocket motors, air munitions, guided bombs, avionics systems, various

instruments and electrical accessories, hydraulic and pneudraulic systems, special purpose vehicles, shelters, radome communications systems, gas turbine engines, secondary power support equipment, and other related components (The Aerospace Maintenance and Regeneration Group, which aligned under Ogden Air Logistics Center in 2007, performs maintenance and regeneration.)

- Oklahoma City ALC, Tinker AFB, Oklahoma—Bombers, surveillance and tanker aircraft, aircraft engines, cruise missile engines, hydraulic and pneudraulic systems, pneumatics, oxygen- and other gas-generating equipment, instruments, offensive avionics systems, flight controllers, and aircraft- and engine-related reparable items

- Warner Robins ALC, Robins AFB, Georgia—Major aircraft, airlift systems and helicopters, hydraulic and pneudraulic systems, pneumatics, oxygen- and other gas-generating equipment, instruments and displays, avionics systems, and aircraft-related reparable items.

Reference for this material is the DoD Maintenance Fact Book 2010 found at http://www.acq.osd.mil/log/mpp/factbooks/2010_Fact_Book_FINAL_27Sep2010.pdf

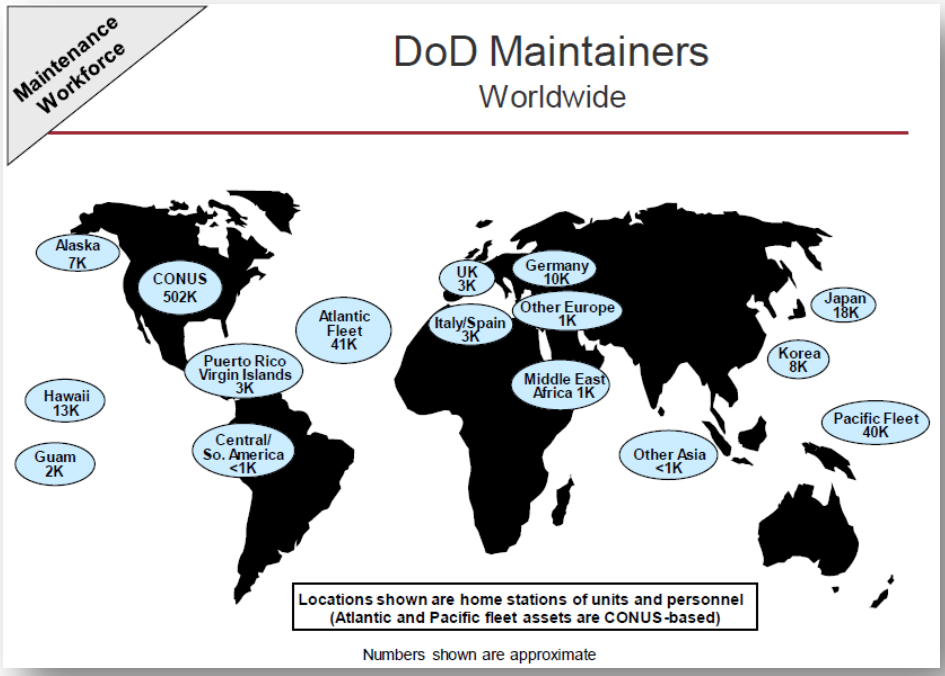


Figure D.F2. Approximate Distribution of DoD Maintainers Worldwide

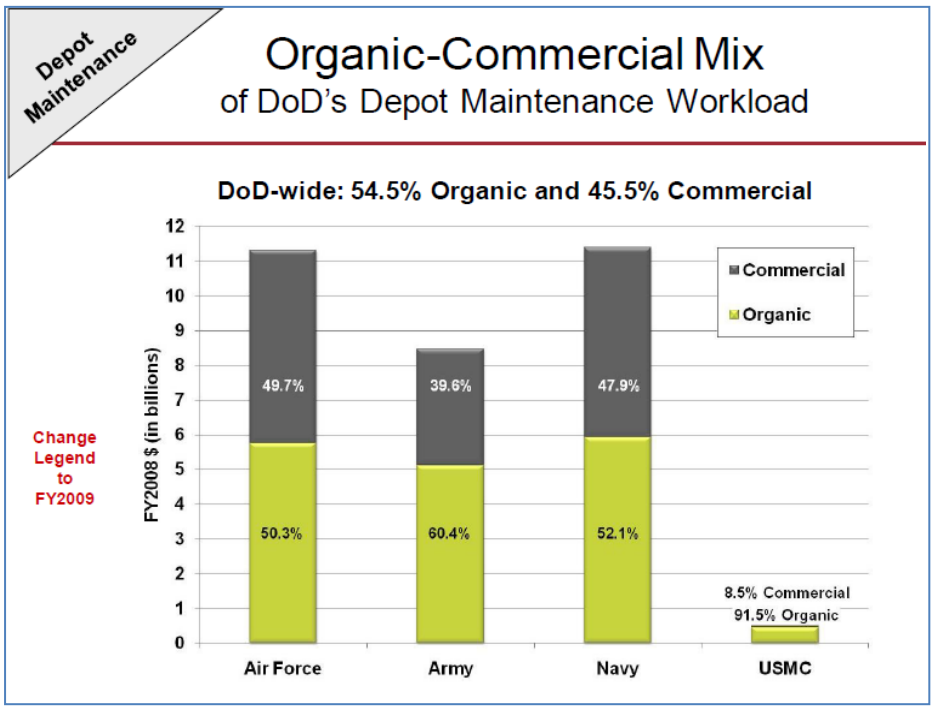


Figure D.F3. Approximate Mix of Organic to Commercial Maintainers

Nearly 650,000 maintainers (active duty and Reserve Component military and DoD civilians) are involved in DoD maintenance operations. Of this total, the Department estimates that about 7 percent are federal civilian employees assigned to depot-level activities. The remaining 93 percent accomplish field-level maintenance. In addition, several thousand private sector firms are engaged in performing maintenance — mostly depot-level — of DoD materiel.

Which organizations actually perform the maintenance will be documented in the LCSP and will depend on a number of factors to include regulatory, user requirements, capabilities, availability of capability, cost, system maintenance requirements, etc. The Product Support Manager should ensure the integrated product team representation is inclusive of all maintenance stakeholders required to make the best decisions for achieving program outcomes and lowest life cycle cost.

Contractors can provide logistics support over a wide range of options, from interim contractor support covering the initial fielding while the product support package is being deployed, to supporting specific limited operations, to full contractor support. When support strategies employ contractors in a battlefield environment, PMs should, in accordance with Joint Publication 4-0 Chapter 5 and DoD Component implementing guidance, coordinate with affected Combatant Commanders. This coordination must be carried out through the lead DoD Component and ensure functions performed by contractors, together with functions performed by military personnel, and government civilians, are integrated in Operations Plans (OPLANs) and Orders (OPORDs). During this process the Combatant Commanders will:

- Identify operational specific contractor policies and requirements, to include restrictions imposed by international agreements;

- Include contractor related deployment, management, force protection, medical, and other support requirements, in the OPORD or a separate annex; and
- Provide this information to the DoD Components to incorporate into applicable contracts.

E. When Is Maintenance Planning & Management Delivered and Managed in the Life Cycle

The maintenance concept, or source of repair concept, is developed early in the acquisition life cycle as part of the AoA during the Materiel Solution Analysis phase. It is then further defined within the Life Cycle Sustainment Plan (LCSP). The LCSP begins in the Technology Development Phase (for approval at MS B) and provides the strategic framework for optimal sustainment at minimal Life Cycle Cost. It evolves into an execution plan for how sustainment is applied, measured, managed, assessed, and reported after system fielding.

By Milestone C, the LCSP describes details on how the program will field and sustain the product support package necessary to meet readiness and performance objectives, lower total ownership cost, reduce risks, and avoid harm to the environment and human health.

Maintenance execution starts during the fielding process. During the production and deployment phase, it is imperative for the PMs and PSMs to ensure the prior planning for maintenance support is executed to meet the supportability requirements of the system and/or subsystems. If organic depot maintenance is a portion of the selected Life Cycle Sustainment Plan (LCSP), it will require the activation of the requisite organic depot maintenance capabilities.

Operations and sustainment maintenance execution will be per the LCSP maintenance strategy. During this phase, the PM/PSM is the system focal point to the user and should continually assess the sustainability effectiveness of the fielded systems, adjusting the program product support execution as required to support the user. During Operations and Sustainment, the maintenance strategy may see changes as a result of the conclusions from The Product Support Manager total continually assessing the system performance from the user's perspective. The Product Support Manager should use existing reporting systems and user feedback to evaluate the fielded system, focusing on performance outcomes meaningful to the user. Potential corrective actions can be implemented through maintenance plan/requirement changes, process changes, modification of performance-based product support agreements, and/or design changes. The final decision for the corrective action selected will be determined by a balance between many factors, including but not limited to risk/safety, costs, schedule, user requirements and probability of success.

PSM efforts to achieve system availability while reducing costs should include periodic assessments and, where necessary, improvements of the product support strategy and processes. While some system deficiencies can be addressed through system design, many can be more effectively resolved by adjusting the product support strategy or processes. The continual application of supportability analysis, including condition based maintenance plus concepts, is an effective means of meeting evolving conditions and providing improved materiel availability.

Defining the maintenance requirements and influencing design, including the incorporation of RCM and CBM+ principles and techniques, should be accomplished early on in the life cycle and can be a very effective in optimizing the sustainment KPP and KSAs during the Operating and Support Phase. Additional approaches useful to the PM in balancing logistics resources, decreasing repair cycle times, and/or improving readiness/availability include:

- Application of Lean, Six Sigma and Theory of Constraints Concepts;
- Updating the supply chain processes based on actual, balancing logistics support through thorough review of readiness degraders, maintenance data, maintenance and support process implementation;
- Implementing properly incentivized performance-based agreements with support providers that encourage product support assessments and improvements based on comparisons between performance expectations against actual performance data.

F. How Maintenance Planning & Management Is Developed, Established and Managed

Figure F.F1. Illustration of Weapon System Support Components

The graphic above, taken from the DAG, illustrates very simply that to operate and support a weapon system requires both materiel and personnel supported by technical and installation

infrastructure. Maintenance shows up in multiple places, in terms of material to execute the maintenance, manpower to perform the maintenance, plus equipment, support services and repair parts. Equipment maintenance is the backbone of weapon system operation.

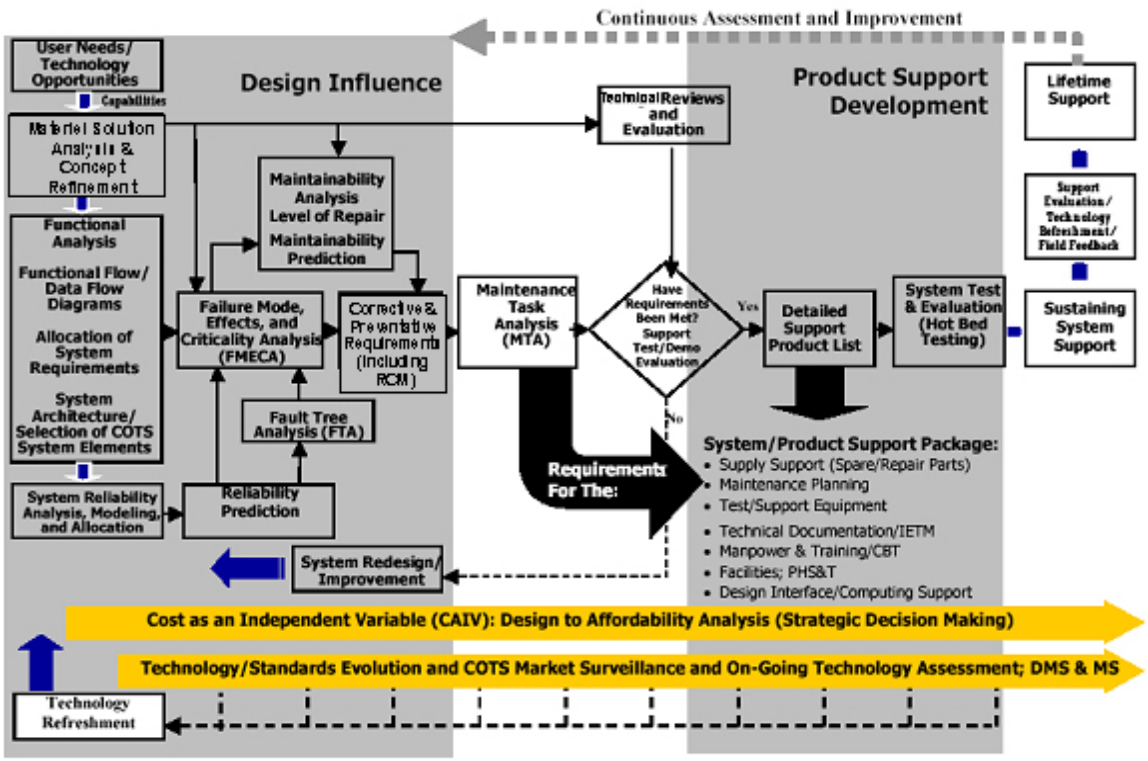


Figure F.F2. Maintenance Task Analysis Process Elements

The core of maintenance planning and management can be considered as the Maintenance Task Analysis activity as shown in the above figure, (source: DAG Figure 5.2.1.2.F1., Supportability Relationships). Implementation of a disciplined supportability analysis approach during design influence will produce a Maintenance Task Analysis (MTA) directly linked to the system's reliability and maintainability characteristics. This disciplined approach includes systems engineering activities such as CBM+, Failure Mode Effects and Criticality Analysis (FMECA), Fault Tree Analysis (FTA), Reliability Centered Maintenance (RCM) (see Enclosure 3 of DoDI 4151.22 RCM Process), and level of repair analysis (considering cost and availability implication of the maintenance level and locations).

The Maintenance Task Analysis (illustrated in the center of the graphic) is the opportunity to determine whether the design has met the supportability requirements defined in the system specification. It also provides a feedback loop to the Systems Engineer that is either positive (design has met requirements) or that there is a need for re-evaluation of either the requirement or the design itself. The results of the re-evaluations permits the trade space required for the PM/PSM to make a justifiable decision.

The RCM analytical process, a critical input to the Maintenance Task Analysis results, determines the preventive maintenance tasks critical in providing recommendations for actions necessary to maintain a required level of safety, maximize materiel availability, and minimize operating cost. The technical inputs to the maintenance task analysis provide a detailed understanding of the necessary logistics support element requirements to sustain required materiel availability.

The MTA process identifies, as outputs, the support tasks and the physical locations where they will be accomplished with consideration of the costs, availability implications, and statutory requirements. (The Depot Source of Repair (DSOR) process is key in determining location.) Finally, a product support package is created that identifies support element requirements and associated product data based on the system reliability and maintainability.

The product support package provides descriptions of the following topics:

- Supply Support (Spare/Repair Parts);
- Maintenance Plan and Requirements to include Calibration;
- Support, Test & Calibration Equipment;
- Technical Data (Paper Based and/or Electronic Interactive);
- Manpower & Training including Computer Based Training;
- Facility Requirements;
- Packaging, Handling, Storage, & Transportation;
- Computer Resource Support.

There is continuous assessment and improvement on-going throughout the life cycle through operations and sustainment. The MTA continuous undergoes reviews and updates to reflect the current state of maintenance requirements.

The Maintenance Planning and Management Product Support Element is also inclusive of maintenance execution per the LCSP.

Maintenance strategies may vary considerably from system to system, but there are three fundamental areas: Field (which includes organizational and any intermediate) and Depot.

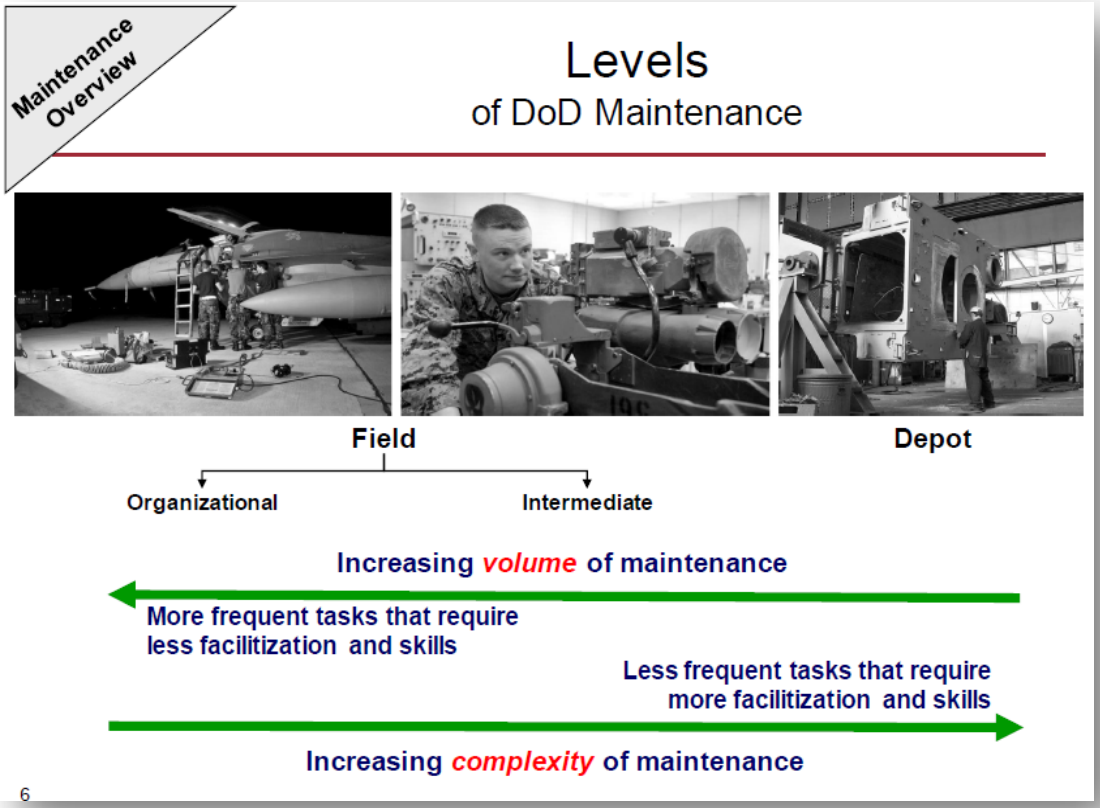


Figure F.F3. Levels of DoD Maintenance

Field-level maintenance is comprised of two sub-levels that perform shop-type work as well as on-equipment maintenance activities at maintenance levels other than depot:

- Intermediate or shop-type work includes: limited repair of commodity-oriented assemblies and end items (e.g., electronic "black boxes" and mechanical components); job shop, bay, and production line operations for special requirements; repair of subassemblies such as circuit boards; software maintenance; and fabrication or manufacture of repair parts, assemblies, and components; and

- Organizational (or on-equipment) maintenance is normally performed by an operating unit on a day-to-day basis to support operations of its assigned weapon systems and equipment. Organizational maintenance encompasses a number of categories, such as inspections, servicing, handling, preventive maintenance, and corrective maintenance. Although no set of financial management systems captures the total cost of field-level maintenance, it is currently estimated to be in the range of $54 billion annually.

Depot-level maintenance entails materiel maintenance requiring the major repair, overhaul, or complete rebuilding of weapon systems, end items, parts, assemblies, and subassemblies; manufacture of parts; technical assistance; and testing. Each military service manages and

operates its own organic depot-level maintenance infrastructure. The bulk of the workload — about three quarters — is associated with ships and aircraft. Aircraft work amounts to more than half of the overall total while ship work accounts for about a third. The remaining work includes missile, combat vehicle, tactical vehicle, and other ground equipment system workloads. For FY2007, the DoD spent over $30 billion for depot-level maintenance and repair work. Approximately 54 percent of the Department's FY 2007 depot-level workload was accomplished in organic facilities; the remainder was done in the private sector — by commercial firms.

The below listing of Maintenance related considerations, issues, and initiatives should be considered and explored by The Product Support Manager during development of the maintenance strategy. Once the system is fielded, it is difficult to change where and how maintenance is performed.

- Depot Level Maintenance considerations:
    - Title 10 Statutory Requirements
    - Public Private Partnering (PPP)
    - 10 USC 2474 Centers of Industrial and Technical Excellence (CITE)
    - 10 USC 2464 Core Logistics Capabilities
    - Depot Source of Repair (DSOR),
    - Joint Depot Maintenance Activities Group (JDMAG)
    - Maintenance, Repair, & Overhaul (MRO)
    - Programmed Depot Maintenance (PDM)
    - Scheduled Depot Level Maintenance (SDLM)

- Maintenance Related Issues, Programs, and Initiatives
    - Condition Based Maintenance Plus (CBM+)
    - Reliability Centered Maintenance (RCM) ,
    - Advanced Diagnostics, Prognostics and Health Management (PHM)
    - Corrosion Prevention and Control
    - Preventative and Scheduled Maintenance
    - Maintenance Data Collection (MDC)
    - Munitions Maintenance & Sustainment
    - Munitions & Explosive Safety
    - Structural Integrity Programs (SIP)
    - Quality Deficiency Reporting (QDR)
    - Product Improvement Programs (PIP)
    - Modifications, Upgrades and Service Life Extension Programs (SLEP)

G. Communities of Interest and Practice

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- The Acquisition Community Connection found at http://acc.dau.mil
- ACQuipedia Library Articles found at https://acquipedia.dau.mil

Administrative Delay Time
Condition Based Maintenance Plus (CBM+)
Corrective Maintenance time
Failure Modes Effects and Criticality Analysis (FMECA)
Fault Tree Analysis (FTA)
Level of Repair Analysis (LORA)
Maintenance Plan
Maintenance Planning
Maintenance Task Analysis (MTA)
Mean Time Between Failure
Reliability Centered Maintenance (RCM) Analysis

- The PM e-Toolkit found at https://acc.dau.mil/CommunityBrowser.aspx?id=18531

The Defense Logistics Agency (DLA) provides a website called "Assist Online" which is a search engine for Data Item Deliverables, found at https://assist.daps.dla.mil/online/start/

Additionally there are many professional organizations which provide critical knowledge supporting Design Interface topics.

SAE International is a global association of more than 128,000 engineers and related technical experts in the aerospace, automotive and commercial-vehicle industries.

Annual Department of Defense Maintenance Symposium & Exhibition is hosted by SAE.

H. Lessons Learned / Best Practices

The Defense Acquisition University's Best Practices Clearinghouse. This clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;

- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

Researching the Defense Acquisition Guidebook on the DAU Website. On the Defense Acquisition University (DAU) Defense Acquisition Guidebook (DAG) website, located at https://dag.dau.mil/Pages/Default.aspx, there is an interactive graphic depicting the DoD Acquisition Lifecycle Framework View with specific acquisition phases and milestone decision reviews highlighted. By moving the cursor onto the graphic, the viewer can click onto the Milestone Review "letter", i.e., A or B or C, and a listing will show itself of each major defense program and major information system program deliverables. Each deliverable is then further hyperlinked to show information regarding its content.

DoD Maintenance Award Programs:

- 2009 Phoenix Award Program
- 2010 Secretary of Defense Field-Level Maintenance Award
- 2010 Robert T. Mason Award for Depot Maintenance Excellence

Additional Information on Depot Maintenance Practices can be found at http://www.acq.osd.mil/log/mpp/depot.html:

- Depot Maintenance Production Workforce
- Title 10 United States Code
- Map of Depot Maintenance Activities
- Depot Profiles
- Homepages of the Depots
- Joint Depot Maintenance Activities Group (JDMAG)
- DA DCSLOG — Army National Maintenance Program
- Financial Management Regulation (FMR), Volume 6A, Chapter 14, Depot Maintenance Reporting

Designation of Centers of Industrial and Technical Excellence

- Air Force Designation of Centers of Industrial and Technical Excellence
- Army Designation of Centers of Industrial and Technical Excellence
- Navy Designation of Centers of Industrial and Technical Excellence

Additional Information on Depot Maintenance Partnerships can be found at http://www.acq.osd.mil/log/mpp/partnering.html

Selected readings on Partnerships:

- Public-Private Partnerships for Depot-Level Maintenance Through the End of Fiscal Year 2006
- DoDI 4151.21 Public-Private Partnerships for Depot-Level Maintenance — April 25,2007
- Public-Private Partnerships for Depot-Level Maintenance Through the End of Fiscal Year 2005
- Changes Published to the DoD Financial Regulation Providing Additional Guidance Supporting Implementation of Depot Maintenance Partnerships
- Partnership Practitioners' Toolbox — Terms and conditions examples and other useful language
- Case Study, "Compendium of Depot Maintenance Public-Private Partnerships,", March 2005
- Electronic Funds Transfer for Payment of DoD Depot Work Performed for Private Entity Partners
- Brochure: DoD Depot Maintenance Capabilities and Services – Public-Private Partnerships
  Is Indemnification a Barrier to Public-Private Partnerships? Study Report By Eric F. Hertzerg, April 2004
- Depot Sales of Goods and Services to Private Parties – Pricing Partnering Agreements Study Report by Clark L. Barker and Robert C. Steans July 2003.
- Public-Private Partnerships for Depot Maintenance Briefing, Office of the Assistant Deputy Under Secretary of Defense (Logistics & Materiel Readiness) Maintenance Policy, Programs & Resources
- Defense Acquisition University "Depot Maintenance Partnering" Self Paced Module. Scroll down to the "Depot Maintenance Partnering" module under "Self-Paced Modules" section."
- Partnership Synopsis - All FY04 and Earlier Partnerships at:
  - Army Depots
  - Navy Depots
  - Marine Corps Depots
  - Air Force Depots
- Public-Private Partnerships for Depot-Level Maintenance Case Study by Steven R. Erickson, March 2002
- Hold Harmless Guidance on Public-Private Business Arrangements Regarding 10 U.S.C. 2563 and 2474

The DoD maintains a community of practice found at the website, https://www.corrdefense.org/CorrDefense%20WebPage%20Content/WhyDoDMustProtectItsAssets.aspx, which addresses policy, regulations and latest practices for corrosion prevention and control.

I. Training Resources

Rapid Deployment Training describes statutory and regulatory updates to DoDI 5000.02
Defense Acquisition University (DAU) 2009 Catalog of Courses (iCatalog)

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

DAU Resident Courses

- LOG 201, Intermediate Acquisition Logistics,
- LOG 350 Enterprise Life Cycle Logistics Management

DAU Distance Learning Courses

- LOG 101, Acquisition Logistics Fundamentals
- LOG 102, Systems Sustainment Management Fundamentals
- LOG 200, Intermediate Acquisition Logistics
- LOG 103, Reliability and Maintainability
- LOG 204, Configuration Management
- LOG 206 Intermediate System Sustainment Management
- LOG 235, Performance Based Logistics (PBL)
- SYS 202, Intermediate Systems Planning, Research, Development and Engineering

DAU Continuous Learning Modules

- CLL001 Life Cycle Sustainment Metrics
- CLL015 Business Case Analysis
- CLL029 Condition Based Maintenance Plus (CBM+)
- CLL002 Defense Logistics Agency Support To The PM
- CLL 022 Depot Maintenance Statutes Overview
- CLL 023 Title 10 U.S.C 2464 Core Logistics Capabilities
- CLL 024 Title 10 U.S.C 2466 Limitations on the Performance of Depot-level Maintenance (50/50
- CLL026 Depot Maintenance Capacity Measurement
- CLL025 Depot Maintenance Interservice Support Agreement
- CLL006 Depot Maintenance Partnering
- CLL008 Designing for Supportability in DoD Systems
- CLL020 Independent Logistics Assessments (ILA)
- CLL016 Joint Logistics
- CLL004 Life Cycle Logistics For The Rest Of Us
- CLL011 Performance Based Logistics (PBL)
- CLL030 Reliability Centered Maintenance (RCM)

J. Key References

PSM's should check with their respective DoD Component / Agency for further guidance.

- DoD 7000.14-R, Vol. 6, Chapter 14 (Depot Maintenance Reporting)
- DoD 4151.20, Depot Maintenance Core Capabilities Determination Process — January 5, 2007
- DoD 4151.18-H, Depot Maintenance Capacity and Utilization Measurement — March 10, 2007
- DoDD 4151.18, "Maintenance of Military Materiel", Mar 31, 2004
- DoDI 4151.19, "Serialized Item Management (SIM) for Materiel Maintenance", Dec 26, 2006
- DoDI 4151.22, Condition Based Maintenance Plus (CBM+) for Materiel Maintenance — December 2, 2007
- DoDI 4151.21, Public-Private Partnerships for Depot-Level Maintenance — April 25, 2007
- DoDI 1348.30, Secretary of Defense Maintenance Awards Program — October 16, 2009
- DEPSECDEF Depot Maintenance Production Workforce memo — October 12, 2001
- Defense Acquisition Guidebook, Chapter 5 plus numerous other locations
- CBM+ references include the DoDI 4151.22, the CBM+ Guidebook, the CBM+ DAU Continuous Learning Module (CLL029), CBM+ Guidebook, The Condition Based Maintenance Plus DoD Guidebook, May 2008
- Joint Depot Maintenance Program references are OPNAVINST 4790.14A, AMC-R 750-10, AFI 21-133(I), MCO P4790.10B, DLAD 4151.16, "Logistics, Joint Depot Maintenance Program"
- USC 10, Section 2208(h): Sales
- USC 10, Section 2460: Definition of Depot Level Maintenance
- USC 10, Section 2464, Core Logistics Capabilities
- USC Title 10, Section 2466: Depot Level Maintenance Limitations AR 750-1, Army Materiel Maintenance Policy, Sept 20, 2007
- USC Title 10, Section 2469: $3M Rule (Competition)
- USC Title 10, Section 2474: Centers of Industrial and Technical Excellence
- USC 10, Section 2539b: Services
- USC 10, Section 2563: Direct Sales / Depot Subcontracting
- USC 10, Section 2667: Leasing
- USC 10, Section 2754: Sales or Lease of Articles or Services
- USC 10, Section 2770: Sales of Articles or Services
- USC 10, Section 4543: Sales (Army)
- USC 10, Section 7300: Navy Shipyard Sales
- MIL-HDBK-470A Designing and Developing Maintainable Products and Systems DTD Aug 4, 1997
- DAU Acquipedia Articles
    - eLog21 Fact Sheet - Repair Enterprise 21 (RE21)
    - Operations & Maintenance Funds
    - Maintenance Task Analysis (MTA)
    - Level of Repair Analysis (LORA)

- Reliability Centered Maintenance (RCM)
- https://acc.dau.mil/CommunityBrowser.aspx?id=18073&lang=en-US, "Sustainment"
- https://acc.dau.mil/CommunityBrowser.aspx?id=22449, "Maintenance Management"

- GAO Report 04-305R, Nov 6, 2003; "Defense Logistics: Preliminary Observations on the Effectiveness of Logistics Activities during Operation Iraqi Freedom".

U.S. Army

- AR 750-6, Army Equipment Safety and Maintenance Notification System, Feb 3, 2009
- AR 750-10, Army Modification Program, Feb 24, 2006
- AR 750-43, Army Test, Measurement and Diagnostic Equipment, Nov 3 2006
- AR 750-59, Army Corrosion Prevention and Control Program, Dec 9, 2005
- DA PAM 738-751, Functional Users Manual for the Army Maintenance Management System Aviation (TAMMS-A)
- DA PAM 750-1, Commanders' Maintenance Handbook, Feb 2, 2007
- DA PAM 750-3, Soldiers' Guide for Field Maintenance Operations, Sep 29, 2006
- DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual, Aug 22, 2005
- DA PAM 750-43, Army Test Program Set Implementation Guide, Jun 28, 2006
- FM 4-30.31, "Recovery and Battle Damage Assessment and Repair

U.S. Air Force

- AFI 21-113, "Air Force Metrology and Calibration Management"
- Air Force Technical Order 00-20-2, "Maintenance Data Documentation" available at http://www.tinker.af.mil/technicalorders/index.asp
- Air Force Logistics Management Agency (AFLMA) On-Line Logistics Resources - X

U.S. Navy

- U.S. NAVAIR site, http://www.navair.navy.mil/logistics/padhm/index.cfm, hosts the Prognostics, Advanced Diagnostics and Health Management (PADHM)
- OPNAV Instruction 4790.2J "The Naval Aviation Maintenance Program (NAMP)"
- OPNAVINST 3960.16 Series, "Navy Test and Monitoring Systems (TAMS)"
- NAVAIRINST 13640.1 Series, "Naval Aviation Metrology and Calibration Program"
- MCO 4733.1 Series, "Marine Corps Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Maintenance Program (CAMP)

6.0 Packaging, Handling, Storage, and Transportation (PHS&T)
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6.0. Packaging, Handling, Storage, and Transportation (PHS&T)

6.0.1. Objective

Identify, plan, resource, and acquire packaging / preservation, handling, storage and transportation (PHST) requirements to maximize availability and usability of the materiel to include support items whenever they are needed for training or mission.

6.0.2. Description

PHS&T is the combination of resources, processes, procedures, design, considerations, and methods to ensure that all system, equipment, and support items are preserved, packaged, handled, and transported properly, including environmental considerations, equipment preservation for the short and long storage, and transportability. Some items require special environmentally controlled, shock isolated containers for transport to and from repair and storage facilities via all modes of transportation (land, rail, air, and sea).

Packaging, Handling, Storage and Transportation (PHS&T) focuses on the unique requirements involved with packaging, handling, storing and transporting not only the major end items of the weapon system but also spare parts, other classes of supply, infrastructure items, and even personnel. The requirements and constraints which a military environment imposes on these activities can significantly impact availability, reliability and life cycle costs of the weapon system. Care must be taken to ensure PHS&T objectives are applied to the entire system and not just the spare and repair parts, unfortunately this constrained application happens quite often. Additionally, PHS&T items may require their own life cycle support, such as maintenance of re-usable containers or special storage facilities similar to those required for explosives.
PHS&T is defined by its functional areas:

Packaging**:** provides for product security, transportability, storability, with the added utility of serving as a medium of communication from the producer to the user. The nature of an item determines the type and extent of protection needed to prevent its deterioration. Shipping and handling, as well as the length and type of storage considerations, dictate materials selected for preservation and packing (P&P).

- Handling**:** involves the moving of items from one place to another within a limited range and is normally confined to a single area, such as between warehouses, storage areas, or operational locations, or movement from storage to the mode of transportation.

Storage**:** infers the short or long term storing of items. Storage can be accomplished in either temporary or permanent facilities.

Transportation**:** the movement of equipment and supplies using standard modes of transportation for shipment by land, air and sea. Modes of transportation include cargo, vehicle, rail, ship and aircraft.

Product Support Manager Activities

6.1. Packaging

Packaging**:** provides for product security, transportability, storability, with the added utility of serving as a medium of communication from the producer to the user. The nature of an item determines the type and extent of protection needed to prevent its deterioration. Shipping and handling, as well as the length and type of storage considerations, dictate materials selected for preservation and packing (P&P).

The requirements for product packaging are derived from the item's characteristics and the Warfighter's need in a military distribution environment. The overarching performance requirement is to ensure the protection and preservation of items of supply during handling, transport and storage. The CONOPS and projected operational environment will influence these requirements. The operational parameters that describe the need are most commonly expressed in environmental and logistics terms. DLA recommends The Product Support Manager and contractors review the guidebooks located on their packaging website at http://www.dscc.dla.mil/Offices/Packaging/newcomertips.html. The Defense Contract Management Agency's (DCMA's) packaging website is http://guidebook.dcma.mil/50/index.cfm.

DoD 4140.1-R has several appendices devoted to packaging instructions related to preservation, levels of packaging, a charter for the Defense Packaging Group, an a description of the DoD awards program for excellence in packaging.

6.1.1. Marking

The proponent office is OSD Defense Procurement and Acquisition Policy (DPAP), website found at https://acc.dau.mil/CommunityBrowser.aspx?id=24469

Product marking uses MIL-STD-130N as a set of standards followed by the Department of Defense concerning the proper requirements and methods of marking, identifying, and keeping track of military property in their possession. This includes anything that is produced, stocked, stored, or issued by or for the Department of Defense.

The implantation and the marking of Unique Identification (UID) to the DoD recognized items principally aim at keeping track of items from the point of production and through the strategic item management process. The items that come under the scope of UID marking program include item in operational use, in inventory or undergoing depot maintenance along with new solicitations, items procured under ongoing contracts, and the Government-furnished property in the possession of contractors.

Manufacturers using the standards of the CEA (Consumer Electronics Association) should mark all items in accordance with the MH10.8.7 and CEA-706 standards as applicable. Although this protocol allows for other manufacturer codes, a CAGE (Commercial and Government Entity) code accompanied by the appropriate Data Identifier is recommended as the manufacturer ID. Manufacturers using the standards of GS1 should mark all items in accordance with the GS1 standards as applicable.

For DoD actions that directly support NASA (National Aeronautics and Space Administration), the marking standards of NASA shall be implemented. These standards can be found in NASA-STD-6002; a detailed how-to guide for implementing these standards can be found in NASA-HDBK-6003.

MRI protocols other than those listed above should be approved by USTRANSCOM TCJ5/4-I Asset Visibility Division.

UID Standard Policy involves two processes. The first process involves item marking and the second process involves delivering data about items as part of the acceptance and delivery process. The unique item or UID marking consists of a unique 2-Dimensional data matrix symbol which consists of Serial Number, Part Number, and **CAGE Code** for every product. This 2-D data matrix symbol can done by dot peen, ink jet, durable polyester, chemical etch or laser mark.

For items that are under the control of the Department of Defense and subject for marking, there are many specifications that must be met for a proper mark. These requirements state that all marking must be applied to a metal or stiff plastic identification plate, identification band, identification tag, or identification label that is securely fastened to the item. Additionally, the marking may even be applied directly to the surface of the item itself – provided of course it can still meet the requirements

Key References

- MIL-STD-105, Sampling Procedures and Tables for Inspection by Attributes (withdrawn) and replaced by MIL-STD-1916, "DoD Preferred Methods for Acceptance of Product" (available online at http://assist.daps.dla.mil)
- MIL STD 129P, a standard is used for maintaining uniformity while marking

- MIL STD 130, a standard that is mandated by the DoD for any item to be UID Compliance
- MIL-STD-498, on software development and documentation, canceled on May 27, 1998 and replaced by J-STD-016 and IEEE 12207

UID Standard Policy requirement criteria**:**

- All items whose acquisition cost is $5,000 or more;
- For all DoD-recognized UID equivalent items available;
- When program manager determines that UID is required or when UID is a component of a delivered item;
- Items are mission essential, controlled inventory piece of equipments, serially managed, repairable items, or consumable items where permanent identification is required;
- UID Standard Policy goes beyond marking and traceability.

6.1.2. Re-Usable Packing Material

Per DoD 4140.1-R, "DoD Supply Chain Materiel Management Regulation", incorporate environmental pollution prevention measures into packaging standards, specifications, and other instructions and processes. The design and selection of packaging materials shall include consideration of disposability, reuse, biodegradability (when it meets logistics needs), recycling, and conservation.

6.1.3. Environmental Control

An essential step to designing a cushioned package system is to determine the severity of the environment in which it will be shipped. The general idea is to evaluate the method of distribution to determine the hazards which exist and the levels at which they are present. These hazards may include such things as accidental drops during handling, vehicle vibration, shock inputs, temperature extremes, humidity levels, and compression loads during storage. A key reference is MIL-STD-2073-1D, Notice 1, 10 May 2002, "DoD Standard Practice For Military Packing".

6.1.4. Physical and Static Shock

For controlling shock to items during PHS&T, DLA has a website and helpdesk for basic packaging standards and specifications located at http://www.dscc.dla.mil/Offices/Packaging/specstds.html. Per DLA's website, The Product Support Manager is also referred to MIL-STD-2073 1D, "Standard Practice for Military Packaging Requirements." (15 December 1999). This document outlines standard processes for the development and documentation of military packaging, as distinct from commercial packaging. This standard covers methods of preservation to protect material against environmentally induced corrosion and deterioration, physical and mechanical damage, and other forms of degradation during storage, multiple handling, and shipment associated with the military distribution system.

6.1.5. Security Classification

Classified cargo requires protection in the interest of national security. Classified cargo shipments have characteristics that require them to be identified, accounted for, secured, segregated, or handled in a special way to ensure their safeguard or integrity. Sensitive cargo is

cargo that could threaten public safety if it is compromised. Sensitive cargo must be properly secured and identified so sufficient security can be provided. For more information, The Product Support Manager should contact the DLA Packaging helpdesk for latest references and guidelines.

6.2. Handling

Handling**:** involves the moving of items from one place to another within a limited range and is normally confined to a single area, such as between warehouses, storage areas, or operational locations, or movement from storage to the mode of transportation.

Material handling is the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. The focus is on the methods, mechanical equipment, systems and related controls used to achieve these functions. The material handling industry manufactures and distributes the equipment and services required to implement material handling systems. Material handling systems range from simple pallet rack and shelving projects, to complex conveyor belt and Automated Storage and Retrieval Systems (AS/RS). Material handling can also consist of sorting and picking as well as automatic guided vehicles.

The topic of handling within the DoD is addressed under multiple topic areas, to include shelf life, marking/IUID, transportation, and packaging. There is no specific set of policy or regulations on the more general topic of "Handling". The regulations are also broken out by Classes of supply and special categories of items such as food perishables, chemical weapons, ammunition, etc. The Product Support Manager is referred to their organization's guidelines for handling specific classes of items.

6.2.1. Handling Processes

Per DoD 4140.1-R, "DoD Supply Chain Materiel Management Regulation", the DoD Components shall package materiel to provide adequate and quality protection at a fair and reasonable cost and to ensure efficient and cost-effective handling. The DoD Components shall use packaging designed to accommodate unitized or containerized loading and handling when it results in overall economy.

In the absence of specific contract requirements, commercial packaging shall provide protection and preservation for the safe delivery of the item to the shipping destination and for storage at destination in enclosed facilities. Extraordinary preservation requirements shall be contractually specified, in advance of each contract award. Safe delivery shall be deemed to mean no damage to the contents of the package. Damage to the packaging is permissible provided that the integrity of the package remains sufficient to permit reasonable handling and storage at destination.

Storage activity personnel should be evaluated on the timely and accurate handling of issues and receipts. Performance matrices shall allow for separate processing standards based on the type of issue (material release, redistribution and/or disposal order); and source of receipt (e.g., New procurement, returns and/or stock redistribution).

6.2.2. Special Materials Handling

The DoD has many policies and instructions / guidance for special materials handling, especially for those classes of supply which create hazards such as class III (petroleum, oils and lubricants) and class V (ammunition).

Hazardous materials storage and handling policies and procedures shall be as uniform as possible. The DoD Components shall follow hazardous materials guidelines and policies set forth by the Department of Defense and their respective headquarters.

The DoD Components shall reduce hazardous materials use and long-term storage as much as possible. PSMs should check with their safety offices, shipping and transportation offices, Office of Safety and Health Administration (OSHA), and suppliers for current information regarding the handling of all materials.

DoD 4140.1-R, Appendix 15, contains instructions regarding preservation. Preservation designed to protect an item during shipment, handling, indeterminate storage, and distribution to consignees worldwide. This regulation also contains instructions on best practices and outcome-oriented processes for handling such as:

- Ensure that storage location assignments use zoned locations, frequency of access criteria, special handling, and security requirements to optimize physical storage and picking;
- Seek to enhance, where appropriate, automatic material handling capabilities at all storage locations to ensure timely, safe, and secure movement and storage of material.

6.2.3. Licenses / Certifications

Licenses and certifications in the area of handling can be for (below list includes selected examples only):

- Packaging: Hazardous materials packaging testing shall include all Title 49 CFR requirements or the applicable Competent Authority decisions for the affected item's hazard class; A Certificate of Equivalency (COE) is an approval issued by DoD in accordance with procedures prescribed in Appendix C in instances where a packaging design differs from the prescribed regulations in 49 CFR. A COE certifies that the proposed packaging design equals or exceeds the comparable requirements of 49 CFR for the commodity being shipped. Requests for COE's must be submitted to the DoD Component listed in Appendix D.
- Equipment: licensing on special handling equipment such as forklifts and cranes;
- Personnel: special training to certify that personnel are knowledgeable of the Hazardous Materials Transportation Act (HMTA) and the Resource Conservation and Recovery Act (RCRA) as it applies to the generation, transportation, and disposal of hazmat, focusing upon hazardous waste. It enables employers to certify that as required by 49 CFR 172 Subpart H, that their employees have been trained and tested on general awareness and function specific elements;
- Security and information assurance: Department of Defense Directive 8570 (DoDD 8570) provides guidance and procedures for the training, certification, and management of all government employees who conduct Information Assurance functions in assigned duty positions. These individuals are required to carry an approved certification for their particular job classification;

- Transportation urgency of need designations: Ensure that the assignment of priority designators is valid and accurate, and consistent with FADs assigned by higher authority as well as the existing urgency of need. Additionally, they must ensure that required delivery dates that are assigned to requisitions are valid. Similarly, commanding officers of international logistics control offices that receive requisitions from MAP requisitioners are responsible for review of assigned priority designators and delivery dates. Personally review, or delegate in writing to specific personnel the authority to review, all requirements that are assigned an urgency of need designator (UND) A on the basis of an inability to perform a mission. That review shall be done before the transmission of requisitions to the source of supply; and in cases in which the assignment of UND A is sustained; it constitutes a certification that the assignment is correct;
- Other areas.

6.3. Storage

Storage**:** infers the short or long term storing of items. Storage can be accomplished in either temporary or permanent facilities. All DoD Components maintain inventory and store items.

Storage standards are developed by each DoD Component and are published and maintained by the responsible organization. Storage standards provide mandatory instructions for the inspection, testing and/or restoration of items in storage; encompassing storage criteria, preservation, packaging, packing and marking requirements, and time-phasing for inspection during the storage cycle to determine the materiel serviceability and the degree of degradation that has occurred. These standards are used by DoD, GSA and other Storage Activities (SAs) to ensure that such materiel is maintained in a ready-for-issue status. For example, the joint publication (multiple designators) DLAD 4155.37 AR 702-18
NAVSUPINST 4410.56A AFJMAN 23-232 MCO 4450.13A, March 10, 2004, “MATERIEL QUALITY STORAGE STANDARDS POLICY FOR SHELF-LIFE MATERIEL”, prescribes uniform policies, responsibilities, and guidance for the development, preparation, publication, and maintenance of storage standards for Military Services (U.S. Army, U.S. Navy, U.S. Air Force, and U.S. Marine Corps), Defense Logistics Agency (DLA), General Services Administration (GSA), Federal Aviation Administration (FAA) and U.S. Coast Guard (USCG) managed shelf-life materiel. The guidelines contained provide the principles for quality assurance techniques to be used when performing surveillance of shelf-life materiel in storage; determining the condition of shelf-life materiel during storage and upon shipment; and the inspection, testing, or restorative actions required to maintain and to return shelf-life stocks to a ready-for-issue status.

The DoD Components also maintain storage facilities dedicated to a special purpose. For example, the Aerospace Maintenance And Regeneration Group (AMARG) is a joint service facility managed by the US Air Force Material 309th Aerospace Maintenance and Regeneration Group, under the 309th Maintenance Wing located at Hill Air Force Base, Utah. Often referred to as 'The Boneyard', AMARG is an aerospace storage and maintenance facility adjoining Davis-Monthan Air Force Base which provides a service to all branches of the US military (Air Force, Navy, Marines, Coast Guard and Army), as well as other national agencies. Occupying 2,600 acres of desert southwest and renowned for its impressive footprint of 4,400 military aircraft within the Tucson city limits, the center will continue to use its widely recognized and legacy name "AMARC" in some circumstances. Many of the stored aircraft can be returned to an

operational status in a short period of time and there is a continual process of anti-corrosion and re-preservation work which keeps the aircraft in a stable condition during their stay. The website is found at http://www.amarcexperience.com/AMARCDescription.asp.

6.3.1. Shelf Life

Shelf-Life is the total period of time beginning with the date of manufacture, cure, assembly, or pack (subsistence only), that an item may remain in the combined wholesale (including manufacturer's) and retail storage systems, and still remain usable for issue and/or consumption by the end user.

Each item that meets the shelf-life criteria is assigned a National Stock Number (NSN) and a specific shelf-life code. Typical shelf-life items include food, medicines, batteries, paints, sealants, adhesives, film, tires, chemicals, packaged petroleum products, hoses/belts, mission-critical o-rings, and Nuclear/Biological/Chemical equipment and clothing.

The Shelf-Life code identifies the shelf-life time period by which an item must be used, or subjected to inspection/test/restoration or disposal action. These codes are identified in Appendix A of the DoD 4140.27-M, and consist of two types, Type I and Type II. Type I is an individual item of supply which is determined through an evaluation of technical test data and/or actual experience, to be an item with a definite non-extendible period of Shelf-Life, and ends with the expiration date. Type II is an individual item of supply having an assigned shelf-life time period that may be extended after completion of inspection, test, or restorative action, and is identified by an inspection/test/date.

The policies for optimizing shelf-life materiel are contained in DoD 4140.27-M, Shelf-Life Management Manual, as authorized by DoD Directive 4140.1, Materiel Management Policy. This policy provides for the supply chain (life-cycle management) of standard and hazardous shelf-life items contained in the federal supply system.

Shelf-life management for hazardous material follows the same procedures as those for any shelf-life items, except that hazardous material should receive priority processing over non-hazardous material. Issues and guidelines concerning the acquisition, storage, handling, transportation, and disposal of hazardous material are addressed in Chapters 3 and 5 of DoD Regulation 4140.1-R, DoD Materiel Management Regulation. Class I perishable subsistence, Class III bulk petroleum, Class V ammunition, and Class VIII-B blood, are excluded from this Manual and shall continue to be managed in accordance with existing regulations. Commodities excluded from this Manual may be represented by their respective DoD Component to the DoD Shelf-Life Board.

Shelf life considerations are critical in all phases of the life cycle. Early planning identifies special requirements and risk related to shelf life. Engineering inputs can help to mitigate risks associated with items having a very short shelf life or needed special storage considerations. Sustainment planning determines the resources and infrastructure necessary to implement a logistical capability for designated items.

Storage requirements are based on an item's characteristics and usage requirements. Typically the functional subject matter experts, in partnership with the operational users and with advisory from manufacturers, will determine optimal storage criteria for weapon system items.

Best practices for storage are focused on product categories, i.e., Batteries, fresh produce, medical items, hazardous or dangerous items, etc. There are no generic best practices for the broader category of "storage". Please research storage practices based on the specific class of supply or individual item characteristics.

6.3.2. Short and Long Term Preservation

The purpose of preservation is to protect the item being prepared for shipping from deterioration due to corrosion, physical damage, or other types of deterioration. Short vs. Long term preservation requirements are defined in MIL-P-116 Methods of Preservation and depend upon the departure point, destination and mode of transportation (e.g., aircraft, truck, ship, and rail).

6.3.3. Storage Infrastructure

Storage infrastructure refers to the physical property, i.e., buildings, shelving, magazines, information technology hardware, land, etc., for both short and long term storage of all classes of supply. Storage infrastructure is provided by both organic DoD assets and industry assets. A good source for technical information on storage facilities is found at The National Institute for Building Sciences Whole Building Design Guide, website at http://www.wbdg.org/.

The DoD has a designation, Defense Critical Infrastructure (DCI) that refers to the composite of DoD and non-DoD assets essential to project, support, and sustain military forces and operations worldwide. DCI is a combination of task critical assets and defense critical assets. A critical asset is an asset of such extraordinary importance to operations in peace, crisis, and war that its incapacitation or destruction would have a very serious, debilitating effect on the ability of the Department of Defense to fulfill its missions. An asset in this definition is a distinguishable entity that provides a service or capability. Assets are people, physical entities, or information located either within or outside the United States and employed, owned, or operated by domestic, foreign, public, or private sector organizations. Coordination on the risk management of defense critical infrastructure (DCI) shall be accomplished with other Federal departments and agencies; State, local, regional, territorial, and tribal entities; the private sector; and foreign countries, as appropriate. Reference is DoDD 3020.40, January 14, 2010, "DoD Policy and Responsibilities for Critical Infrastructure".

6.4. Transportation

Transportation is the movement of equipment and supplies using standard modes of transportation for shipment by land, air and sea. Modes of transportation include cargo, vehicle, rail, ship and aircraft.

Defense transportation is a world class, globally capable, intermodal transportation system that is responsive, efficient, fully integrated, and in partnership with commercial partners to ensure military readiness, sustainability and improved quality of life for service members, their families and civilian employees. Transportation planning needs to start as early during concept and

analysis as possible. Often critical problems result when a system cannot be shipped due to weight, volume, hazardous materials, or special packaging requirements.

USTRANSCOM's mandate as DoD's Distribution Process Owner (DPO) is to improve the overall efficiency and interoperability of DOD distribution related activities - deployment, sustainment, and redeployment support during peace and war. To accomplish this, a Governance Structure was established to prioritize and implement improvements to the DOD's distribution system. The key elements of the Governance Structure are the DPO Executive Board, chaired by the Commander of USTRANSCOM; the Distribution Transformation Task Force, chaired by the Deputy Commander of USTRANSCOM; and the Distribution Steering Group, co-chaired by the USTRANSCOM Director of Strategy, Policy, Programs, and Logistics; the Defense Logistics Agency Director of Logistics Operations; and the USTRANSCOM Director of Command, Control, Communications and Computer Systems.

6.4.1. Distribution

USTRANSCOM's mandate as DoD's Distribution Process Owner (DPO) is to improve the overall efficiency and interoperability of DOD distribution related activities - deployment, sustainment, and redeployment support during peace and war. To accomplish this, a Governance Structure was established to prioritize and implement improvements to the DOD's distribution system. The key elements of the Governance Structure are the DPO Executive Board, chaired by the Commander of USTRANSCOM; the Distribution Transformation Task Force, chaired by the Deputy Commander of USTRANSCOM; and the Distribution Steering Group, co-chaired by the USTRANSCOM Director of Strategy, Policy, Programs, and Logistics; the Defense Logistics Agency Director of Logistics Operations; and the USTRANSCOM Director of Command, Control, Communications and Computer Systems.

The DPO Governance Structure membership consists of logisticians from the Office of the Secretary of Defense, Military Services, Combatant Commands, and DOD Agencies. These organizations are the collaborative network of partners comprising the Joint Deployment & Distribution Enterprise Community of Interest (JDDE COI) as described in DoDI 5158.06. The JDDE COI share common distribution-related goals, interests, missions, and business processes that are focused on supporting the end-to-end supply chain needs of the Warfighter.

USTRANSCOM's three component commands -- the Army's Military Surface Deployment and Distribution Command, Scott AFB, Ill.; the Navy's Military Sealift Command, Washington, D.C.; and the Air Force's Air Mobility Command, Scott AFB, Ill. -- provide intermodal transportation across the spectrum of military operations.

6.4.2. Transportation Modes

Transportation is defined as the movement of equipment and supplies using standard modes of transportation for shipment by land, air and sea. Modes of transportation include vehicle, rail, ship and aircraft.

The PM is encouraged to determine the best overall support strategy for the customer to include the use of all available transportation alternatives, including those provided by original equipment manufacturers (OEMs), third party logistics providers, or commercial transportation providers. These alternatives may include the use of commercial transportation services and facilities to the maximum extent practicable; the use of organic transportation consistent with military needs; or the combination of both commercial and organic transportation to support customer requirements. Regardless of the approach taken, when making the transportation source decision the PM needs to ensure the entire end-to-end chain is considered including the "last mile" aspects along with any required implementing technology (e.g., IUID).

In considering transportation options, the PM should also plan for transition of the supply and distribution chain from normal operations to expeditionary operations in austere locations that are not served, at least initially, by commercial transportation services and facilities. Transportation alternatives in contractual arrangements must require the contractor to comply with established business rules, when the DoD organic distribution system is used in lieu of or with the commercial transportation service. All contractual arrangements requiring that deliveries be made using door-to-door commercial transportation must include a provision that requires vendors to notify the contracting officer or the contracting officer's designee when they are unable to use door-to-door commercial transportation and to request alternate shipping instructions. The contracting officer or contracting officer's designee must expeditiously provide alternate shipping instructions and make the appropriate contract price adjustments. For additional information, see the on-line Defense Transportation Policy Library.

6.4.3. Hazardous Cargo

PSMs should refer to DoD 4500.9-R, Defense Transportation Regulation, Part 2, and DoD Manual 5100.76-M, This PDF is only current as of the date listed on the cover sheet. Find the current, authoritative Defense Acquisition Guidebook (DAG) online at https://dag.dau.mil. Use the online version of the DAG whenever possible, and if needed, check the site for updated information frequently. Please visit https://dag.dau.mil to get the current version of this guidance. Page Number 474,
Physical Security of Sensitive Conventional Arms, Ammunition and Explosives (AA&E), for transportation and security criteria regarding the movement of arms, ammunition, and explosives. Contract provisions should apply to the prime contractor and all subcontractors.

Handlers, packers, inspectors, and preparers (certifiers) of hazardous materials comply with rules designed to maximize safety and security of the aircraft, aircrew, cargo and passengers. They

must know the exceptions, exemptions, and waivers to federal laws and related government directives that are unique to military airlift operations and how to apply them.

6.4.4. Frustrated Cargo

Any shipment of supplies and/or equipment that, while en route to destination, is stopped prior to receipt and for which further disposition instructions must be obtained.

The DoD has determined that frustrated cargo is a serious issue. The Defense Logistics Agency (DLA), in partnership with the U.S. Transportation Command (TRANSCOM), the Department of Defense (DoD) Distribution Process Owner, has taken on the task of eliminating frustrated freight that often occurs with vendor shipments to locations outside of the continental United States.

Collaborating with DLA and TRANSCOM are the Office of the Secretary of Defense, the Joint Staff, the U.S. Joint Forces Command, the DoD Government Purchase Card (GPC) Project Management Office, the military services, and the General Services Administration (GSA). Problems ranging from illegible, incomplete, or missing military shipping labels (MSLs) to poor coordination among contractors, GPC holders, and their transportation support offices can cause delays or "frustrations" along the transportation supply chain and sometimes result in shipments that never reach the intended recipients. However, an analysis conducted in 2004 of frustrated cargo destined for locations outside the United States showed that incorrectly prepared MSLs account for 98.8 percent of the problems. Although policies and procedures already in effect provide guidance on shipping information requirements, the problem appears to lie in a lack of knowledge, misuse, or avoidance of these procedures among users.

6.4.5. Containerization

A robust Defense Transportation System (DTS) is modern, flexible, and capable of projecting military power anywhere in the world. To achieve this capability, the Department of Defense will integrate military, commercial, alliance, and host-nation resources to the maximum extent possible. DoDI 4500.57, March 18, 2008, “Transportation and Traffic Management” and the references contained therein provide implementation guidance for transportation requirements and container utilization.

All DoD Components and Agencies have strict guidelines for container utilization and re-utilization. The Department of Defense has established a computerized Container Design Retrieval System (CDRS) for the purpose of precluding the proliferation of long-life reusable specialized containers and containerized pallets. CDRS is a computerized repository of over 6000 specialized containers. CDRS contains details for each container including size, weight, items carried, fragility level, drawings, location(s) of containers, quantity available, container item managers and more. The following DoD documents Army Regulation 700-15; NAVSUPINST 4030.28E; AFJMAN 24-206; MCO 4030.33E; DLAR 4145.7 mandates that CDRS be utilized when programs require a specialized reusable long life container for an item. Contractual direction is given in AFMCFARS Part 5347.305-10(96) and the recommended contract clause is given in AFMCFARS 5352.247-9010.

PHS&T in the Life Cycle

A. Purpose

Packaging, Handling, Storage and Transportation (PHS&T) focuses on the unique requirements involved with packaging, handling, storing and transporting not only the major end items of the weapon system but also spare parts, other classes of supply, infrastructure items, and even personnel. The requirements and constraints which a military environment imposes on these activities can significantly impact availability, reliability and life cycle costs of the weapon system. Care must be taken to ensure PHS&T objectives are applied to the entire system and not just the spare and repair parts, unfortunately this constrained application happens quite often. Additionally, PHS&T items may require their own life cycle support, such as maintenance of re-usable containers or special storage facilities similar to those required for explosives.

Examples of unique military requirements include storage of materiel in extreme environments for long periods of time, transport into and out of remote regions where commercial carriers are not present, international customs and inspection requirements, and the routine shipping of dangerous and hazardous items.

PHS&T is one of the twelve Integrated Product Support Elements. The activities occurring within the scope of this area should be integrated with other product support element areas in keeping with KPP and KSA optimization goals and constraints.

a. Why PHS&T is Important

The outcomes of PHS&T activities directly impact the Key Performance Parameter of Availability through logistics delays in a number of ways:

- Transportation problems where items are delayed, or more significantly, cannot be shipped due to physical or regulatory restrictions;
- Storage issues where shelf life has expired or improper storage has caused degradation of the product;
- Poor packaging resulted in lost items during shipping;
- Incorrect handling resulted in damage to the item being shipped.

Since all items, even software data, are subject to PHS&T requirements and considerations, The Product Support Manager must ensure that PHS&T is given thorough consideration starting early in the design process.

Historically, PHS&T activities were the primary responsibility of the manufacturing group, with PHS&T sustainment being planned and implemented often under separate contract line items and separate management.

b. Summary of Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information.

Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

Note that the Logistics Analysis (LA), also known as an independent logistics analysis, is part of **each** Milestone Decision Package and is a requirement for type classification.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Packaging, Handling, Storage and Transportation (PHS&T) IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, includes in the left column a listing of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	**PHS&T Major Activities**
User Need / Technology Opportunities & Resources	The Product Support Manager must be able to understand and forecast PHS&T requirements to actual product support sustainment activities and outcomes. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Key Products: • Requirements • Metrics • PHS&T strategy
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. The initial PHS&T strategy is developed in this phase to include the impacts of anticipated PHS&T issues on initial sustainment cost estimates, the initial Life Cycle Sustainment Plan (LCSP) and related sustainment metrics. Analysis includes the approach for implementing enabling sustainment technologies to implement the product support strategy and achieve the sustainment metrics. Risks to achieving the necessary support structure for the time frame of the program by IOC should be identified and a mitigation strategy outlined. The specific PHS&T processes and

	infrastructure should be identified. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of Milestone Decision Review required documents. Key Products: • PHS&T strategy
Technology Development	At Milestone B, the LCSP evolves into a detailed execution plan for how the product support package is to be designed, acquired, sustained, and how sustainment will be applied, measured, managed, assessed, modified, and reported from system fielding through disposal. The elements of PHS&T appropriate to a given program must be considered by Life Cycle Logisticians, System Engineers and Program Managers during development of the product support strategy. This "upfront and early" integrated effort is required in order to increase Ao and reduce costs. The Product Support Manager is required to also provide information on many other acquisition documents as listed below under deliverables and the DAU site, https://dag.dau.mil/Pages/Default.aspx. Key Products: • PHS&T Plan to include organizations, technologies, metrics, and risk identification.
Engineering & Manufacturing Development	It is during this phase that the impacts of PHS&T requirements and constraints onto system sustainment are validated through test results and supplier provided data. Any final engineering changes as a result of PHS&T considerations must be implemented no later than this phase to achieve maximum benefit. By Milestone C, the LCSP describes the content and implementation status of the product support package. Significant changes may be required to the product support package to achieve the objective sustainment metrics including major support provider changes. As the program matures, PHS&T processes, metrics, enabling technologies and the organizations providing the capability are assessed. The detail and focus will vary depending on the life-cycle phase but in all cases the information should be in sufficient depth to ensure the acquisition, design, sustainment, and user communities have an early common understanding of the PHS&T requirements, approach, and associated risks. Key Products: • Updated PHS&T plan

Production & Deployment	PHS&T activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, taking part in planning activities that may be on-going already for product improvement, and developing long term plans for PHS&T improvements for both the system and its support infrastructure as part of the LCSP. Fielding occurs during this phase and proof of early planning is now being validated as the system deploys to the operational site. Key Products: • Validation of PHS&T plans • Full implementation of PHS&T activities
Operations & Support	PHS&T continues throughout the system's operations and support phase through multiple avenues which include: 1) new technology refresh activities, 2) modifications and changes to the system due to requirements and constraints, 3) analysis of process effectiveness and efficiency, plus others. The Product Support Manager's responsibility is to continue reviewing system performance while looking for opportunities to improve impacts of PHS&T on both the system itself and on the support infrastructure to optimize cost versus availability. Key Products: • Analysis to improve PHS&T capabilities • Updated PHS&T plans • Implementation of PHS&T improvements

Table 6.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(More information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DI-ILSS-80636, "Transportation Delay Report"
DI-ILSS-80967, "Spares Shipping Data Sheets"
DI-MGMT-80503, "Report of Shipping (Item) and Packaging Discrepancy"
DI-MGMT-80554, "Transportation Discrepancy Report"
DI-MISC-81499, "Packaging Kit Contents List"
DI-PACK-80121B, "Special Packaging Instructions"
DI-PACK-80455, "Packaging Plan"
DI-PACK-80456, "Packaging Test Plan"
DI-PACK, 80457, "Packaging Test Report"
DI-PACK, 80458, "Packaging Cost Analysis"
DI-PACK-80877A, "Transportation Data Report"
DI-PACK-81059, "Performance Oriented Packaging Test Report"

DI-PACK-81582, “Packaging Development Data Report”

C. OSD Proponency, Policy, Regulations and Statutes

Note: please see the References at the end of this section for a more complete list of relevant materials.

a. Proponency

1. Packaging

DoD 4140.1-R, chapter 8 establishes the Defense Packaging Policy Group (DPPG) to assure a uniform DOD approach to implementing packaging policies and packaging training programs. The DPPG is a permanent forum established to develop and recommend changes to policy, guidance, and standardization of packaging throughout the Military Services and the Defense Logistics Agency (DLA).

2. Handling

The topic of handling is addressed under multiple topic areas, to include shelf life, marking/IUID, transportation, and packaging. There is no specific set of policy or regulations on the more general topic of “Handling”, the regulations also broken out by Classes of supply and special categories of items such as food perishables, chemical weapons, ammunition, etc.

3. Storage

The topic of storage is addressed primarily under “warehousing”, a Facilities & Infrastructure topic, or under shelf life (see 6.3.1 below). There is no specific set of policy or regulations on the more general topic of “Storage”.

4. Transportation

Office of the Deputy Under Secretary of Defense (Logistics & Materiel Readiness) Transportation Policy (TP) is responsible for establishing policies and providing guidance to DoD Components for efficient and effective use of DoD and commercial transportation resources. Transportation Policy is organized under the Office of the Deputy Under Secretary for Logistics & Materiel Readiness.

In accordance with DoD Directive 5158.04, United States Transportation Command, the Commander, United States Transportation Command (USTRANSCOM) is the DoD single manager for transportation (for other than Service organic or theater-assigned transportation assets). The U.S. Transportation Command serves as the manager of the transportation

community and is supported by the Military Traffic Management Command, the Military Sealift Command, and Air Mobility Command.

Use of the Defense Transportation System (DTS) is specified as policy in DoDD 4500.09E and DoD 4515.13-R, Air Transportation Eligibility. The Under Secretary of Defense for Acquisition, Technology and Logistics has authority to grant exceptions to DoDD 4500.09E. Requests for Exceptions to Policy for air eligibility will be submitted IAW DoD 4515.13-R, Chapter 10, Special Actions and Procedures.

b. Directives and Regulations

1. Directives

- DoD Directive 4500.09E, "Transportation and Traffic Management ,"Sept. 11, 2007
- DoD Directive 4500.36, "Management, Acquisition, and Use of Motor Vehicles," published Aug. 3, 2004 and updated June 10, 2008
- DoD 4500.43, "Operational Support Airlift (OSA)," Oct. 28, 1996
- DoD Directive 4500.56, "DoD Policy on the Use of Government Aircraft and Air Travel," April 14, 2009, incorporating Change 1, May 11, 2010.
- DoD Directive 4510.11, "Transportation Engineering," Apr. 12, 2004
- DoDD Directive 5101.11, "DoD Executive Agent for the Military Postal Service (MPS)", certified current as of Sept. 5, 2008
- DoD Directive 5129.6, "Exemption Under Title II, Federal Property and Administration Services Act-Transportation and Traffic" Nov. 29, 2004
- DoD Directive 5158.04, "United States Transportation Command (USTRANSCOM)," Sept. 11, 2007

2. Instructions

- DoD Instruction 4500.34, "DoD Personal Property Shipment and Storage Program," July 10, 2006
- DoD Instruction 4500.53, "DoD Commercial Air Transportation Quality and Safety Review Program," Oct. 20, 2008
- DoD Instruction 4500.55, "Civil Reserve Air Fleet (CRAF), Carrier Commercial Access to Military Installations for Non-DoD Operations," Oct. 25, 1995
- DoD Instruction 4500.57, "Transportation and Traffic Management," March 18, 2008
- DoD Instruction 4525.08, "DoD Official Mail Management", Aug. 11, 2006

- DoD Instruction 4540.7, "Operation of the DoD Engineering for Transportability and Deployability Program," Oct. 12, 2004
- DoD Instruction 5158.06, "Distribution Process Owner (DPO)," Sept. 11, 2007

3. Regulations

- The Joint Federal Travel Regulations (JFTR)
- The Defense Transportation Regulations (DTR)
- DoD 4500.36-R, "Management, Acquisition and Use of Motor Vehicles, March 16, 2007"
- DoD 4515.13-R, "Air Transportation Eligibility," November 1994

D. Who Develops, Delivers and Manages PHS&T

6.6.1 Packaging
6.6.2 Handling
6.6.3 Storage
6.6.4 Special Section: Shelf Life
6.6.5 Transportation

a. Packaging

The purpose of product packaging is to provide for product security, transportability, storability, with the added utility of serving as a medium of communication from the producer to the user. The nature of an item determines the type and extent of protection needed to prevent its deterioration. Shipping and handling, as well as the length and type of storage considerations, dictate materials selected for preservation and packing.

1. Packaging Objectives

The major considerations defining the functions and purposes of product packaging are:

- Protection. Design characteristics which shield the package contents against temperature extremes, humidity, aridity, and peculiar climatological elements; shock, compression, puncture, and vibration impacts during movements; and likelihood of pilferage during shipment;
- Labeling and identification. Markings which clearly identify the product, not product safety statements, and assure the purchaser of the standards of quality attributable to the producer and its reputation for achieving levels of expectation;
- Customer safety. Tamperproof features which serve to assure the purchaser that, if there is no indication of violation, the product is in the same form as when it was released from the production line;

- Storability. Features which serve to ensure the optimum shelf life or interval between receipt by the distribution or retailer and issue to the user;
- Transportability. Characteristics of design which accommodate the standard pallet and container utilization configurations for shipment from the producer to the distribution centers and redistribution to the retail activities;
- Environmental factors. Characteristics of the product and product packaging which provide for ease o disposal or recycling after use. So as to conform to ecological and environmental regulations;
- Communication to the customer. Labeling to promote sale of the product, and incorporation of markings and liability disclaimers which rotary warranty stipulations and, if appropriate, warnings of potential hazards associated with the use of the product.

Below is a checklist of major packaging design considerations:

- Protection against rough handling and resulting shocks
- Protection against dirt, dust, moisture, and other contaminants
- Prevention of pilferage and tampering
- Safeguarding of hazardous materials
- Simplification and more efficient piling, warehousing, and inventor control through use of standard shipping units
- Definition of unit of sale
- Provision of product identity and definition of quality, quantity, size, color, etc. – an information function
- Building of convenient and reusable containers
- Relationship to environment in terms of disposability and multipurpose uses
- Facilitation of production and logistics functions

2. Special Section: Marking

Proponent Office. OSD Defense Procurement and Acquisition Policy (DPAP), https://acc.dau.mil/CommunityBrowser.aspx?id=24469

Description. Product marking uses MIL-STD-130N as a set of standards followed by the Department of Defense (DoD) concerning the proper requirements and methods of marking, identifying, and keeping track of military property in their possession. This includes anything that is produced, stocked, stored, or issued by or for the Department of Defense.

When is it used in the life cycle? The implantation and the marking of Unique Identification (UID) to the DoD recognized items principally aim at keeping track of items from the point of production and through the strategic item management process. The items that come under the scope of UID marking program include item in operational use, in inventory or undergoing depot maintenance along with new solicitations, items procured under ongoing contracts, and the Government-furnished property in the possession of contractors.

Who develops it and who reviews it?

Manufacturers using the standards of the CEA (Consumer Electronics Association) should mark all items in accordance with the MH10.8.7 and CEA-706 standards as applicable. Although this protocol allows for other manufacturer codes, a CAGE (Commercial and Government Entity) code accompanied by the appropriate Data Identifier is recommended as the manufacturer ID. Manufacturers using the standards of GS1 should mark all items in accordance with the GS1 standards as applicable.

For DoD actions that directly support NASA (National Aeronautics and Space Administration), the marking standards of NASA shall be implemented. These standards can be found in NASA-STD-6002; a detailed how-to guide for implementing these standards can be found in NASA-HDBK-6003.

MRI protocols other than those listed above should be approved by USTRANSCOM TCJ5/4-I Asset Visibility Division.

How is this product / process developed? UID Standard Policy involves two processes. The first process involves item marking and the second process involves delivering data about items as part of the acceptance and delivery process. The unique item or UID marking consists of a unique 2-Dimensional data matrix symbol which consists of Serial Number, Part Number, and CAGE Code for every product. This 2-D data matrix symbol can done by dot peen, ink jet, durable polyester, chemical etch or laser mark.

Lessons Learned and Best Practices. For items that are under the control of the Department of Defense and subject for marking, there are many specifications that must be met for a proper mark. These requirements state that all marking must be applied to a metal or stiff plastic identification plate, identification band, identification tag, or identification label that is securely fastened to the item. Additionally, the marking may even be applied directly to the surface of the item itself – provided of course it can still meet the requirements

Key References

- MIL-STD-105, Sampling Procedures and Tables for Inspection by Attributes (withdrawn) and replaced by MIL-STD-1916, "DoD Preferred Methods for Acceptance of Product" (available online at http://assist.daps.dla.mil)
- MIL STD 129P, a standard is used for maintaining uniformity while marking
- MIL STD 130, a standard that is mandated by the DoD for any item to be UID Compliance
- MIL-STD-498, on software development and documentation, canceled on May 27, 1998 and replaced by J-STD-016 and IEEE 12207

Policies, Directives, Regulations, Laws

UID Standard Policy requirement criteria**:**

- All items whose acquisition cost is $5,000 or more;
- For all DoD-recognized UID equivalent items available;

- When program manager determines that UID is required or when UID is a component of a delivered item;
- Items are mission essential, controlled inventory piece of equipments, serially managed, repairable items, or consumable items where permanent identification is required;
- UID Standard Policy goes beyond marking and traceability.

b. Handling

Handling involves the moving of items from one place to another within a limited range and is normally confined to a single area, such as between warehouses, storage areas, or operational locations, or movement from storage to the mode of transportation.

c. Storage

Storage infers the short or long term storing of items. Storage can be accomplished in either temporary or permanent facilities.

The role of the storage facility is typically defined by one of the following categories of service:

- Interim custody and protection of goods pending their re-consignment, secondary destination shipment instructions, or release to the customer;
- Materials handling, which include the functions of (1) assembly of inbound goods into consolidated to specific cargo modules of reshipment of designated terminal points and (2) mixing of carload and truckload shipments into customized cargo lots for redistribution to one or more secondary destinations;
- A combination of the storage and materials handling roles;
- Special storage, such as cold or frozen storage, hermetically sealed storage for such sensitive items and medical and pharmaceutical items, and unique bulk storage facilities, such as fuel tanks for petroleum products.

d. Special Section: Shelf Life

1. Proponency:

- Deputy Under Secretary of Defense for Logistics and Material Readiness (DUSD(L&MR)). Establishes policy and provides guidance for the Shelf-Life Program and ensures implementation of that policy in a uniform manner throughout the DoD;
- Secretaries of the Military Departments/Director, Defense Logistics Agency (DLA). Ensure that procedures for the designation, issuance, and management of items in retail and wholesale inventories are compatible;
- Director, DLA. Administer the DoD Shelf-Life Program;
- Director, DoD Shelf-Life Program. Evaluate shelf-life management reports, and determine the adequacy of the reporting and surveillance techniques that measure the degree to which the program objectives are achieved;
- DoD Components/Other Federal Government Agencies. Shelf-Life Management Administrators or focal points of contact are assigned at each Service/Agency Headquarters, Inventory Control Points (ICPs), and storage activity (SA); and are listed on the DoD Shelf-Life Management web site;

- Primary Inventory Control Activity (PICA) and/or Inventory Control Points (ICP). PICAs/ICPs have the basic responsibility for the management and control of shelf-life items;
- Storage Activities (SA). SAs (Depot- to Consumer-level) are responsible for compliance with the storage standards and/or care-of-supplies-in-storage as directed by the managing ICP.

2. Description

Each item that meets the shelf-life criteria is assigned a National Stock Number (NSN) and a specific shelf-life code. Typical shelf-life items include food, medicines, batteries, paints, sealants, adhesives, film, tires, chemicals, packaged petroleum products, hoses/belts, mission-critical o-rings, and Nuclear/Biological/Chemical equipment and clothing.

The Shelf-Life code identifies the shelf-life time period by which an item must be used, or subjected to inspection/test/restoration or disposal action. These codes are identified in Appendix A of the DoD 4140.27-M, and consist of two types, Type I and Type II. Type I is an individual item of supply which is determined through an evaluation of technical test data and/or actual experience, to be an item with a definite non-extendible period of Shelf-Life, and ends with the expiration date. Type II is an individual item of supply having an assigned shelf-life time period that may be extended after completion of inspection, test, or restorative action, and is identified by an inspection/test/date.

3. Policy and Regulations

The policies for optimizing shelf-life materiel are contained in DoD 4140.27-M, Shelf-Life Management Manual, as authorized by DoD Directive 4140.1, Materiel Management Policy. This policy provides for the supply chain (life-cycle management) of standard and hazardous shelf-life items contained in the federal supply system.

Shelf-life management for hazardous material follows the same procedures as those for any shelf-life items, except that hazardous material should receive priority processing over non-hazardous material. Issues and guidelines concerning the acquisition, storage, handling, transportation, and disposal of hazardous material are addressed in Chapters 3 and 5 of DoD Regulation 4140.1-R, DoD Materiel Management Regulation. Class I perishable subsistence, Class III bulk petroleum, Class V ammunition, and Class VIII-B blood, are excluded from this Manual and shall continue to be managed in accordance with existing regulations. Commodities excluded from this Manual may be represented by their respective DoD Component to the DoD Shelf-Life Board.

4. When Is It Used in the Life Cycle?

Shelf life considerations are critical in all phases of the life cycle. Early planning identifies special requirements and risk related to shelf life. Engineering inputs can help to mitigate risks associated with items having a very short shelf life or needed special storage considerations.

Sustainment planning determines the resources and infrastructure necessary to implement a logistical capability for designated items.

5. Who Develops It and Who Reviews It?

Storage requirements are based on an item's characteristics and usage requirements. Typically the functional subject matter experts, in partnership with the operational users and with advisory from manufacturers, will determine optimal storage criteria for weapon system items.

6. Lessons Learned and Best Practices

Best practices for storage are focused on product categories, i.e., batteries, fresh produce, medical items, hazardous or dangerous items. There are no generic best practices for the broader category of "storage". Please research storage practices based on the specific class of supply or individual item characteristics.

e. Transportation

Transportation is the movement of equipment and supplies using standard modes of transportation for shipment by land, air and sea. Modes of transportation include cargo, vehicle, rail, ship and aircraft.

Defense Transportation in the 21st Century is a world class, globally capable, intermodal transportation system that is responsive, efficient, fully integrated, and in partnership with commercial partners to ensure military readiness, sustainability and improved quality of life for service members, their families and civilian employees.

Transportation planning needs to start as early during concept and analysis as possible. Often critical problems result when a system cannot be shipped due to weight, volume, hazardous materials, or special packaging requirements.

USTRANSCOM's mandate as DoD's Distribution Process Owner (DPO) is to improve the overall efficiency and interoperability of DoD distribution related activities - deployment, sustainment, and redeployment support during peace and war. To accomplish this, a Governance Structure was established to prioritize and implement improvements to the DoD's distribution system. The key elements of the Governance Structure are the DPO Executive Board, chaired by the Commander of USTRANSCOM; the Distribution Transformation Task Force, chaired by the Deputy Commander of USTRANSCOM; and the Distribution Steering Group, co-chaired by the USTRANSCOM Director of Strategy, Policy, Programs, and Logistics; the Defense Logistics Agency Director of Logistics Operations; and the USTRANSCOM Director of Command, Control, Communications and Computer Systems.

The DPO Governance Structure membership consists of logisticians from the Office of the Secretary of Defense, Military Services, Combatant Commands, and DoD Agencies. These organizations are the collaborative network of partners comprising the Joint Deployment & Distribution Enterprise Community of Interest (JDDE COI) as described in DoDI 5158.06. The JDDE COI share common distribution-related goals, interests, missions, and business processes that are focused on supporting the end-to-end supply chain needs of the Warfighter.

USTRANSCOM's three component commands -- the Army's Military Surface Deployment and Distribution Command, Scott AFB, Ill.; the Navy's Military Sealift Command, Washington, D.C.; and the Air Force's Air Mobility Command, Scott AFB, Ill. -- provide intermodal transportation across the spectrum of military operations.

E. When Is PHS&T Delivered and Managed in the Life Cycle

PHS&T planning must start as soon as the need or requirement is identified due to the long lead times for budgeting, acquisition, and the need to have the PHS&T infrastructure and operations ready to use at the start of the designated operation (test, maintenance, storage, transportation etc.). During the acquisition life cycle, the PHS&T requirements and planning are required to be included within the LCSP by Milestone B. Specific lead times and planning cycles are further discussed below.

Early analysis is especially important to ensure that each of the four PHST&T domains have no restrictions preventing the weapon system from being fielded to its intended destinations. For example, designated carriers (truck, plane, ship, etc.) must be checked for the capacity to meet PHS&T requirements of the weapon system and its support equipment. Hazardous materials and safety issues often are not considered until design decisions are approved and the system is almost at production stages. There are many "horror stories" where a weapon system or its ammunition is not deployable due to shipping or transportation restrictions!

F. How PHS&T Is Developed, Established and Managed

6.8.1 Packaging
6.8.2 Handling
6.8.3 Storage
6.8.4 Transportation
6.8.5 Special Section: Container Reutilization

a. Packaging

According to the "Integrated DoD Guide for Performance-Based Packaging Practices", acquisition managers and packaging SMEs translate the operational parameters into technical requirements and determine contract requirements to ensure effective packaging performance. Program managers and PSMs need to predict requirements in order to adequately identify, document, fund and contract for the government's requirements based on the environmental and logistics conditions of the item. They should avoid the use of the term "best commercial practice" and similar terms, when identifying packaging requirements, because those terms are undefined and could have different meanings. They should specify the performance requirements that apply to specific weapons systems, components, equipment and other items. They should also encourage and approve the use of commercial materials and processes when their performance can be validated. This is particularly applicable to entire weapons systems and their major components (i.e., LRUs or WRAs) where high cost, fragility, size, weight or irregular shape or military criticality is an issue.

b. Handling

1. Principles of Material Handling Systems

PSMs and logisticians should be guided by the following basic principles relative to material handling technology:

- Handling should be reduced to a minimum;
- Distances over which materials are handled should be as short as possible;
- Routes of materials should be on the same level and much as layouts permit in order to avoid lifting and lowering;
- Once started in motion, materials should be kept moving as long as possible;
- Mechanical and automatic means of materials handling should be used wherever routes of travel and work volume justify the investment;

- Materiel handling equipment should be standardized to the greatest extent possible;
- Gravity flow (the least expensive form of energy should be incorporated wherever practical;
- In mechanized systems, maximum investment should be in movement rather than stationary equipment;
- In equipment selection, an effort should be made to minimize the ratio of dead weight to payload.

2. Material Handling Methods

The basic methods of materials handling are shown in the table below:

Materials Handling Methods	
Manual Systems	Used in situations where there are a large variety of types of items, predominantly in small packages which manual handling
Mechanized Systems	Are appropriate for larger shipments requiring the use of pallets, forklifts and/or overhead cranes
Automated Systems	Used to meet the requirement for frequently occurring, high volume throughput where functions can be preprogrammed
Combination Systems	Used in situations where the use of a combination of materials handling methods would be more efficient and economical

Table 6.8.2.2.T1. Materials Handling Methods

OSHA has an excellent guidebook at http://www.osha.gov/Publications/osha2236.pdf , "Materials Handling and Storage", OSHA 2002, U.S. Department of Labor., discussing personnel safety during handling and storage operations.

c. Storage

The topic of storage has many topical areas which should be reviewed. These include but are not limited to:

- Shelf-life considerations (discussed as a special topic within this Chapter);
- Storage of Government owned property. Typically this situation is when contractors are storing Government owned property. Regulations are contained in the FAR Subpart 45.3—Providing Government Property to Contractors;
- Storage and Handling of hazardous materials;
- The U.S. Environmental Protection Agency maintains regulations governing hazardous material storage at http://www.epa.gov/osw/hazard/tsd/storage.htm;
- The following reference (multiple Service titles) , "Storage and Handling of Hazardous Material", addresses DoD regulations for hazardous materiel storage:
  - DLAI 4145.11
  - TM 38-410
  - NAVSUP PUB 573
  - AFJMAN 23-209

The above regulations establish uniform procedures for the receipt, storage, and handling of hazardous materials and wastes by Department of Defense (DoD) components, installations, and activities. They are to be used in conjunction with pertinent Service-specific and DoD hazardous materials procedures, regulations, manuals, and guidance documents to support safe, effective, and environmentally sound management of hazardous materials throughout their life-cycle.

- Inventory Management (discussed under Supply Support)
- Facilities for storage (discussed in Facilities & Infrastructure)

d. Transportation

The DoD provides transportation solutions that will synchronize specific capabilities necessary to achieve delivery of an item to its intended destination. The organizations that may become involved vary greatly according to the type of resource that needs to be transported, i.e., people, chemicals, food, high vs. low priority supply requisitions, etc.

e. Special Section: Container Reutilization

Proponent Office. The size and configuration of the common-use portion of the DoD container system controlled by the U.S. Transportation Command (USTRANSCOM) will be determined by USTRANSCOM based on established requirements and availability of commercially owned containers and equipment. USTRANSCOM will lease or procure additional containers as required to augment the DoD container system.

Description. The Department of Defense container system comprises all U.S. Department of Defense-owned, leased, and controlled 20- or 40-foot intermodal ISO intermodal containers (shipping containers) and flat-racks, supporting equipment such as generator sets and chassis, container handling equipment, information systems, and other infrastructure that supports DoD transportation and logistical operations, including commercially provided transportation services. This also includes 463L pallets, unit loads, nets, and tie down equipment as integral components of the DoD Intermodal Container System.

Who develops it and who reviews it? Program transportation coordinators work with short and long haul transportation providers regarding usage of containers.

Lessons Learned and Best Practices. Best practices for container utilization are generally obtained from operators of major transportation / logistics hubs and ports for land, sea and air operations. These practices typically revolve around container tracking, container content tracking, load plans, loading and unloading processes, and container utilization.

G. Communities of Interest and Practice

a. The Defense Acquisition University
b. Packaging
c. Handling

d. Storage
e. Transportation

a. **The Defense Acquisition University** maintains a wealth of information on their website under various communities of interest locations:

- PM e-Tool Kit Performance Learning Tools found at https://pmtoolkit.dau.mil/
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, Acquire Search)
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook)
- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02)
- Web enabled new JCIDS Instruction and Guidebook
- Best Practices Clearing House (With addition of Multimedia Assets – video, audio)
- Acquipedia (see Section 1.11 for an extensive listing of Acquipedia articles.)
- Acquisition Community Connection (CoPs and Special Interest Areas)
- PM Certification Course materials and PM Continuous Learning Modules
- Probability of Program Success (PoPS) Model and Service Implementations
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation)
- DoD IG Audit Guides for Acquisition and Contracting
- Service and Agency PMO support sites
- Contract Management Processes Guide
- Leadership Support Center (Requires ACC log-in)

b. Packaging

- The Defense Supply Center Columbus maintains a packaging helpdesk to offer both government and industry contractors the assistance to meet DoD packaging requirements, http://www.dscc.dla.mil/Offices/Packaging/specstds.html
- UID Forum, http://www.uidforum.com/
- UID Journal, http://www.uidjournal.com/
- American National Standards Institute, http://www.ansi.org/
- IUID Implementation Toolkit, http://www.iuidtoolkit.com/

c. Handling

A DoD-wide training program is available for all Services/Government Agencies. The most current training information specific to Shelf Life is obtainable from the DoD Shelf-Life Management web site: https://www.shelflife.hq.dla.mil/.

U.S. Army Tank-Automotive and Armaments Command has a Materiel Handling Equipment (MHE) site located at https://www.tacom-ec.com/mhe/ with policy, guidance, and information on MHE.

d. Storage

DoD 4140.27-M J-1, Appendix J, "Shelf-Life Management Web Sites And Links" has approximately 45 websites devoted to shelf life management and many related areas.

e. Transportation

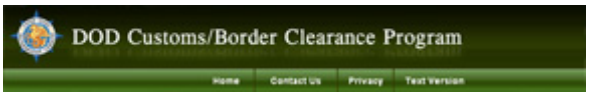
Many professional associations exist to address all aspects of transportation. Below are a few examples:

- Air Transport Association
- American Trucking Association
- National Defense Transportation Association

The Defense Transportation Regulations have a helpdesk listed on their website for direct assistance. Below is a listing of important associated websites with headers, descriptions and weblinks as recommended by USTRANSCOM.

Automatic Identification Technology. In our role as Distribution Process Owner (DPO) and

the lead functional proponent for radio frequency identification (RFID) and related Automatic Identification Technology (AIT) our mission is to ensure AIT is synchronized throughout the DoD Supply Chain to enhance asset visibility and maximize deployment and distribution operational efficiencies. http://www.transcom.mil/ait/



DoD Customs / Border Clearance Program

In our role as the Executive Agent for the DoD Customs and Border Clearance Program (CBCP), our mission is to develop policy and procedural guidance, in collaboration with OSD, DoD Components, USG Border Clearance Activities and Foreign Governments (through supported theater commands) to ensure efficiency and uniformity in the implementation of the DOD CBCP. http://www.transcom.mil/customs/

Defense Courier Division

The United States Transportation Command Defense Courier Division provides secure, timely, efficient end-to-end global distribution of classified and sensitive material for the United States and its Allies. http://www.transcom.mil/dcd/

Defense Enterprise Accounting and Management System
DEAMS is a financial management initiative that will transform business and financial management processes and systems to provide accurate, reliable, and timely business information to support effective business decision making for U.S. Transportation Command, Defense Finance and Accounting Service (DFAS), and the U.S. Air Force.
http://www.transcom.mil/deams/

Department of Defense
Defense.gov is the official web site for the Department of Defense and the starting point for finding U.S. Military information online. The mission of Defense.gov is to support the overall mission of the Department of Defense by providing official, timely and accurate information about defense policies, organizations, functions and operations. http://www.defense.gov

Defense Imagery
Department of Defense's premier imagery website, the location to find all forms of still, motion and multimedia imagery from across the entire DoD enterprise. This includes imagery of operations and activities from throughout the DoD. http://www.defenseimagery.mil

Defense Procurement and Acquisition Policy
The DPAP office serves as the principal advisor to the Under Secretary of Defense for Acquisition, Technology and Logistics (AT&L) and the Defense Acquisition Board on acquisition/procurement strategies for all major weapon systems programs, major automated information systems programs and services acquisitions. http://www.acq.osd.mil/dpap/

Distribution Process Owner
USTRANSCOM's mandate as the DPO is to improve the overall efficiency and interoperability of DOD distribution related activities - deployment, sustainment, and redeployment support during peace and war. http://www.transcom.mil/dpo/

Defense Transportation Electronic Business

The DTEB committee provides a forum where the Defense transportation activities can coordinate the development and implementation of their e-business projects.
http://www.transcom.mil/dteb/

Defense Transportation Coordination Initiative
Improve the reliability, predictability, and efficiency of Department of Defense (DoD) material moving within the Continental United States by all modes through long-term partnerships with a world-class coordinator of transportation management services. http://www.transcom.mil/dtci/

iDistribute
This site is an online workspace which organizes the DoDs distribution information in one place, available to the Warfighter, anytime, anyplace. https://idistribute.ustranscom.mil/web/guest

Joint Distribution Process Analysis Center
Provides Analysis and Engineering Support to Improve the Command's Ability to Move and Sustain the Joint Force and Operate the Joint Deployment and Distribution Enterprise (JDDE).
http://www.transcom.mil/jdpac/

Joint Intermodal Working Group
The mission of the Joint Intermodal Working Group (JIWG) is to facilitate and manage intermodal equipment initiatives; establish DoD standards; define joint doctrine, tactics, techniques and procedures; recommend DoD policy to improve end-to-end (E2E) distribution effectiveness and efficiency; enhance integration and interoperability; and develop solutions to intermodal equipment problems and issues. http://www.transcom.mil/jiwg/

Joint Operational Support Airlift Center
The Joint Operational Support Airlift Center (JOSAC) develops and implements CONUS Operational Support Airlift (OSA) solutions and provides movement visibility for the Department of Defense.
http://www.transcom.mil/josac_public/

Move.mil

Move.Mil is a portal for Electronic Transportation Acquisition (ETA) and Defense Personal Property System (DPS). Move.Mil is also a source of reference information for DoD Service Members/Civilians who are moving, PPSOs and TSPs. http://www.move.mil/

Research Development Test & Evaluation

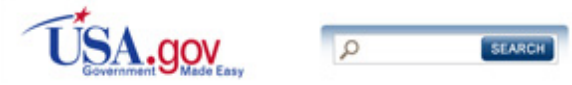
The USTRANSCOM Research Development Test & Evaluation program explores innovative joint technologies that address Distribution Process Owner (DPO) and Defense Transportation System (DTS) capability gaps. Http://www.transcom.mil/rdte/

Joint Chiefs of Staff

The Joint Chiefs of Staff (JCS) is a body of military leaders in the United States armed forces who advise the civilian government of the United States. The Joint Chiefs of Staff consist of the Chairman, the Vice Chairman, the Chief of Staff of the Army, the Chief of Naval Operations, the Chief of Staff of the Air Force, and the Commandant of the Marine Corps. http://www.jcs.mil

Command Surgeon

The Command Surgeon's Office, in addition to providing normal Headquarters staff functions, serves as DoD's single manager for the development of policy and standardization of procedures and information support systems for global patient movement.
http://www.transcom.mil/tcsg_public/



U.S. Government's Official Web Portal

The Command Surgeon's Office, in addition to providing normal Headquarters staff functions, serves as DoD's single manager for the development of policy and standardization of procedures and information support systems for global patient movement. http://www.usa

H. Lessons Learned / Best Practices

The Defense Acquisition University's Best Practices Clearinghouse. This clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;
- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

Integrated DoD Guide to Performance Based Packaging Practices, October 2002. While this guide is a little dated, it contains some good practices and lessons learned on the subject of packaging.

Best practices change over time and are influenced by many factors to include use of technologies, local and regional regulations, access to major transportation hub services, and business dynamics. Examples of best practices in use today include:

- Using centralized transportation management to increase efficiencies;
- Collaboration to manage capacity;
- Long term partnering with multiple carriers to enhance flexibility;
- Establishing and modifying work processes to find efficiencies both within the primary organization and with suppliers.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

I. Training Resources

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

PHS&T topics are primarily covered under the Life Cycle Logistics courses. Below are selected courses by PHS&T functional area.

- LOG 101 Acquisition Logistics Fundamentals
- LOG 102 Fundamentals of System Sustainment Management
- CLL 013 DoD Packaging
- CLL 017 Introduction to Defense Distribution
- TTL 002 Provisioning Management

Defense Logistics Agency's website, http://www.dscc.dla.mil/Offices/Packaging/train.html, lists opportunities for training resources to assist in acquiring (resident, on-site, and correspondence) Military Packaging, Transportation, and Environmental training.

The below web links are taken from the DLA website.

- Department of Transportation Training
- DSCC Packaging Training (TKO Seminar)
- Indiana State University
- Michigan State University School of Packaging
- OSHA - Hazard Communication Course
- Procurement Technical Assistance Centers
- San Jose State University Packaging Program
- School of Military Packaging Technology
- University of Wisconsin-Stout Packaging Program
- U.S. Army Defense Ammunition Center and School (McAlester, OK)

For a list of DAVIS/DITIS packaging training videos, please visit the Military Packaging Awareness web page.

J. Key References

Packaging

There is an extensive listing of packaging references to include policy, law, and regulations at the Defense Supply Center Columbus (DSCC) website on packaging, http://www.dscc.dla.mil/offices/packaging/specstdslist.html

- DoD 4140.27-M J-1, Appendix J, "Shelf-Life Management Web Sites and Links"
- Defense Transportation Regulation (DTR) 4500.9-R, Part VI, "Management and Control of Intermodal Containers and System 463L Equipment"
- MIL-STD-2073-1, "DoD Standard Practice for Military Packaging"

- ASTM D3951, “Standard Practice for Commercial Packaging”
- A website to find additional specifications, standards, and handbooks is found at http://www.everyspec.com/MIL-SPECS/MIL+SPECS+(MIL-E)/MIL-E-17555H_AMENDMENT-2_5225/

Additional references include:

- Air Force Materiel Command, “Acquisition Sustainment (AS) Tool Kit, AS Kneepad Checklist”, Appendix A, pg. 121-122
- AR 700-127, “Integrated Logistics Support”, Table 3-1, pg. 15
- AFPAMPHLET 63-128, “Guide to Acquisition and Sustainment Life Cycle Management”, 3.10, pg. 45
- DAU’s “Acquisition Logistics Guide (ALG)”, December 1997, 7.2.9
- PHS&T Desk Guide for APMLs, https://www.navsup.navy.mil/navsup/ourteam/navicp/prod_serv/support/APML-DESK-GUIDE.doc
- Defense Transportation Regulation – Part VI 29 August 2007, “Management and Control of Intermodal Containers and System”, Chap 605
- MIL-STD-648C, 11 Feb 1999, “DoD Design Criteria For Specialized Shipping Containers”
- DoD 4140.64-M, June 1995, “Secondary Item Stratification Manual”
- ASTM-D996, “Standard Terminology of Packaging and Distribution Environments” (DoD adopted)
- ASTM-D1974, “Standard Practice for Methods of Closing, Sealing, and Reinforcing Fiberboard Boxes” (DoD adopted)
- ASTM-D4279, “Standard Test Methods for Water Vapor Transmission of Shipping Containers – Constant and Cycle Methods”
- ASTM-D5118, “Standard Practice for Fabrication of Fiberboard Shipping Boxes D5118M” (DoD adopted)
- ASTM-D5168, Standard Practice for Fabrication and Closure of Triple Wall Corrugated Fiberboard Containers (DoD adopted)
- Common Naval Packaging System P-700 (https://www.tarp.navicp.navy.mil/p700.nsf)
- OPNAVINST 3960.16A – Navy Test, Measurement, and Diagnostics Equipment, Automatic Test Systems, and Metrology Calibration”
- MIL-STD-130, "Identification Marking of U.S. Military Property"
- MILS-STD-129, "Military Marking for Shipment and Storage"

Handling and Storage

- DoD 4140.27-M J-1, Appendix J, “Shelf-Life Management Web Sites And Links”

The following reference (multiple Service titles), “Storage and Handling of Hazardous Material”, addresses DoD regulations for hazardous materiel storage:

  - DLAI 4145.11,
  - TM 38-410
  - NAVSUP PUB 573

- AFJMAN 23-209

- DoD Regulation 4140.1-R, “DoD Materiel Management”
- DoD Directive 5010.38 (reference (c)), “Management Control (MC) Program”
- FED-STS-313, **“**Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities”
- DLAI 4145.11, “Storage and Handling of Hazardous Materials”
- DoD 4140.27-M / DLA J-373 / May 5, 2003, “DoD Shelf Life”

Transportation

The website of the Office of the Assistant Deputy Undersecretary of Defense (ADUSD) for Transportation Policy lists key references.

Defense Transportation Regulation – Part VI 29 Aug 2007, “Management and Control of Intermodal Containers and System 463L Equipment”; Chap 605, “Intermodal Container Movement Reporting (CMR), Tracking, and Inventory Requirements”; and Chap 604, “Intermodal Container Inspection, Re-inspection, Maintenance, and Repair”.

Below is an extensive list of transportation references which The Product Support Manager may review.

- Air Force Joint Instruction 24-223, AR 70-44, OPNAVINST 4600.22B, MCO 4610.14C, DLAR 4500.25, “DoD Engineering for Transportability”.
- Air Force Manual 24-204(I), Technical Manual 38-250, Marine Corps Order P4030.19I, Naval Supply Pub 505, Defense Logistics Agency Instruction 4145.3, and Defense Contract Management Agency Directive 1, CH 3.4 (HM24), “Preparing Hazardous Materials for Military Air Shipments”.
- Army Regulation 15-6, “Procedures for Investigating Officers and Boards of Officers”.
- Army Regulation 735-5, “Policies and Procedures for Property Accountability”.
- Code of Federal Regulations, Title 46 Part 340, “Priority Use and Allocation of Shipping Services, Containers and Chassis, and Port Facilities and Services for National Security and National Defense Related Operations”.
- Code of Federal Regulations, Title 49 Part 450, “General”.
- Code of Federal Regulations, Title 49, Part 452, “Examination of Containers”, 452.3.
- Code of Federal Regulations, Title 49 Part 452.3(b), “Elements of Periodic Examinations”.
- “Defense Production Act of 1950”, Title 1, Sec 101 (A)(1).
- Defense Transportation Regulation, Part II, “Cargo Movement”.
- Defense Transportation Regulation, Part III, “Mobility”.
- Department of Defense Directive 4500.09E, “Transportation and Traffic Management”.
- Department of Defense Directive 4510.11, “DoD Transportation Engineering”.
- Department of Defense Directive 5158.04, “United States Transportation Command”.
- Department of Defense Instruction 4540.7, “Operation of the DoD Engineering for Transportability and Deployability Program”.
- Department of Defense Standard Family of Tactical Shelters (Rigid/Soft/Hybrid).

- Institute of International Container Lessors (IICL), “Multiple Guides”.
- “International Convention for Safe Containers (CSC)”.
- “International Maritime Dangerous Goods Code (IMDG Code)”.
- Joint Committee on Tactical Shelters Brochure, “Department of Defense Standard Family of Tactical Shelters”.
- Joint Publication 3-35, “Joint Deployment and Redeployment Operations”.
- Joint Publication 4-01, “Joint Doctrine for the Defense Transportation System”.
- Joint Publication 4-01.7, “Joint Tactics, Techniques, and Procedures for Use of Intermodal Containers in Joint Operations”.
- Military Handbook-138B, “Guide to Container Inspection for Commercial and Military Intermodal Containers”.
- Military Handbook-1791, “Designing for Internal Aerial Delivery in Fixed Wing Aircraft”.
- Technical Bulletin 43-0002-40, “Maintenance Expenditure Limits for FSC Group 81”.
- Technical Bulletin 55-8115-200-233, “Standards and Maintenance of MILVAN Containers”.
- Technical Bulletin 55-8115-200-237P, “Organization and Direct Support Maintenance Manual”.
- Technical Order 00-110N-16, “Equipment Authorized for Use with Nuclear Weapons”.
- Technical Order 13C2-1-1, “Cleaning, Repair and Test Instruction -- Cargo Tie Down Equipment”.
- Technical Order 1C-1-71, “Listing of Cargo Tie-down Equipment Authorized for All Series Cargo Aircraft”.
- Technical Order 35D33-2-2-2, “Instruction with Parts Breakdown -- 463-L Air Cargo Pallets, Types HCU-6/E and HCU-12/E”.
- Technical Order 35D33-2-3-1, “Maintenance and Repair Instructions -- Air Cargo Pallet Nets, HCU-7/E, I, Side, HCU-15/C, II, Top, HCU-11/C, III, Side, HCU-16/C, IV, Top”.
- Technical Order 36M-1-141, “Operator and Operation Instruction -- Materials Handling Equipment System Components of 463-L”.
- United States Code, 18 U.S.C. 1001, “Statements or Entries Generally”.
- United States Code, 46 U.S.C. 1503, “International Safe Container Act of 1980”.
- United States Transportation Command Charter for Updates to and Coordination of the Defense Transportation Regulation, DTR 4500.9-R, Jun 11, 2009.

7.0 Technical Data
7.0.1 Objective
7.0.2 Description
Product Support Manager Activities
Technical Data in the Life Cycle
A. Purpose
B. Data Item Description (DID) Deliverables
C. OSD Proponency, Policy, Regulations and Statutes
D. Who Develops, Delivers and Manages It
E. When Is It Delivered and Managed in the Life Cycle
F. How It Is Developed, Established and Managed
G. Communities of Interest and Practice
H. Lessons Learned / Best Practices
I. Training Resources
J. Key References

7.0. Technical Data

7.0.1. Objective

Identify, plan, validate, resource and implement management actions to develop and acquire information to:

- Operate, maintain, and train on the equipment to maximize its effectiveness and availability;
- Effectively catalog and acquire spare/repair parts, support equipment, and all classes of supply;
- Define the configuration baseline of the system (hardware and software) to effectively support the Warfighter with the best capability at the time it is needed.

7.0.2. Description

Technical Data represents recorded information of scientific or technical nature, regardless of form or character (such as equipment technical manuals and engineering drawings), engineering data, specifications, standards and Data Item Descriptions (DID). Data rights, data delivery, as well as use of any source controlled data as part of this element are included in technical data as are “as maintained” bills of material and system configuration identified by individual configuration item. Technical data does not include computer software or financial, administrative, cost or pricing, or management data or other information incidental to contract administration." See 10 U.S.C. 2302(4).

Technical manuals (TMs) including Interactive Electronic Technical Manuals (IETMs) and engineering drawings are the most expensive and probably the most important data acquisitions made in support of a system. TMs and IETMs provide the instructions for operation and maintenance of a system. IETMs also provide integrated training and diagnostic fault isolation procedures.

For ACAT I and II programs, a Technical Data Rights Strategy is required prior to each milestone review as part of the Acquisition Strategy. Technical data acquisition, management, and rights are defined in the Technical Data Rights Strategy. For additional guidance regarding the Technical Data Rights Strategy, refer to Defense Acquisition Guidebook sections 2.2.14 and 5.1.6.4.

Product Support Manager Activities

7.1. Technical Data Rights Strategy

In August 2004, the Government Accountability Office (GAO) recommended that DoD consider requiring program offices to develop acquisition strategies that provide for future delivery of technical data should the need arise to select an alternative source for logistics support. In response to the GAO audit along with other Service memorandum, the Fiscal Year 2007 Defense Authorization Act specifically addressed data rights issues and mandated requirements for DoD acquisition programs. DoD policy, reflected in DoDI 5000.02, now requires inclusion of a Technical Data Rights Strategy within the Acquisition Strategy. The Technical Data Rights Strategy must provide an assessment of "the long-term technical data needs" for weapon systems. Additional information can be found in the GAO report, "Weapons Acquisition: DOD Should Strengthen Policies for Assessing Technical Data Needs to Support Weapon Systems", GAO-06-839 July 14, 2006.

Technical data rights fall into eight categories (http://ucsarchitecture.org/downloads/11-0086-BttrBuingPowerloiRes(16).pdf):

- Unlimited Rights. Developed exclusively at Government expense, and certain types of data (e.g., Form, Fit, and Function data (FFF); Operation, Maintenance, Installation, and Training (OMIT)). These rights involve the right to use, modify, reproduce, display, release, or disclose technical data in whole or in part, in any manner, and for any purpose whatsoever, and to have or authorize others to do so;
- Government Purpose License Rights. This right involves the right to use, duplicate, or disclose technical data for government purposes only, and to have or permit others to do so for government purposes only. Government purposes include competitive procurement, but do not include the right to permit others to use the data for commercial purposes;
- Limited Rights. A limited rights agreement permits the government to use proprietary technical data in whole or in part. It also means that the government has the expressed permission of the party providing the technical data to release it, or disclose it, outside the government;
- Restricted Rights. Developed exclusively at private expense. See DFARS 252.227-7014(a)(14);
- Negotiated License Rights. This right pertains whenever the standard license arrangements are modified to the mutual agreement of the contractor and the government. In this case, the exact terms are spelled out in a specific license agreement unique to each application;
- Small Business Innovative Research (SBIR) Data Rights. All technical data or computer software generated under an SBIR contract. Non-government users cannot release or disclose outside the Government except to Government support contractors;

- Commercial Technical Data License Rights. Applies to TD related to commercial items (developed at private expense). Managed same as Limited Rights;
- Commercial Computer Software Licenses. Applies to any commercial computer software or software documentation. Managed as specified in the commercial license offered to the public.

How the government uses technical data is controlled by the data rights associated with it. Although the government owns the delivered physical medium on which delivered data resides (i.e., Paper drawings, computer disks, etc.), ownership of the data, the intellectual property, remains with the developer in most cases even if the government has funded most or even all of its development. Any data rights the government procures will determine how the data may be used. Unless a contractor has a legitimate basis to limit the government's rights, all data deliverables must be provided with unlimited license rights.

If the contractor has funded the development of an item completely at private expense, then the contractor may limit the government's use of technical data using limited license rights (for hardware) or restrict the government's use using restricted license rights (for computer software). However, regulations do list a number of data types that must be provided with unlimited license rights to do business with the government including:

- Studies, analyses, test data, etc. Developed under the contract when the study, analysis, or test was specified as an element of performance
- Form, fit, and function data
- Data necessary for installation, operation, maintenance, or training purposes (other than detailed manufacturing or process data)
- Data to which the government has acquired license rights by other means.

Per the 20 April 2011 Technology Development Strategy outline, the process is as listed below:

- Summarize the Technical Data Rights strategy for meeting product life-cycle data rights requirements and to support the overall competition strategy. Include:
- Analysis of the data required to design, manufacture, and sustain the system as well as to support re-competition for production, sustainment, or upgrade. The strategy should consider, but is not limited to, baseline documentation data, analysis data, cost data, test data, results of reviews, engineering data, drawings, models, and Bills of Materials (BOM);
- How the program will provide for rights, access, or delivery of technical data the government requires for the system's total life cycle sustainment. Includes analysis of data needed to implement the product support life cycle strategy in such areas as materiel management, training, Information Assurance protection, cataloging, open architecture, configuration management, engineering, technology refreshment, maintenance/repair within the technical order (TO) limits and specifically engineered outside of TO limits, and reliability management;
- The business case analysis, conducted in concert with the engineering tradeoff analysis, that outlines the approach for using open systems architectures and acquiring technical data rights;

- The cost benefit analysis of including a priced contract option for the future delivery of technical data and intellectual property rights not acquired upon initial contract award; and
- Analysis of the risk that the contractor may assert limitations on the government's use and release of data, including Independent Research and Development (IRAD)-funded data (e.g., require the contractor to declare IRAD up front and establish a review process for proprietary data).

Data Management and Data Rights Resources Laws, Regulations, Policies, and Instructions

- Title 10, U.S. Code, Sections 2320 and 2321
- Defense Federal Acquisition Regulation Supplement (DFARS):
  - 227.71 (Rights in Technical Data)
  - 227.72 (Rights in Computer Software and Computer Software Documentation)
  - 252.227-7013, -7014, -7015, -7018
- OSD Policy Memo, Clarifying Guidance Regarding Open Source Software (OSS), 16 Oct 2009
- DoDI 5000.02, Operation of the Defense Acquisition System, Enclosure 12, Section 9, Dec. 2008
- DoD 5010.12-M, Procedures for the Acquisition and Management of Technical Data, May 1993 (under revision)

Additional Guidance

- Army Guide for the Preparation of a Program Product Data Management Strategy
- Naval Open Architecture Contract Guidebook for Program Managers
- Acquiring and Enforcing the Government's Rights in Technical Data and Computer Software under Department of Defense Contracts, Air Force Space and Missile Systems Center

Also see a two-page summary of Understanding Intellectual Property Rights in DoD Acquisitions located at http://ucsarchitecture.org/downloads/11-0086-BttrBuingPowerloiRes(16).pdf.

Please visit https://acc.dau.mil/oa for additional information and resources.

7.2. Technical Data Requirements

The DoD 5010.12-M, "Procedures for the Acquisition and Management of Technical Data", provides a uniform approach to the acquisition and management of data required from contractors. The procedures are intended to provide data management tools necessary to minimize and standardize data requirements that will be included in DoD contracts. This manual has not yet been updated. The processes described in DoD 5010.12-M, are essentially correct, with the exception that, as a result of the age of the document, references are outdated. The Acquisition Management System and Data Requirements Control List (AMSDL) have been replaced by the on-line ASSIST database.

7.2.1. Defense Handbook (MIL-HDBK)

A MIL-HDBK is a guidance document containing standard procedural, technical, engineering, or design information about the material, processes, practices, and methods covered by the DSP. Mil-STD-962 covers the content and format for defense handbooks.

7.2.2. Standards

A defense standard is a document that establishes uniform engineering and technical requirements for military-unique or substantially modified commercial processes, procedures, practices, and methods. There are five types of defense standards: interface standards, design criteria standards, manufacturing process standards, standard practices, and test method standards. MIL-STD-962 covers the content and format for defense standards.

Data Standards are documented agreements on representations, formats, and definitions of common data. Data standards improve the quality and share-ability of environmental data by: increasing data compatibility and improving the consistency and efficiency of data collection.

United States defense standards, often called a military standard, "MIL-STD" or "MIL-SPEC", are used to help achieve standardization objectives by the U.S. Department of Defense.

Standardization is beneficial in achieving interoperability, ensuring products meet certain requirements, commonality, reliability, total cost of ownership, compatibility with logistics systems, and similar defense-related objectives Data sharing has become an increasingly important aspect of sound environmental management. Diverse organizations, both government and commercial, face the critical challenge of sharing information among themselves and with their respective stakeholders and customers. Data standards are fundamental to the seamless exchange of data and they help improve the ability of partners (internal and external) to exchange data efficiently and accurately. They also assist secondary data users understand, interpret, and use data appropriately.

PMs/PSMs should establish a data management system within the Integrated Data Environment (IDE) that allows every activity involved with the program to cost-effectively create, store, access, manipulate, and exchange digital data. This includes, at a minimum, the data management needs of the system engineering process, modeling and simulation activities, test and evaluation strategy, product support strategy, and other periodic reporting requirements. The PM/PSM should use existing infrastructure (e.g., internet) as appropriate and the summary in the Acquisition Strategy should briefly include leveraged and/or planned new development IDE infrastructure.

DoD 4120.24-M, “Defense Standardization Programs and Procedures”, was revised in 2005 to comply with the CSI Public Law and CSI DFARS sections. These changes can be found in Appendix 1, Definitions, (where "Aviation Critical Safety Item (CSI)" and "Design Control Activity (DCA) were added) and in Appendix 2 Section AP2.1.1., Responsibility for Qualification**,** and Section AP2.4., Waiver of Qualification. This information can be found at the web site address https://acc.dau.mil/CommunityBrowser.aspx?id=309393.

7.2.2.1. Interface Standards

DoD interface standards should be developed to specify the physical, functional, or military operational environment interface characteristics of systems, subsystems, equipment, assemblies, components, items, or parts to permit interchangeability, interconnection, interoperability, compatibility, or communications. Non-Government standards should be used to the extent possible to specify interface requirements. DoD interface standards should only be developed to specify military-unique interface requirements. DoD interface standards may be cited as solicitation requirements without need for a waiver by the Milestone Decision Authority.

Per the Defense Acquisition Guidebook, The interface management process ensures interface definition and compliance among the elements that compose the system, as well as with other systems with which the system or system elements will interoperate (i.e., system-of-systems). Interface management control measures ensure that all internal and external interface requirement changes are properly documented in accordance with the configuration management plan and communicated to all affected configuration items.

Interface management deals with:

- Defining and establishing interface specifications;
- Assessing compliance of interfaces among configuration items comprising systems or system of systems;
- Monitoring the viability and integrity of interfaces within a system;
- Establishing an interface management plan to assess existing and emerging interface standards and profiles, update interfaces, and abandon obsolete architectures.

An interface management plan is a part of a configuration management plan that:

- Documents a system's internal and external interfaces and their requirement specifications;
- Identifies preferred and discretionary interface standards and their profiles;
- Provides justification for selection and procedure for upgrading interface standards, and
- Describes the certifications and tests applicable to each interface or standard.

7.2.2.2. Design Criteria Standards

DoD design criteria standards should be developed to specify military-unique design or functional criteria that must be adhered to in the development of systems, subsystems, equipment, assemblies, components, items, or parts. These design criteria are not primarily related to requirements that affect interchangeability, interoperability, interconnection, compatibility, or communications. Adherence to these design criteria standards, however, will affect the manufacturing of a product. Some examples include military-unique design selection, nuclear blast protection, safety requirements, and human factors requirements. A DoD design criteria standard requires the Milestone Decision Authority's waiver to be cited as a solicitation requirement.

The DoD has many design criteria standards. Two examples are below:
Example #1: DoD Design Criteria Standard – Human Engineering MIL-STD-1472F, establishes general human engineering criteria for design and development of military systems, equipment and facilities. Its purpose is to present human engineering design criteria, principles and practices to be applied in the design of systems, equipments and facilities so as to: achieve

required performance by personnel; minimize skill, personnel requirements and training time; achieve required reliability of personnel-equipment combinations; and foster design standardization within and among systems;

Example #2: DoD 5015.02-STD Design Criteria Standard for Electronic Records Management Software Applications. The goal of this Standard relative to the DoD records is to make records:

- Visible by developing and registering standardized metadata;
- Accessible through web services with usable, standardized interfaces;
- Understandable through the availability and use of rich metadata describing the records and their context;
- As part of the DoD movement towards net-centric information sharing, RMA software should migrate towards providing standards-compliant services for the Department of Defense.

These services provide the capability to announce an RMA's holdings and request records, making records both visible and accessible. The services are paired with service connection instructions, making the service itself understandable. DoD users of RMA software would then incorporate these services into a larger service-oriented architecture to achieve broader information sharing.

7.2.2.3. Manufacturing Process Standards

A manufacturing process standard states the desired outcome of manufacturing processes or specifies procedures or criteria on how to perform manufacturing processes.

The DoD discourages the development of manufacturing process standards. A DoD manufacturing process standard requires the Milestone Decision Authority's waiver to be cited as a solicitation requirement. The concept of DoD manufacturing process standards is inconsistent with both Department's emphasis on using commercial processes and reliance on performance specifications that state desired outcomes rather than "how-to's." The role for DoD MIL-STD-962D process standards is limited to situations where the DoD alone has the technological expertise to specify a military-unique process. If there is an advantage to establishing requirements for an industry-wide commercial process, a non-Government standard should be developed.

7.2.2.4. Standard Practices

DoD standard practices should be developed when it is necessary to specify procedures on how to conduct non-manufacturing functions. Standard practices should only be developed for functions that, at least some of the time, are obtained via contract from commercial firms. Procedures for functions performed only by DoD personnel should be covered by such documents as regulations, directives, instructions, technical manuals, or standard operating procedures. DoD standard practices may be cited as solicitation requirements without need for a waiver by the Milestone Decision Authority.

The program manager must balance the decision to standardize against specific mission requirements, technology growth, and cost effectiveness. Under the DoD's performance based acquisition policies, it is primarily the contractor's responsibility to recommend the use of standard materials, parts, components, and other items needed to meet performance requirements

and satisfy other program elements, such as parts management and logistics support. However, interoperability, compatibility, and integration are key standardization goals that must be satisfactorily addressed for all acquisitions. These goals shall be specified and validated during the requirements generation process and throughout the acquisition life cycle. This Chapter provides policies on when to standardize, how to document standardization decisions, and tailoring of standardization requirements. DoD 4120.24-M, DSP Policies & Procedures, March 2000.

7.2.2.5. Test Method Standards

The purpose of the test method standard, MIL-STD-1916, 1 April 1996, DoD Test Method Standard DoD Preferred Methods for Acceptance of Product", is to encourage defense contractors and other commercial organizations supplying goods and services to the U.S. Government to submit efficient and effective process control (prevention) procedures in place of prescribed sampling requirements. The goal is to support the movement away from an AQL-based inspection (detection) strategy to implementation of an effective prevention-based strategy including a comprehensive quality system, continuous improvement and a partnership with the Government.

The underlying theme is a partnership between DoD and the defense supplier, with the requisite competence of both parties, and a clear mutual benefit from processes capable of consistently high quality products and services. The objective is to create an atmosphere where every noncompliance is an opportunity for corrective action and improvement rather than one where acceptable quality levels are the contractually sufficient goals.

7.2.2.6. Non-Government Standards

Nationally and internationally recognized technical, professional, and industry associations and societies (hereafter referred to as "non-Government standards bodies (NGSBs)") prepare standards, many having potential application or impact in the DoD. Section 12(d) of Public Law 104-113 (reference (y)) requires Federal agencies to use NGSs and participate in their development to meet agency needs and objectives, when it is consistent with the agency's mission, priorities, and budget resources. OMB Circular A-119 (reference (z)) provides government-wide guidance for implementing the public law. The SD-9 (reference (aa)) provides guidance information on DoD participation in the development and use of NGSs.

7.2.2.6.1. Product Life Cycle Support (PLCS) ISO 10303

ISO 10303 is an ISO standard for the computer-interpretable representation and exchange of product manufacturing information. Its official title is: Automation systems and integration — Product data representation and exchange. It is known informally as "STEP", which stands for "Standard for the Exchange of Product model data". The International standard's objective is to provide a mechanism that is capable of describing product data throughout the life cycle of a product, independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

Typically STEP can be used to exchange data between CAD, Computer-aided manufacturing, Computer-aided engineering, Product Data Management/EDM and other systems. STEP is

addressing product data from mechanical and electrical design, geometric dimensioning and tolerancing, analysis and manufacturing, with additional information specific to various industries such as automotive, aerospace, building construction, ship, oil and gas, process plants and others.

7.2.2.6.2. Common Source Database (CSDB) and S1000D

The Technical Publications Specification Maintenance Group (TPSMG) is responsible for the development and maintenance of Aerospace and Defence Industries Association of Europe (ASD) and Aerospace Industries Association (AIA) Specification 1000D (S1000D). S1000D is the International Standard for the Development of Interactive Electronic Technical Publications. This Specification has been produced to establish standards for the documentation of any civil or military vehicle or equipment. It is based on international standards such as "SGML", "XML" and Computer Graphics Metafile (CGM) for production and use of electronic documentation. In addition, it defines a Common Source Data Base (CSDB) to provide source information for compilation of the publications and for use in electronic logistics information systems to deliver modules of information direct to the user. More information on international standards can be found at the website, http://www.s1000d.org and http://www.oasis-open.org/ .

7.2.2.7. Commercial Standards

The policy of the DoD is to utilize to the maximum degree possible those non-Government standards which satisfy the needs of the military. The policy has its roots in the advent of acquisition reform in the early 90's. The move toward Commercial Off-the-Shelf (COTS) components gained momentum as a result of the 1994 Secretary of Defense Memorandum, "Specifications and Standards – A New Way of Doing Business", dated 29 June 94, often referred to as the "Perry Memorandum". The Perry Memorandum encouraged, where practical, the use of commercial standards in lieu of military standards and specifications. As a result, hundreds of military standards were cancelled, and the use of performance-specifications to describe desired capabilities and outcomes was initiated.

Today there are commercial, non-government and government standards in use today. PSMs can check with the DoD Standardization Office, the ASSIST database, and their respective Component's functional areas and agencies for information on the use of specific standards.

7.2.3. Specifications (MIL-SPEC)

A MIL-SPEC is a document that describes the essential technical requirements for purchased material that is military unique or substantially modified commercial items.

A specification is an explicit set of requirements to be satisfied by a material, product, or service. Should a material, product or service fail to meet one or more of the applicable specifications, it may be referred to as being out of specification or non-conforming. Sometimes the term specification is used in connection with a data sheet (or spec sheet). A data sheet is usually used for technical communication to describe technical characteristics of an item or product. It can be published by a manufacturer to help people choose products or to help use the products. A data sheet is not a technical specification.

MIL-STD 961D: Defense and Program-Unique Specifications Format and Content, establishes the format and content requirements for defense specifications and program-unique specifications prepared either by DoD activities or by contractors for the DoD.

7.2.3.1. Performance Specification

A performance specification states requirements in terms of the required results with criteria for verifying compliance, but without stating the methods for achieving the required results. A performance specification defines the functional requirements for the item, the environment in which it must operate, and interface and interchangeability characteristics.

System Performance Specifications state the system level functional and performance requirements, interfaces, adaptation requirements, security and privacy requirements, computer resource requirements, design constraints (including software architecture, data standards, and programming language), software support and precedence requirements, and developmental test requirements for a given system.

7.2.3.2. Detailed Specifications

Detail specifications specify requirements in terms of material to be used; how a requirement is to be achieved; and how a product is to be assembled, integrated, fabricated or constructed. Applicable to development of contractor final design drawings as well as items being built, coded, purchased, or reused.

7.3. Technical Data Products

7.3.1. Product and Performance Data

The terms product data and technical data are often used interchangeably. Product data is usually descriptive, business oriented, logistics, or information that is related to usage of the product. Product data is typically not scientific or engineering in nature. Product data sheets often contain technical data that define engineering or scientific parameters or characteristics of the product.

Product Data Management (PDM) is the use of software or other tools to track and control data related to a particular product. The data tracked usually involves the technical specifications of the product, specifications for manufacture and development, and the types of materials that will be required to produce goods. The use of product data management allows a company to track the various costs associated with the creation and launch of a product. Product data management is part of product life cycle management, and is primarily used by engineers.

Within PDM the focus is on managing and tracking the creation, change and archive of all information related to a product. The information being stored and managed (on one or more file servers) will include engineering data such as Computer-aided Design (CAD) models, drawings and their associated documents.

7.3.2. Engineering Data For Provisioning (EDFP)

Form, fit, and function data is used synonymously with Engineering Data for Provisioning (EDFP). EDFP is defined as technical data which provides definitive identification of

dimensional, material, mechanical, electrical, functional and/or other characteristics that depict the physical characteristics, location, and function of the item. It includes specifications, standards, drawings, photographs, descriptions, assembly and general arrangement drawings, schematic diagrams, wiring, cabling diagrams, and similar data needed to indicate the location and functions of the item. EDFP is also been referred to as Supplementary Provisioning Technical Data (SPTD).

7.3.3. Technical Data Package

A technical data package is a technical description of an item meeting requirements for supporting an acquisition strategy, production, engineering, and logistics support. The description defines the required design configuration and procedures to ensure adequacy of item performance. It consists of all applicable TD such as drawings, associated lists, specifications, standards, performance requirements, quality assurance (QA) provisions, and packaging details.

There are generally four types of Technical Data Packages (TDPs):

- Conceptual TDP. A conceptual package is a collection of sketches, low fidelity Computer Aided Design (CAD) models and text that document basic concepts of how an item may be developed to meet operational requirements. The TDP is used to determine if the requirements are feasible;
- Developmental TDP. A developmental package is a collection of data intended to document a specific design approach and the fabrication of a developmental prototypes for test or experimentation. These data elements capture the basic design of equipment/weapon systems developed from a concept. They are not intended for, nor are they adequate for use in, the competitive procurement of component parts;
- Product TDP. A product package is a collection of product engineering data related to the design and manufacture of an item or system. Product drawings and/or CAD models contain all of the descriptive documentation needed to ensure the competitive procurement of spare parts or end items;
- Commercial TDP. A commercial package is for end items developed by the contractor prior to the award of the contract at his/her own expense. Unless the Government purchases rights for these drawings and/or CAD models, the drawings provide the contractor's proprietary engineering and design information for commercially developed items, off-the-shelf items, or items not developed at Government expense;
- While not a type of TDP, the Decision Tree is important because it provides a process for selecting the appropriate type data item requirements to be placed on contract.

7.3.4. Technical Manuals (TMs)

A technical manual is a publication that contains instructions for the installation, operation, maintenance, training, and support of weapon systems, weapon system components, and support equipment. TM information may be presented in any form or characteristic, including but not limited to hard copy, audio and visual displays, magnetic tape, discs, and other electronic devices. A TM normally includes operational and maintenance instructions, parts lists or parts breakdown, and related technical information or procedures exclusive of administrative procedures. Technical Orders (TOs) that meet the criteria of this definition may also be classified as TMs.

In the ASSIST database, there are over 41 active documents to assist with the development of technical manuals. https://assist.daps.dla.mil/quicksearch/index.cfm.

A detailed guide for the outsourcing of Technical Manuals is found in the NAVAIR Technical Manual Acquisition Process (Outsourcing) Standard Work Package, SWP6851-003, 31 Aug 2010.

7.3.4.1. Paper Based Technical Manual

Traditionally, technical manuals have been paper based. With the advent of improved technologies for managing and sharing data, paper based technical manuals are becoming the exception rather than the rule for publications.

7.3.4.2. Electronic Technical Manual (ETM)

Electronic technical manuals (ETMs) are generally distributed on a CD-ROM but do not have the interactive features that an IETM would have. Generally, ETMs are paper based technical manuals which have been electronically scanned.

Each of the DoD Components maintains sites and helpdesks for access to the most current ETM or IETM. For example, the USAMC Logistics Support Activity (LOGSA) maintains on its site listings of current ETMs for all Army weapon systems, a helpdesk, and automatic notification features for technical manual updates. https://www.logsa.army.mil/etms/welcom1.cfm

7.3.4.3. Interactive Electronic Technical Manual (IETM)

IETMs, or Interactive Electronic Technical Manuals, provide dialog driven interaction with the user, guided diagnostic troubleshooting & fault isolation, and integration with training and other logistics support functions.

From the ASSIST database, the following instructions are available governing the development of interactive electronic technical manuals.

- MIL-DTL-87268C, Interactive Electronic Technical Manuals – General Content, Style, Format, and User-Interaction Requirements
- MIL-DTL-87269C, Data Base, Revisable – Interactive Electronic Technical Manuals, for the Support
- MIL-STD-3008B, Interactive Electronic Technical Manual (IETM) Technical Data Requirements to Support the Global Combat Support System – Army (GCSS-A)
- MIL-STD-40051-1A, Preparation of Digital Technical Information for Interactive Electronic Technical Manuals (IETMs)
- DI-TMSS-81814, Interactive Electronic Technical Manual (IETM) Content Plan

7.3.5. Embedded Technical Data Systems

An embedded technical data system is an electronic system designed to do one or a few dedicated and/or specific functions for the collection, storage, transmission and possibly even management of technical data relevant to the mission of the weapon system in which it resides. Embedded systems typically contain processing capability. The key characteristic, however, is being dedicated to handle a particular task unique to the mission. These systems may require very powerful processors and extensive communication, for example air traffic control systems

may be viewed as embedded, even though they involve mainframe computers and dedicated regional and national networks between airports and radar sites (each radar probably includes one or more embedded data system of its own).

Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

7.3.6. Engineering Drawings

Engineering drawings are a collection of data related to the design and manufacture of an item or system. Drawings document the level of design maturity achieved and are used for future development; as well as supporting quality assurance functions, maintaining configuration, and procurement of spare parts and systems. Engineering drawings are the major source of technical information for logistics support throughout a system's life cycle.

7.3.7. Data Sheets

A datasheet, data sheet, or spec sheet is a document summarizing the performance and other technical characteristics of a product, machine, component (e.g., an electronic component), material, a subsystem (e.g., a power supply) or software in sufficient detail to be used by a design engineer to integrate the component into a system. Typically, a datasheet is created by the component/subsystem/software manufacturer and begins with an introductory page describing the rest of the document, followed by listings of specific characteristics, with further information on the connectivity of the devices. For example, a Material Safety Data Sheet, or MSDS, is a technical data sheet summarizing information about material identification; hazardous ingredients; health, physical, and fire hazards; first aid; chemical reactivity and incompatibility; spill, leak, and disposal procedures; and protective measures required for safe handling and storage. These are required by agencies such as OSHA in its Hazard Communication Standard, 29 C.F.R. 1910.1200.

7.4. Technical Data Management

The process of applying policies, systems, and procedures for identification and control of data requirements; for the timely and economical acquisition of such data; for assuring the adequacy of data for its intended use; for the distribution or communication of the data to the point of use; and for use analysis.

7.4.1. Distribution Statements and Access

A distribution statement is a statement used in marking a technical document to denote the extent of its availability for distribution, release, and disclosure without additional approvals or authorizations. A distribution statement marking is distinct from and in addition to a security classification marking assigned in accordance with DoD 5200.1-R (reference (h)). Also see http://www.dtic.mil/dtic/submit/guidance/distribstatement.html.

DoD Directive 5230.24, dated 18 March 1987, states that all documents sent to DTIC® must be assigned a distribution statement by the contributor. Clicking the Distribution Statement title will provide additional information on each statement. The following distribution statements and notices are authorized for use on DoD technical documents:

- DISTRIBUTION STATEMENT A.

Approved for public release; distribution is unlimited.

- DISTRIBUTION STATEMENT B.

Distribution authorized to U.S. Government agencies only (fill in reason) (date of determination). Other requests for this document shall be referred to (insert controlling DoD office).

- DISTRIBUTION STATEMENT C.

Distribution authorized to U.S. Government Agencies and their contractors (fill in reason) (date of determination). Other requests for this document shall be referred to (insert controlling DoD office).

- DISTRIBUTION STATEMENT D.

Distribution authorized to the Department of Defense and U.S. DoD contractors only (fill in reason) (date of determination). Other requests shall be referred to (insert controlling DoD office).

- DISTRIBUTION STATEMENT E.

Distribution authorized to DoD Components only (fill in reason) (date of determination). Other requests shall be referred to (insert controlling DoD office).

- DISTRIBUTION STATEMENT F.

Further dissemination only as directed by (inserting controlling DoD office) (date of determination) or higher DoD authority.

- DISTRIBUTION STATEMENT X.

Distribution authorized to U.S. Government Agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with _____(Insert appropriate regulation); _____ (Insert date of determination). DoD Controlling Office is _____(Insert the name of DoD Controlling Office).

- Export Control Warning.

All technical documents that are determined to contain export-controlled technical data shall be marked "WARNING - This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751, et seq.) or the Export Administration Act of 1979 (Title 50, U.S.C., App. 2401 et seq.), as amended. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DoD Directive 5230.25." When it is technically not feasible to use the entire statement, an abbreviated marking may be used, and a copy of the full statement added to the "Notice To Accompany Release of Export Controlled Data" required by DoD Directive 5230.25.

- Handling and Destroying Unclassified/Limited Distribution Documents.

Unclassified/Limited Distribution documents shall be handled using the same standard as "For Official Use Only (FOUO)" material, and will be destroyed by any method that will prevent

disclosure of contents or reconstruction of the document. When local circumstances or experience indicates that this destruction method is not sufficiently protective of unclassified limited information, local authorities may prescribe other methods but must give due consideration to the additional expense balanced against the degree of sensitivity.

7.4.2. Classified Data

It is DoD policy, per DoDI 5210.50, that known or suspected instances of unauthorized public disclosure of classified information shall be reported promptly and investigated to decide the nature and circumstances of the disclosure, the extent of damage to national security, and the corrective and disciplinary action to be taken. Unauthorized disclosure of classified information to the public reduces the effectiveness of DoD management; damages intelligence and operational capabilities; and lessens the Department of Defense's ability to protect critical information, technologies, and programs.

7.4.3. Data Security & Protection

Per the Defense Acquisition Guidebook, para. 4.2.3.1.7.2, "Data Protection", the program manager is responsible for protecting system data, whether the data is stored and managed by the government or by contractors. The DoD policy with regard to data protection, marking, and release can be found in DoD Directive 5230.24, DoD Directive 5230.25, DoD 5400.7-R, and DoD 5200.1-M. Data containing information subject to restrictions are required to be protected in accordance with the appropriate guidance, contract, or agreement. Guidance on distribution statements, restrictive markings, and restrictions on use, release, or disclosure, of data can be found in the DFARS Part 252.227-7013 &7014, and DoD Directive 5230.24. When digital data is used, the data should display applicable restriction markings, legends, and distribution statements clearly visible when the data is first opened or accessed. These safeguards not only assure government compliance with use of data but also guarantee and safeguard contractor data that are delivered to the government, and extend responsibilities of data handling and use to parties who subsequently use the data.

Section 208 of Public Law 107-347 and DoD Privacy Impact Assessment (PIA) guidance requires that PIA be conducted prior to developing or purchasing any DoD information system that will collect, maintain, use, or disseminate personally identifiable information about members of the public, federal personnel, DoD contractors and, in some cases, foreign nationals. Available PIA Guidance provides procedures for completing and approving PIAs in the Department of Defense. For further details, see section 7.5.6.4.

All data deliverables should include distribution statements. Processes should be established to protect all data that contain critical technology information, as well as ensure that limited distribution data, intellectual property data, or proprietary data is properly handled throughout the life cycle, whether the data are in hard-copy or digital format.

The DFARS does not presently address the safeguarding of unclassified DoD information within industry, nor does it address cyber intrusion reporting for that information. DoD published an Advance Notice of Proposed Rulemaking (ANPR), and notice of public meeting in the Federal Register at 75 FR 9563 on March 3, 2010, to provide the public an opportunity for input into the

initial rulemaking process. The ANPR addressed basic and enhanced safeguarding procedures for the protection of DoD information.

The purpose of this proposed DFARS rule is to implement adequate security measures to safeguard unclassified DoD information within contractor information systems from unauthorized access and disclosure, and to prescribe reporting to DoD with regard to certain cyber intrusion events that affect DoD information resident on or transiting through contractor unclassified information systems. This rule addresses the safeguarding requirements specified in Executive Order 13556, Controlled Unclassified Information. On-going efforts, currently being led by the National Archives and Records Administration regarding controlled unclassified information, may also require future DFARS revisions in this area. This case does not address procedures for Government sharing of cyber security threat information with industry; this issue will be addressed separately through follow-on rulemaking procedures as appropriate. More information is found at http://www.gpo.gov/fdsys/pkg/FR-2011-06-29/html/2011-16399.htm.

7.4.4. Data Assurance and Quality Controls

Technical data assurance and quality control is a program responsibility. The DoD has established policy, guidelines and resources to implement effective data assurance programs. With the increasing amount of concern and Information Warfare activities requiring rapid responses, it is difficult to ensure that all appropriate agencies and organizations are given the knowledge and tools to protect from, react to, and defend against Information Warfare attacks.

The Information Assurance Technology Analysis Center (IATAC) is a U.S. Department of Defense Information Analysis Center (IAC) sponsored by the Defense Technical Information Center (DTIC), and Director, Defense Research & Engineering (DDR&E). IATAC has been established under the direction of the Defense Technical Information Center and the integrated sponsorship of the Office of the Director of Defense Research and Engineering (ODDR&E); Assistant to Secretary of Defense/Networks and Information Integration; the Joint Staff; and Director, Defense Research & Engineering (DDR&E). IATAC serves as a central authoritative source for Information Assurance vulnerability data, information, methodologies, models, and analyses of emerging technologies relating to the survivability, authenticity, and continuity of operation of information systems critical to the nation's defense in support of the agencies' front line missions.

7.4.5. Intellectual Property

Due to the intangible nature of IP, the value of any IP is limited to what the courts and legislatures are willing to protect against unauthorized use. In the United States, the parameters of what is—or is not—protected as IP are defined through an extensive collection of statutes, court opinions, legal rules, regulations, and procedures. Generally speaking, IP law is divided into categories according to the form of the human intellect product and the exclusive rights and remedies afforded the producers of that product. A good guidebook is found at http://www.acq.osd.mil/dpap/Docs/intelprop.pdf.

7.4.5.1. Patents

Patent categories include:

- utility patents (also known as patents for inventions), which are the most common type of patent;
- design patents, which cover new, original, and ornamental designs for articles of manufacture;
- plant patents, which cover asexually reproduced new varieties of plants.

7.4.5.2. Copyrights

A "copyright" allows an author to exclude others from copying, performing, displaying, or distributing their expressions of original thought or works of authorship. Works of authorship include literary works, pantomimes and choreographic works, musical works, dramatic works, pictorial, graphic, and sculptural works, sound recordings, motion pictures and other audiovisual works, architectural works, and computer programs.

7.4.5.3. Trade Secrets

Trade secrets can protect any original thought or work product covered by the other forms of IP. They protect any knowledge that, for economic reasons, is either kept secret or requires nondisclosure by any third party. A trade secret may be thought of as "know-how"—which may include business or technical knowledge— that is kept secret to gain an advantage over competitors. Some examples of trade secrets may be special customer lists, sources of scarce materials, secret processes, formulas, techniques, advertising ploys, and unique business plans.

Unlike other forms of IP, there are simply no standards to meet for trade secrets, as long as the trade secret provides some value and remains a secret. Trade secrets last only as long as the information is kept secret. As a result, as long as the knowledge or information is kept secret, trade secrets may be protected eternally against disclosure by all who have received such secrets in confidence and all who would have obtained the secrets by theft. For example, the formula of Coca- Cola™ (originally developed in the late 1800s) is considered a trade secret, even though many copies of the beverage have been developed by others and is available on the market.

Trade secret protection is established by state laws. A majority of states have adopted the Uniform Trade Secrets Act (UTSA). The UTSA defines a "trade secret" as follows: "Trade secret" means information, including, but not limited to, technical or non-technical data, a formula, pattern, compilation, program device, method, technique, drawing or process, financial data, or list of actual or potential customers that: (i) is sufficiently secret to derive economic value, actual or potential, from not being generally known to other persons who can obtain economic value from its disclosure or use, and (ii) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.

The disadvantage of trade secrets is that no protection exists against discovery or use by fair means (i.e., accidental disclosure, independent invention, and reverse engineering).

7.4.5.4. Trademarks and Service marks

A "trademark" is defined as a word, phrase, logo, or other graphic symbol used by a manufacturer or merchant to distinguish its line of products from the products of others. Similarly, a "service mark" distinguishes a provider's services from similar services provided by others. Trademarks and service marks are protected under the Lanham Trade-Mark Act9 and

protected under local state laws. The two basic purposes of the Lanham Act are (1) to eliminate deception and unfair competition in the marketing of goods and services, and (2) to provide a means for the owner of a mark to be protected against the use of a confusingly similar mark by others.

The U.S. Patent and Trademark Office (PTO) registers trademarks and service marks. Such a registration may be renewed every 10 years as long as the registrant is still using the mark. Many marks currently in the marketplace are more than one hundred years old. In the Government contracting process, the Government has not traditionally asserted any rights to the names and logos associated with the products it has made for itself. On occasion, however, Government agencies and patriotic societies have sought and obtained their own trademarks. Examples are “Smokey the Bear,” “Give a Hoot, Don’t Pollute,” “PX,” “FDIC,” “4-H Club,” “Red Cross”.

7.4.5.5. Mask Works

Mask works IP protects the patterns used in fabricating integrated circuits on semiconductor chips.

7.4.5.6. Vessel Hull Designs

Vessel hull designs IP protects the artistic or distinctive aspects of certain vessel hulls, plugs, or molds.

7.4.5.7. Other Forms of Proprietary Information.

There are other forms of valuable IP that may not be covered by any of the previously mentioned lists, such as a trade secret or copyrighted information that does not meet the definition of “technical data” or “computer software.” These deliverables may qualify as “special works” or “existing works,” or they may be some other form of company-proprietary information, such as financial, cost, business, or marketing information. When acquiring these deliverables, the contracting officer should consider requiring the contractor to identify and assert any restrictions on the Government use thereof.

7.5. Technical Data Delivery

A member of the Program Management Team should be designated the Data Manager to monitor the contractor preparation and delivery of required Technical Data. This should include the following:

- Assure timely delivery to all activities on the distribution list for the data item;
- Assure that the data deliverable is acceptable (meets contractual requirements);
- Assure that all data users are satisfied with the product;
- Formally receipt for the data delivery by signing the DD Form 250;
- Recommend the Program Manager approve and accept the delivered data by signing the DD Form 250;
- Provide a repository for <u>all</u> contractor delivered technical data until the Product Baseline is formally established and the Configuration Status Accounting activity has all the data needed to manage the configuration of the system and provide information for its life cycle support.

7.5.1. Contract Data Requirements List (CDRL)

The Contract Data Requirements List (CDRL) is a list of authorized data requirements for a specific procurement that forms a part of the contract. It is comprised of either a single DD Form 1423, or a series of DD Forms 1423 (individual CDRL forms) containing data requirements and delivery information. The CDRL is the standard format for identifying potential data requirements in a solicitation, and deliverable data requirements in a contract. Subpart 215.470 of the DFARS requires the use of the CDRL in solicitations when the contract will require delivery of data.

CDRLs should be linked directly to SOW tasks and managed by the program office data manager. Data requirements can also be identified in the contract via Special Contract Clauses (e.g., DFARS), which define special data provisions (such as, Rights in Data, Warranty, etc.).

The purpose of the CDRL is to provide a standardized method of clearly and unambiguously delineating the Government's minimum essential data needs. The CDRL groups all of the data requirements in a single place rather than have them scattered throughout the solicitation or contract. https://acc.dau.mil/CommunityBrowser.aspx?id=18172.

7.5.2. Data Item Description (DID)

A completed form that defines the data required of a contractor. DIDs specifically define the data content, preparation instructions, format, and intended use. MIL-STD-963 covers the content and format for DIDs. Per DSPO Policy Memo 06-1, Data Item Descriptions (DIDs), the preparation, coordination, clearance, and approval of DoD Data Item Descriptions is included in DoD 4120.24-M, Defense Standardization Program Policies and Procedures.

Q. What is a Data Item Description (DID)?
A. It is a completed document that defines the data required of a contractor. The document specifically defines the data content, format, and intended use.

Q. Where can I obtain a copy of specific DIDs?
A. If you know the number of the DID(s) you are looking for and just want to download a copy of one or a few DIDs, then a good tool to use is the ASSIST–Quick Search. Simply enter the 5-digit DID number (do not use revision letters) in the [Document Number] block and click on the [Submit] button.

Q. Is there a website that lists all Data Item Descriptions?
A. By entering “DI” in the [Document ID] block of the ASSIST–Quick Search and clicking on the [Submit] button, you can generate a list of over 1100 DIDs; however, the list is generated in HTML and is cumbersome to print. To print a preformatted listing of all DIDs in Adobe PDF format, use the ASSIST–Online . If you have not already registered for a user account and password, you'll need to complete the online application form .

Once you've logged on, click on the [DIDs] link on the left side of the page to get to the "DIDs Menu" and then click on the link for the "DIDs Browser." The DIDs Browser allows you to generate a list of Active DIDs, Canceled DIDs, or all DIDs (both Active and Canceled). This same screen allows you to filter the results by Standardization Area, Preparing Activity, or

Preparing Service, or to search for DIDs by Keywords. The resultant list will be generated in HTML, but may be saved as a preformatted report in Adobe PDF format by clicking on the [Report] button at the bottom of the screen. The list may also be exported in Microsoft Excel format by clicking on the [Spreadsheet] button at the bottom of the screen. Where can I find an online copy of DoD 5010.12-L, "Acquisition Management Systems and Data Requirements Control List (AMSDL)"?
A. The Acquisition Management System and Data Requirements Control List (AMSDL) is no longer published, as all DIDs have been incorporated into the ASSIST database. The AMSDL was cancelled in 2007.
Source:
http://www.dsp.dla.mil/APP_UIL/displayPage.aspx?action=content&accounttype=displayHTML&contentid=22

7.5.3. Acquisition Streamlining and Standardization Information System (ASSIST)

ASSIST is the official source for specifications and standards used by the Department of Defense and it always has the most current information. Over 111,000 technical documents are indexed in ASSIST, and the ASSIST document database houses over 180,000 PDF files associated with about 82,000 of the indexed documents. There are more than 33,000 active ASSIST user accounts and over 6,000 active Shopping Wizard accounts. Managed by the DoD Single Stock Point (DODSSP) in Philadelphia, the ASSIST-Online web site provides free public access to most technical documents in the ASSIST database. The ASSIST Shopping Wizard provides a way to order documents from the DODSSP that are not available in digital form.

ASSIST-Online is a robust, comprehensive web site used by standardization management activities to develop, coordinate, and manage defense and federal specifications and standards, military handbooks, commercial item descriptions, data item descriptions, and related technical documents prepared in accordance with the policies and procedures of the Defense Standardization Program (DSP). In addition to DoD-prepared documents, ASSIST also has U.S.-ratified international standardization agreements, such as NATO STANAGs. Website is found at https://assist.daps.dla.mil/online/faqs/overview.cfm.

7.6. Technical Data Maintenance

Technical data maintenance incorporates tools, processes, and people to maintain the quality of the data. Data must be maintained to be accurate, complete and consistent. All data should have a data steward who is responsible for ensuring the quality of the source data. The data steward is normally a person who has knowledge of the data, can recognize incorrect data, and has the knowledge and authority to correct the issues. The technical data maintenance infrastructure should include tools that help the data steward recognize issues and simplify corrections. A good data-stewardship tool should point out questionable matches that were made— the same user with different names and part numbers for a different weapon system other than assigned to that user, for example. The steward might also want to review items that were added as new, because the match criteria were close but below the threshold. It is important for the data steward to see the history of changes made to the data by the technical data maintenance systems, to isolate the source of errors and undo incorrect changes. Maintenance also includes the processes to pull changes and additions into the technical data maintenance system, and to distribute the cleansed data to the required places.

The DoD is fielding more sophisticated technical data management tools throughout the community, it is important to ensure the maintenance functions of those tools are adequate for the requirements of accurate, complete and consistent data.

7.6.1. Storage

Archival/Retention activities are intended to ensure that data is archived toward organizational regulations and requirements, to meet near-term and far-term needs – and to include Records Management requirements. For some contracts, data may be required to be online or available for periods of time ranging from one year to up to 12 years, for example. Organizations frequently have requirements for retention imposed upon them externally, as from The National Archives and Records Administration (NARA). DoD 5015.02-STD provides an extensive list of references to United States Code, Executive Orders, Policy, and Guidelines for Data and Records storage.

Per the Defense Acquisition Guidebook, 4.2.3.1.7.3, "Data Storage", the program manager also has responsibility for addressing long-term storage and retrieval of data and associated program information. This includes long-term planning and incremental digitization, as required, to ensure that applicable data are available, preserved, and migrated to successive formats for future planning and use.

The DoD Components also maintain their respective storage and archiving practices. For example, NAVAIR's Aviation Readiness Analysis Division, AIR-6.8.2, is implementing an integrated documentation standards and library system for analytical products and processes that:

- Applies a standards template to drive Systems Engineering (SE) process for analytical product development and for analytical product and process documentation
- Provides a standard format for essential documentation capture of Analytical Products and process
- Provides the user with concise and essential documentation for developed analytical products
- Provides documentation that defines and delineates the capabilities and limitations of analytical products
- Provides a system that IDs, classifies and stores available analytical products/capabilities and process documentation
- Provides analytical products and process documentation for all stakeholders (developers, maintainers, users, customers, etc.)
- Facilitates Quality Assurance and Continuous Improvement of analytical products and processes
- Facilitates analytical products reuse.

Reference is NAVAIR SWP-6822-IDSLS, 5 Nov 2009.

7.6.2. Retrieval

Data retrieval, in database management, involves extracting the wanted data from a database. The two primary forms of the retrieved data are reports and queries. In order to retrieve the desired data the user present a set of criteria by a query. Then the Database Management System

(DBMS), software for managing databases, selects the demanded data from the database. The retrieved data may be stored in a file, printed, or viewed on the screen.

7.6.3. Archiving

An archive is a collection of historical records, or the physical place they are located. Archives contain primary source documents that have accumulated over the course of an individual or organization's lifetime. In general, archives consist of records that have been selected for permanent or long-term preservation on grounds of their enduring historical or evidentiary value. Archival records are normally unpublished and almost always unique, unlike books or magazines for which many identical copies exist. This means that archives (the places) are quite distinct from libraries with regard to their functions and organization, although archival collections can often be found within library buildings.

Most DoD organizations maintain data archives. Program offices maintain archives of weapon system operational and sustainment performance for the life of the system and beyond. Archiving of technical data is especially important in areas such as obsolescence / DMSMS, maintenance and historical cost and performance data.

7.6.4. Disposal

Technical data disposal has significant security implications. Per DoD 5220.22-M National Industrial Security Program Operating Manual (NISPOM) January 1995, classified information no longer needed shall be processed for appropriate disposition. Classified information approved for destruction shall be destroyed in accordance with this document. The method of destruction must preclude recognition or reconstruction of the classified information or material. In the end, only total physical destruction affords total security.

Each of the DoD Components provides policy and guidance on the life cycle management of data records. For example, the Army's AR 25-400-2, "The Army Records Information Management System", provides instructions to properly manage information from its creation through final disposition, according to Federal laws and Army recordkeeping requirements.

The computer hardware on which the technical data resides should be disposed of in accordance with Federal and DoD regulations. See NIST Special Publication 800-88, "Guidelines for Media Sanitization" found at http://csrc.nist.gov/publications/nistpubs/800-88/NISTSP800-88_rev1.pdf.

Technical Data in the Life Cycle

A. Purpose

The technical data product support element includes the processes of applying policies, systems and procedures for identification and control of data requirements; for the timely and economical acquisition of such data; for assuring the adequacy of data for its intended use; for the distribution or communication of the data to the point of use; and for use analysis.

Technical data activities document and maintain the database reflecting system life cycle decisions, methods, feedback, metrics, and configuration control. It directly supports the configuration status accounting process. Technical data processes govern and control the selection, generation, preparation, acquisition, and use of data imposed on contractors.

a. Why Technical Data is Important

DoDI 5000.02 states that Program Managers for ACAT I and II programs, regardless of planned sustainment approach, shall assess the long-term technical data needs of their systems and reflect that assessment in a Technical Data Rights Strategy. The Technical Data Rights Strategy shall:

- Be integrated with other life-cycle sustainment planning and included in the Acquisition Strategy;
- Assess the data required to design, manufacture, and sustain the system, as well as to support re-competition for production, sustainment, or upgrades;
- Address the merits of including a priced contract option for the future delivery of technical data and intellectual property rights not acquired upon initial contract award and shall consider the contractor's responsibility to verify any assertion of restricted use and release of data.

If affordable, ownership of full data rights is beneficial. But The Product Support Manager must consider the spectrum of alternatives available for data access, which can include ownership, option to buy ownership, leasing agreements, or access by way of a public-private partnership. There are choices that exist between the acquire or not-acquire decision.

Technical data is the "knowledge products" of the acquisition process, as well as the sustainment process. It is the basis for most, if not all acquisition, design, development, production, operation, support, and maintenance decision-making. Being able to access the right data at the right time to make the right decisions does not happen by chance. Good data management also does not happen as a result of ordering excessive data, just in case. Rather, effective technical data strategy implementation is the product of an effective data management process.

Technical data is recorded information (regardless of the form or method of recording) of a scientific or technical nature (including computer software documentation.) necessary to operate and maintain a defense system.

Technical Data:

- Describes product, interfaces, and decisions made;
- Is traceable, responsive to changes, and consistent with CM requirements;
- Is prepared and stored digitally;
- Involves deciding what data is needed, who shall control it, and when.

Technical Data is one of the twelve Integrated Product Support Elements. The activities occurring within the scope of this area should be integrated with other product support element areas in keeping with KPP and KSA optimization goals and constraints.

Historically, Technical Data activities were the primary responsibility of engineering and product development, with Technical Data sustainment being planned and implemented often under separate contract line items and separate management. The current view of integrated product support requires that the Life Cycle Sustainment Plan include and implement an integrated strategy, inclusive of all the Integrated Product Support Elements, that is reviewed and reported on throughout the acquisition life cycle.

The current view represents Technical Data activities being heavily influenced prior to system deployment by the design interface activities which focus on ensuring that the program KPPs are achieved through a design to optimize availability and reliability at reduced life cycle cost.

After deployment and during Operations and Sustainment (O&S), the activities of sustaining engineering (including product improvement, reliability fixes, continuing process improvements and technology refresh) continue those of design influence and integrate both back with engineering and manufacturing activities and forward to collect and validate system operational performance with the user. The Product Support Manager is thus capable of implementing a total enterprise sustainment strategy inclusive of all acquisition phases and all product support element scopes.

b. Major Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Technical Data IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, includes in the left column a listing of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	**Technical Data Activities**

User Need / Technology Opportunities & Resources	The Product Support Manager must be able to understand and forecast technical data requirements to actual product support sustainment activities and outcomes. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Key Products: • Requirements • Metrics
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. The AoA requires, at minimum, full consideration of possible trade-offs among cost, schedule, and performance objectives for each alternative considered. CM is initiated during this phase. While not officially designated until Milestone B, the outcomes of a PSM perspective should be introduced at this point as inputs to Milestone review documents which can be summarized as the initial sustainment cost estimates, the initial Life Cycle Sustainment Plan (LCSP) and related sustainment metrics. The Technical Data Rights Strategy is the major deliverable for Technical Data. This document should reflect the assessment and integration of the data rights requirements across all the functional disciplines required to develop, manufacture and sustain the system over the life cycle. Restricted use and intellectual property rights should be minimized. The Technical Data Rights Strategy must be approved in the context of the Technology Development Strategy prior to issuing a contract solicitation. Risks to achieving the necessary support structure for the time frame of the program by IOC should be identified and a mitigation strategy outlined. The specific enabling support technologies should be identified along with the corresponding plan to technically mature each support element. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of how Milestone Decision Review required documents are impacted by each Product Support Element. Key Products: • Technical Data Rights Strategy • Initial cost estimates • Inputs into key required acquisition documents such as

	Acquisition Information Assurance Strategy, Analysis of Alternatives, Net-Centric Data Strategy, and Systems Engineering Plan
Technology Development	At Milestone B, the LCSP evolves into a detailed execution plan for how technical data and its associated products and infrastructure is to be designed, acquired, sustained, and how sustainment will be applied, measured, managed, assessed, modified, and reported from system fielding through disposal. The Product Support Manager is required to also provide technical data information on many other acquisition documents as listed below under deliverables and the DAU site, https://dag.dau.mil/Pages/Default.aspx. Key Products: • Technical Data plans as required for each of 12 IPS Elements • Inputs into key required acquisition documents such as Net-Centric Data Strategy, Information Support Plan, Systems Engineering Plan, and Test and Evaluation Master Plan • Updated cost estimates for technical data
Engineering & Manufacturing Development	Technical data requirements designed earlier in the acquisition process should be validated and those that were not defined are assessed for impact through test results and supplier provided data. Significant changes may be required to the product support package to achieve the objective sustainment metrics including major support provider changes. As the program matures, the LCSP is updated to reflect increasing levels of detail as they become available. The detail and focus will vary depending on the life-cycle phase but in all cases the technical data information should be in sufficient depth to ensure the acquisition, design, sustainment, and user communities have an early common understanding of the sustainment requirements, approach, and associated risks. Key Products: • Product and performance data associated with the detailed product baseline • Engineering drawings • Engineering data for provisioning
Production & Deployment	Technical data collection, usage, and management continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, taking part in planning activities that may be on-going already for product improvement, and developing long term plans for improvements for both the system and its support infrastructure as part of the LCSP. Fielding occurs during this phase and proof of early planning is now being validated as the system deploys to the operational

	site. Key Products: • Technical Manuals (including ETMs and IETMs) • Technical Repair Standards • Technical Data Packages • Embedded technical data systems • DIDs and CDRLs for operations and sustainment finalized
Operations & Support	During this phase, technical data is delivered by the contractor. The on-going collection, analysis, and assessment processes for technical data are implemented to support achievement of system KPP and KSAs. Technical data requirements may changes during the system's operations and support phase through multiple avenues which include: 1) engineering change proposals (ECP's), 2) new technology refresh activities, 3) modifications and changes to the system, 4) analysis of failure data and reliability growth programs, plus others. The Product Support Manager 's responsibility is to continue reviewing system performance while looking for opportunities to use technical data and its related infrastructure to improve both the system itself and the support infrastructure to optimize cost versus availability. Key Products: • Delivery of technical data • Maintenance and updating of technical data processes and supporting infrastructure

Table 7.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

- DI-ALSS-81557, Supplemental Data For Provisioning (SDFP). Note: SDFP is synonymous with Engineering Data For Provisioning (EDFP) and Form, Fit, and Function Data. This data is required in the provisioning and cataloging process and should be obtained from the contractor with unlimited rights.
- DI-CMAN-80639C , "Engineering Change Proposals (ECP)"
- DI-CMAN-80776, "Technical Data Package"
- DI-EGDS-80918, "Technical Data Package Index"
- DI-FNCL-80166C, "Program Cost and Technical Data Reports"
- DI-GDRQ-80650, "Design Data and Calculations"
- DI-ILSS-80812, "Logistics Technical Data User Profile"

- DI-ILSS-80813, “List of Logistics Technical Data Users”
- DI-MISC-80711A, “Scientific and Technical Reports”
- DI-MISC-80734, “Technical Data Assessment”
- DI-MISC-80750, “Technical Data Package Review Report”
- DI-QCIC-81009, “Technical Data Package Quality Control Program Plan”
- DI-QCIC-81013, “Technical Data Package Validation Report”
- DI-SAFT-80103B , “Engineering Change Proposal System Safety Report (ECPSSR)”
- DI-SESS-81000C, “Product Drawings/Models and Associated Lists”
- DI-SESS-81002D, “Developmental Design Drawings/Models and Associated Lists”
- DI-SESS-81011C, “Drawing Number Assignment Report”
- DI-SESS-81309A, “Internal Contractor Technical Data Report”
- DI-TMSS-80527, “Commercial TMs/Data”
- QAP-99 ED.1, “Technical Data Packages Required to Support Equipment Throughout the Life-Cycle”

A Technical Data Package normally contains:

- Engineering drawings
- Associated lists
- Specifications that define
  - Function, performance, interfaces
  - Physical geometry, other constraints
- Process descriptions
- Material composition
- Class I changes, deviations & waivers approved but not yet incorporated
- Safety requirements
- Preservation and packaging requirements
- Test requirements data and quality provisions
- Preventative maintenance system/Maintenance Requirements Card
- Environmental stress screening requirements
- Requirements to interchangeability, form, fit, and function information

C. OSD Proponency, Policy, Regulations and U.S. Statutes

a. Proponency

Assistant Secretary of Defense for Networks & Information Integration and Department of Defense Chief Information Officer (ASD (NII) / DoD CIO) is responsible for setting policy and providing oversight of information processes, systems, and technologies.

The Undersecretary of Defense for Acquisition, Technology and Logistics is the primary proponent office for the acquisition, technology and logistics policy and oversight for weapons systems.

b. Policy and Regulations

Recent OSD policy requires the setting of rules for the acquisition of technical data rights to ensure sustained consideration of competition in the acquisition of weapon systems. This policy can be found at https://acc.dau.mil/adl/en-US/158916/file/29612/USDATL%20USDATL%20DM%20and%20Tech%20Data%20Jul%2007.pdf.

It is current DoD policy that (*DoDD 8320.02, December 2, 2004):*

- Data is an essential enabler of Network-Centric Warfare (NCW) and shall be made visible, accessible, and understandable to any potential user in the Department of Defense as early as possible in the life cycle to support mission objectives;
- Data assets shall be made visible by creating and associating metadata ("tagging"), including discovery metadata, for each asset. Discovery metadata shall conform to the Department of Defense Discovery Metadata Specification. [Note: There is a DoD community of practice found at https://metadata.dod.mil/mdr/irs/DDMS/ .] DoD metadata standards shall comply with applicable national and international consensus standards for metadata exchange whenever possible. All metadata shall be discoverable, searchable, and retrievable using DoD-wide capabilities;
- Data assets shall be made accessible by making data available in shared spaces. All data assets shall be accessible to all users in the Department of Defense except where limited by law, policy, or security classification. Data that is accessible to all users in the Department of Defense shall conform to DoD-specified data publication methods that are consistent with Global Information Grid (GIG) enterprise and user technologies. More information can be found at the DISA website at http://www.disa.mil/ge/;
- Data assets shall be made understandable by publishing associated semantic and structural metadata in a federated DoD metadata registry. The DoD Data Services Environment (DSE) community of practice website is found at https://metadata.ces.mil/dse/homepage.htm;
- To enable trust, data assets shall have associated information assurance and security metadata, and an authoritative source for the data shall be identified when appropriate;
- Data interoperability shall be supported by making data assets understandable and by enabling business and mission processes to be reused where possible;
- Semantic and structural agreements for data sharing shall be promoted through communities (e.g., communities of interest (COIs)), consisting of data users (producers and consumers) and system developers, in accordance with reference (b);
- Data sharing concepts and practices shall be incorporated into education and awareness training and appropriate DoD processes.
- Also see TITLE 10, Subtitle A, PART IV, Chapter 137, Section 2320, Rights in Technical Data

D. Who Develops, Delivers and Manages Technical Data

The entire Program Management Team, led by the Program Manager and Product Support Manager, participates in determining data requirements and in preparing the contracting documentation. Someone on the Project Team should be designated the Data Manager to

oversee the contractor preparation and delivery of the required data items and to determine their acceptability.

In developing acquisition strategies, acquisition program managers shall ensure data management expertise is included in all such efforts in order to ensure the:

- Definition of all of the product's data users, over the entire life cycle of the product, in order to properly specify data sharing requirements and enable the establishment /maintenance of an Integrated Data Environment (IDE) with respect to the program;
- Determination of the minimum essential DoD data needs and the alignment of those needs as much as possible to the types of data normally acquired in commercial purchases of similar items;
- Selection of data requirements through the "tailoring" process to minimize the amount of DoD-unique data acquired from contractors;
- Determination of the appropriate data format and media to enable the IDE and data sharing among all members of the Integrated Product Team (IPT), regardless of their physical locations;
- Provisions are made for the complete visibility of data requirements in contracts;
- Cost-effectiveness of the data being acquired;
- Promotion of the uniform use of commercial data exchange standards and open systems among DoD components and contractors;
- Quality of the data being acquired / accessed meets contractual requirements and industry standards;
- Timeliness, accuracy, and adequacy of the data being delivered / accessed;
- Proper marking of technical data for distribution;
- Compliance with all current Federal and DoD regulations on the selection, acquisition and use of data;
- Coordination of data delivery schedules with overall acquisition program schedules and needs.

E. When Is Technical Data Delivered and Managed in the Life Cycle

By Milestone A, PSM's need to ensure that the Technical Data Rights Strategy (part of the Technology Development Strategy) is developed. Technical data deliveries continue in the form of data itself, the environments with which to manage it, safeguards to protect it, quality control to ensure it is accurate and timely, and strategies and reports to ensure it is meeting program requirements. Technical data and its management continues even beyond the disposal of the weapon system with lesson learned, historical archives, and analysis. By establishing the best technical data strategies early in the life cycle, The Product Support Manager can contribute significantly to the weapon systems operation and sustainment long term success.

F. How Technical Data Is Developed, Established and Managed

a. Planning

Planning for Technical Data Management commences early in the program concurrently with developing the Technical Data Rights Strategy and concepts for Configuration Management, Life Cycle Logistics Support, and Maintenance Concepts.

Prior to preparing a contract Statement of Work (SOW), a data call elicits data requirements to be incorporated into the SOW and the Contract Data Requirements List (CDRL).

b. Technical Data Contracting Strategies

Once The Product Support Manager has identified the technical data requirements, acquisition occurs through contracts between the government and the contractor. Technical data requirements are identified in Contractor Data Requirements Lists (CDRLs) that are integrated into the prime system development contract (i.e., they are not usually separate contracts). In the case of the Navy and Marine Corps, a Technical Manual Contract Requirement (TMCR) is used to procure technical manuals and Interactive Electronic Technical Manuals (IETMs). If immediate delivery of one of more Technical Data Packages (TDPs) is not required, there are four basic contracting options for specifying future delivery requirements:

- Deferred delivery. This technique is normally used when the specific requirements for the data can be determined, but the time or place of delivery is not certain. Deferred delivery is also a means of postponing the delivery of data until the design of the related item has stabilized. The Government has the right to defer the delivery of technical data or computer software for up to two years after the acceptance of all other items;
- Deferred ordering. This option is normally used when there is an indication that certain data may be needed, but more information will be required before specific requirements can be identified or until the product stabilizes to the extent accurate requirements can be specified. This ensures the availability of raw data while avoiding the cost of buying the data, if the need never arises;
- Priced option agreements. The program manager must assess the merits of including priced option agreements for the purchase of additional data or additional license rights not initially acquired. The PM may reasonably believe that the government will need to develop a second source for this subsystem;
- Data escrow. An agreement to deliver a detailed technical data package at a later date, normally when production is nearing completion or when the information no longer represents a competitive advantage for the manufacturer. This is useful primarily when DoD plans to maintain a legacy model that is older than that carried in the commercial marketplace. The parties must negotiate a number of important elements, such as the escrow period, the conditions under which the government can require deliver, the procedures for requesting delivery, and the payment of escrow fees.

DoD policy recognizes that all data does not have to be fully purchased. Access to the data may be all that is required. The following benefits can be achieved through an access-only strategy:

- Reduced costs;
- Facilities integration into a shared data environment;
- Use of industry “best practices” to manage and deliver access to data that crosses program-specific boundaries.

c. Data Required By Contract

Data is defined as recorded information, regard-less of form or characteristic, and includes all the administrative, management, financial, scientific, engineering, and logistics information and documentation required for delivery from the contractor. Contractually required data is classified as one of three types:

- Type I: Technical data
- Type II: Non-technical data
- Type III: One-time use data (technical or non-technical)

d. Purpose of Data Acquisition

Data is acquired for two basic purposes:

- Information feedback from the contractor for program management control, and
- Decision making information needed to manage, operate, and support the system (e.g., specifications, technical manuals, engineering drawings, etc.).

Data analysis and management is expensive and time consuming. Present DoD philosophy requires that the contractor manage and maintain significant portions of the technical data, including the Technical Data Package (TDP). Note that this does not mean the government isn't paying for its development or shouldn't receive a copy for post-delivery use. Minimize the TDP cost by requesting the contractor's format (for example, accepting the same drawings they use for production), and asking only for details on items developed with government funds.

e. Data Call for Government Contracts

As part of the development of an Invitation for Bid or Request for Proposals, the program office convenes the Program Management Team (Integrated Product and Process Development process) and presents the planned procurement and asks integrated team members and affected functional managers to identify and justify their data requirements for that contract. A description of each data item needed is then developed by the Program Management Team and reviewed by the Program Manager. Data Item Descriptions, located in the Acquisition Streamlining & Standardization Information System (ASSIST) database, are used for guidance in developing these descriptions.

Concurrent with the DoD policy on specifications and standards, there is a trend to avoid use of standard Data Item Descriptions on contracts, and specify the data item with a unique tailored data description referenced in the Contract Data Requirements List.

The U.S. Marine Corps has a Statement of Work, CDRL, and Tracking Tool (SCATT) that is available within MARCORSYSCOM **(http://www.marcorsyscom.usmc.mil/sites/scatt/)** to assist in the preparation of SOW's and CDRL's.

f. Data Environments

Data environments feature automated services that support the implementation and maintenance of data resources that are used by two or more combat support applications. These automated services provided include: identification of common data, physical data modeling, database segmentation, development of data access and maintenance routines, and database reengineering to use the common data environment.

In his July 2, 1997 memorandum entitled "Policy for the Transition to a Digital Environment for Acquisition Programs," the Deputy Secretary of Defense set a corporate goal of digital operations being the method of choice across our community by the end of 2002. The DoD has been fully complying with this policy and the majority of DoD acquisition and logistics operations are based on digital methodologies and products.

In December 2001, the DoD Chief Information Officer requested development of an enterprise level data strategy to advance the Department toward the goal of network centric operations. The key attributes of the strategy included:

- Ensuring data are visible, available and usage when needed and where needed to accelerate decision-making;
- "Tagging" of all data (intelligence, non-intelligence, raw and processed) with metadata to enable discovery of data by users;
- Posting of all data to shared spaces to provide access to all users except when limited by security, policy or regulations;
- Advancing the Department from defining interoperability through point-to-point interfaces to enabling the "many-to-many" exchanges typical of a net-centric data environment;
- Also introducing the management of data within Communities of Interest (COIs) rather than standardizing data elements across the Department.

By 2011, the DoD and each of the Components now have robust data environment tools and processes for managing both technical and product data. The recent DoD CIO strategic plan now features six key elements which further strengthen the use of data environments:

- Information as a Strategic Asset;
- Interoperable Infrastructure;
- Synchronized and Responsive Operations;
- Identify and Information Assurance;
- Optimized Investments;
- Agile Information Management / Information Technology / Information Assurance Workforce.

The CIO strategic plan is found at http://cio-nii.defense.gov/docs/DodIESP-r16.pdf.

Just one example is the U.S. Navy's "The Configuration Data Managers Database - Open Architecture" (CDMD-OA) that tracks the status and maintenance of naval equipment and their related logistics items (drawings, manuals, etc.) on ships and naval activities around the world. The term "open architecture" is used to denote the fact that CDMD-OA is a client/server-based system, not dependent upon any vendor's proprietary hardware or software; data may flow to and from CDMD-OA provided that open protocols are used. The status of a given piece of equipment on a ship determines what and how many spare parts will be stored on that ship for it, making

this tracking extremely important in terms of cost, shipboard space and weight, and the operational availability of the ship. CDMD-OA was designed specifically to aid the tracking of this configuration data by shore-based Configuration Data Managers (CDMs). The Naval Sea Systems Command (SEA 04TD) initiated the development of CDMD-OA to shorten the dataflow lag time between the ship, the CDM, and the Naval Inventory Control Point. As part of the client/server architecture of CDMD-OA, a single repository of all naval configuration and logistics data from around the world is available for querying. CDMD-OA incorporates the latest technological innovations to maintain data integrity and speed transmission of updates between the ships, NAVICP and the CDMs. This tool requires for access a PKI certification and registration. http://www.cdmd.navy.mil/.

g. The Data Reference Model (DRM)

The Data Reference Model (DRM) is one of the five reference models of the Federal Enterprise Architecture (FEA). The DRM is a framework whose primary purpose is to enable information sharing and reuse across the federal government via the standard description and discovery of common data and the promotion of uniform data management practices. The DRM describes artifacts which can be generated from the data architectures of federal government agencies. The DRM provides a flexible and standards-based approach to accomplish its purpose. The scope of the DRM is broad, as it may be applied within a single agency, within a Community of Interest (COI), or cross-COI.

The DRM provides a standard means by which data may be described, categorized, and shared. These are reflected within each of the DRM's three standardization areas:

• Data Description: Provides a means to uniformly describe data, thereby supporting its discovery and sharing;

• Data Context: Facilitates the discovery of data through an approach to the categorization of data according to taxonomies and enables the definition of authoritative data assets within a Community of Interest;

• Data Sharing: Supports the access and exchange of data where access consists of ad-hoc requests (such as a query of a data asset), and exchange consists of fixed, re-occurring transactions between parties and enabled by capabilities provided by both the Data Context and Data Description standardization areas.

As a reference model, the DRM is presented as an abstract framework from which concrete implementations may be derived. The DRM's abstract nature will enable agencies to use multiple implementation approaches, methodologies and technologies while remaining consistent with the foundational principles of the DRM.
http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/DRM_2_0_Final.pdf

h. The Defense Logistics Agency (DLA) Defense Logistics Management System (DLMS) and the EDI Standard

OSD AT&L direction, per the Dec 22, 2003 OSD(AT&L) memo "Migrate to DLMS, Eliminate MILS", migrated the DoD Automated Information Systems to a commercial Electronic Data Interchange (EDI) standard. DoD Directive 8190.1, then assigned DLMSO the responsibility to

act as the executive agent for logistics information interchanges and established the American National Standards Institute (ANSI) Accredited Standards Committee X12 as the new baseline EDI standard. DoD Directive 4140.1 establishes the authority for the material management regulation and the series of manuals where DLMSO managed processes are published.

- Wynne 22 Dec. 2003, Memo, Migrate to DLMS, Eliminate MILS
  http://www.dau.mil/pubscats/PubsCats/atl/2004_03_04/pol-ma04.pdf
- DLMSO 5 Jan.2004, Memo, Migrate to DLMS, Eliminate MILS
- DoDD 8190.1, DoD Logistics Use of EDI Standards:
  - Assigns DLMSO as DoD Executive Agent for logistics data interchange
  - Establishes ANSI ASC X12 as DoD standard for logistics system interchanges:
    - All new systems
    - Major modifications to existing systems

  http://www.dtic.mil/whs/directives/corres/pdf/819001p.pdf
- DoDD 4140.1 Materiel Management Policy
  - Authorizes publication of DoD business rules and standards

  http://www.dtic.mil/whs/directives/corres/pdf/414001p.pdf
- DoD 4140.1-R Materiel Management Regulation
  - "Loaded" with DLMSO responsibilities, policy, procedure, and guidance

  http://www.dtic.mil/whs/directives/corres/pdf/414001r.pdf
- DoD 4000.25 series of Manuals covering both the DLMS and DLSS/MILS (8K pages)
  - Prescribes logistics management policy, responsibilities, procedures, rules, and electronic data interchange and data standards

  https://www2.dla.mil/j-6/dlmso/elibrary/manuals/milstrip/default.asp

Technical data interoperability and connectivity across core business mission areas and among enterprise service providers is facilitated and achieved by the services that the Defense Logistics Management Standards Office (DLMSO) and Defense Automatic Addressing System Center (DAASC) provide. These services are depicted by the yellow diagonal in the graphic below.

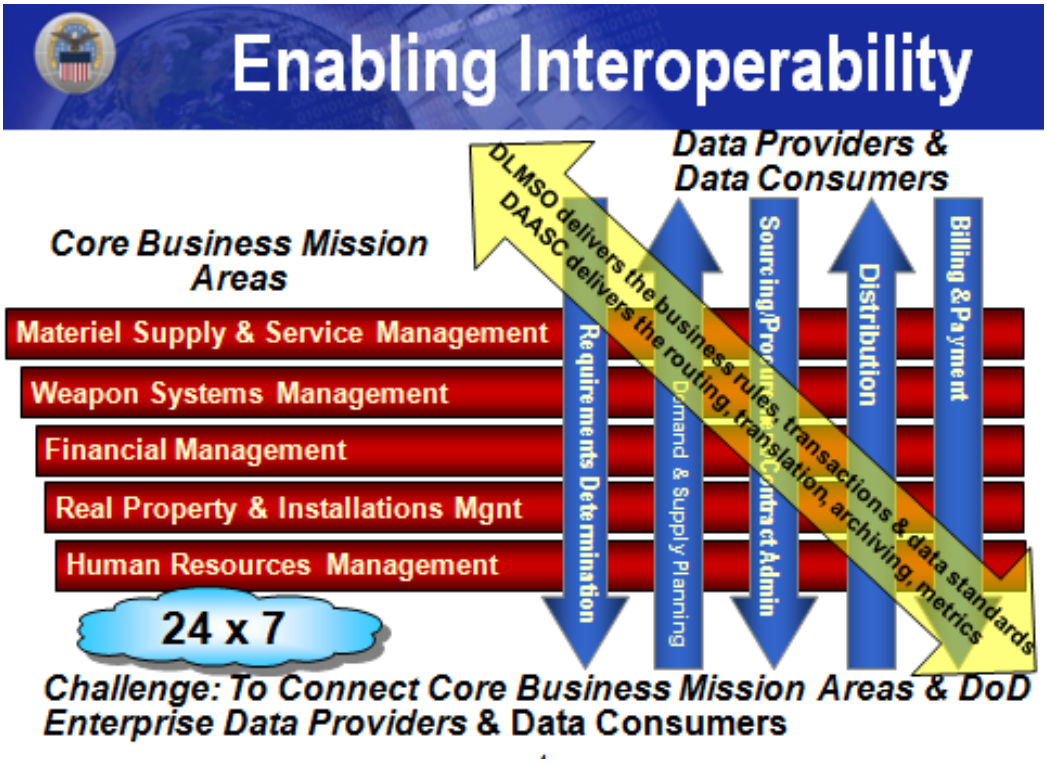


Figure 7.8.6.2.F1. Technical Data Services Provided by DLMSO and DAASC.

The next graphic (Figure 7.8.6.2.F2) highlights characteristics of the DLMS transactions:

- DLMS transactions provide for two forms of information exchange; EDI based on ANSI ASC X12 commercial standard and W3C compliant XML schemas.
- Component systems can use either with the full knowledge that:
    - they support all the data content and process functionality of the MILS
    - and are expandable to handle all future data and process requirements
- DAASC has developed and implemented translation maps to make the either form of the DLMS transparent and even allows translation in most cases back to the MILS transaction format, so long as they exist.

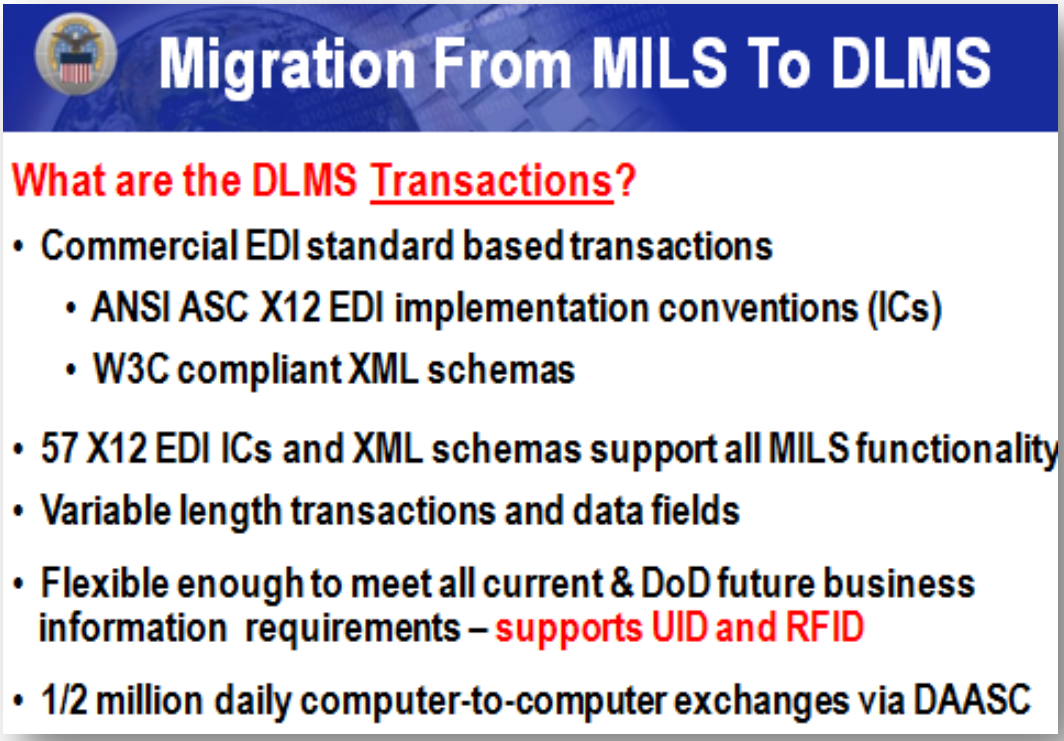


Figure 7.8.6.2.F2. Characteristics of DLMS Transactions

The Product Support Manager should refer to the DLA DLMSO website, http://www.dla.mil/j-6/dlmso/ , for more information on the EDI standard and the preferred XML format for electronic delivery of product.

i. **Data Disposal**

The National Institute of Standards and Technology (NIST) maintains instructions for federal agencies to properly dispose of technical data. See NIST Special Publication 800-88, "Guidelines for Media Sanitization."

Disposal, or "sanitization", means the removal of data from storage media so that, for all practical purposes, the data cannot be retrieved. Some instances in which sanitization must be considered include whenever media is transferred from one organization to another, when equipment is declared surplus, and when organizations dispose of media.

1. Data Sanitization: Why Be Concerned?

In the past, reports have surfaced that federal agencies have disposed of surplus Information Technology (IT) equipment without taking appropriate measures to erase the information stored

on the system's media. This can lead to the disclosure of sensitive information, embarrassment to the agency, costly investigations, and other consequences which could have been avoided. Personnel throw away old diskettes believing that "erasing" the files on the diskette has made the data un-retrievable. In reality, however, "erasing" a file simply removes the "pointer" to that file. The pointer tells the computer where the file is physically stored on the disk. Without this pointer, the files will not appear on a directory listing of the diskette's files. This does not mean that the file was removed from the diskette. (Commonly available utility programs can often retrieve information that is presumed "deleted.") Fortunately, with foresight and appropriate planning, these situations can be avoided.

2. Techniques for Media Sanitization

Three techniques are commonly used for media sanitization: overwriting, degaussing, and destruction. Overwriting and degaussing are the methods recommended for disposition of sensitive automated information. (Users of classified systems may also have to be concerned with data remanence. This refers to the residual information left behind once media has been in some way erased.) Security officers should be consulted for appropriate guidance.

Personnel must understand the following essential elements:

- Media containing sensitive information should not be released without appropriate sanitization;
- File deletion functions usually can be expected to remove only the pointer to a file (i.e., the file is often still recoverable);
- When data is removed from storage media, every precaution should be taken to remove duplicate versions that may exist on the same or other storage media, back-up files, temporary files, hidden files, or extended memory;
- Media in surplus equipment should be sanitized.

G. Communities of Interest and Practice

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- PSM e-Tool Kit Performance Learning Tools found at https://psmtoolkit.dau.mil/
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, ACQuire Search)
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook)
- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02)
- Web enabled new JCIDS Instruction and Guidebook
- Best Practices Clearing House (With addition of Multimedia Assets – video, audio)
- ACQuipedia Library Articles
- Acquisition Community Connection (CoPs and Special Interest Areas)
  - Data Management
- PM Certification Course materials and PM Continuous Learning Modules

- Probability of Program Success (PoPS) Model and Service Implementations
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation)
- DoD IG Audit Guides for Acquisition and Contracting
- Service and Agency PMO support sites
- Contract Management Processes Guide
- Leadership Support Center (Requires ACC log-in)

The Defense Logistics Agency (DLA) provides a website called "Assist Online" which is a search engine for Data Item Deliverables, found at https://assist.daps.dla.mil/online/start/

DoD Directive 8320.2 establishes policies and responsibilities to implement data sharing, in accordance with Department of Defense Chief Information Officer Memorandum, "DoD Net-Centric Data Strategy," May 9, 2003, throughout the Department of Defense. COIs are a collaborative group of people that exchange information in pursuit of its shared goals, interests, missions, or business processes and therefore must have a shared vocabulary for the information it exchanges. To achieve data sharing among its communities, COIs make data Visible, Accessible, Governable, Understandable and Trusted.

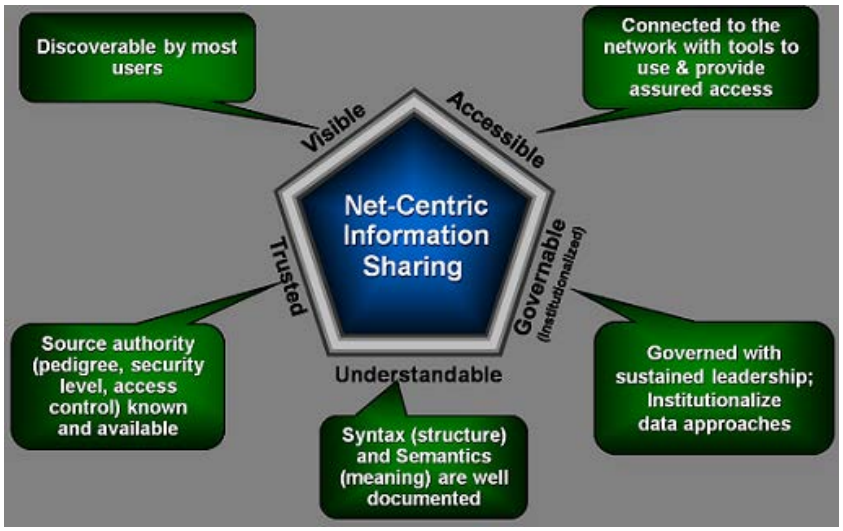


Figure 7.9.F1. Characteristics of an Information Sharing Environment

- **Visible** - Users and applications can discover the existence of data assets through catalogs, registries, and other search services. All data assets (intelligence, non-intelligence, raw, and processed) are advertised or "made visible" by providing metadata, which describes the asset.
- **Accessible** - Users and applications post data to a "shared space." Posting data implies that (1) descriptive information about the asset (metadata) has been provided to a catalog that is visible to the Enterprise and (2) the data is stored such that users and applications in the Enterprise can access it. Data assets are made available to any user or application except when limited by policy, regulation, or security.

- **Governable** (Institutionalized) - Data approaches are incorporated into Department processes and practices. The benefits of Enterprise and community data are recognized throughout the Department.
- **Understandable** - Users and applications can comprehend the data, both structurally and semantically, and readily determine how the data may be used for their specific needs
- **Trusted** - Users and applications can determine and assess the authority of the source because the pedigree, security level, and access control level of each data asset is known and available.

Communities of Interest, with a DoD website highlighting these communities at http://cio-nii.defense.gov/sites/coi/coi.shtml.htm, may be formal or informal groups dedicated to improving all aspects of technical data. COI's are typically endorsed by industry or professional associations.

Other communities of interest mentioned in this section include:

- Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx for a complete list of Milestone Decision Review required documents;
- Specification 1000D (S1000D) website at http://www.s1000d.org;
- The Information Assurance Technology Analysis Center (IATAC) is a U.S. Department of Defense Information Analysis Center (IAC) sponsored by the Defense Technical Information Center (DTIC), and Director, Defense Research & Engineering (DDR&E);
- The OSD Item Unique Identification (IUID) website is found at http://www.acq.osd.mil/dpap/pdi/uid/about.html;
- There is a DoD community of practice found at https://metadata.dod.mil/mdr/irs/DDMS/ on the topic of Discovery Metadata Specifications;
- More information on the Global Information Grid (GIG) enterprise and user technologies can be found at the DISA website at http://www.disa.mil/ge/;
- The DoD Data Services Environment (DSE) community of practice website is found at https://metadata.ces.mil/dse/homepage.htm;
- The U.S. Marine Corps has a Statement of Work, CDRL, and Tracking Tool (SCATT) that is available within MARCORSYSCOM **(http://www.marcorsyscom.usmc.mil/sites/scatt/)** to assist in the preparation of SOW's and CDRL's;
- The Federal Enterprise Architecture's Data Reference Model website is found at http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/DRM_2_0_Final.pdf;
- The DLA DLMSO website, http://www.dla.mil/j-6/dlmso/ , contains more information on the EDI standard and the preferred XML format for electronic delivery of product.

H. Lessons Learned / Best Practices

The Defense Acquisition University's Best Practices Clearinghouse. This clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and

acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;
- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

The DAU Community of Practice website lists a number of important issuances related to technical data rights and data management strategies since July 2006, including:

- 3 May 06 Secretary of the Air Force Memo "Data Rights and Acquisition Strategy" ;
- 2 Jul 06 GAO Report "Weapons Acquisition: DoD Should Strengthen Policies for Assessing Technical Data Needs to Support Weapon Systems" ;
- PL 109-364, FY07 John Warner National Defense Authorization Act ;
- USD AT&L 19 July 07 Policy Memo "Data Management and Technical Data Rights" requires Program Managers to assess long-term technical data requirements for all ACAT I and II programs, regardless of the planned sustainment approach and reflect that assessment in a Technical Data Rights Strategy;
- Data Management and Technical Data Rights verbiage is being added to the next update of the DoD Instruction 5000.2 ;
- DFARS Interim Rule Issued 6 Sep 07 .

Data that is accessible to all users in the Department of Defense shall conform to DoD-specified data publication methods that are consistent with Global Information Grid (GIG) enterprise and user technologies. More information can be found at the DISA website at http://www.disa.mil/ge/.

Technical Data & Interactive Electronic Technical Manuals, https://acc.dau.mil/CommunityBrowser.aspx?id=22427

DAU maintains an “ACQuipedia” website that is an additional source of references, definitions and general articles on a number of topics. This site is at https://acquipedia.dau.mil/default.aspx

Examples of ACQuipedia article topics include:

- Intellectual Property and Data Rights
- Information Support Plan
- e-Business
- Product Support Package / PBL Management
- Product Support Package/PBL Implementation

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

I. Training Resources

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

Technical data topics are primarily covered under the Life Cycle Logistics and the Engineering & Technology courses.

- CLB 030 Data Collection and Sources
- CLE 008 Six Sigma: Concepts and Processes
- CLE 036 Engineering Change Proposals for Engineers
- CLE 040 IUID Marking
- LOG 101 Acquisition Logistics Fundamentals
- LOG 102 Systems Sustainment Management Fundamentals
- SPS 106 Database Maintenance

J. Key References

- CJCS Instruction 3170.01G, “Joint Capabilities Integration and Development System”
- DoD 4000.25 series of Manuals covering both the DLMS and DL
- DoD 4120.24-M, “Defense Standardization Program Policies and Procedures”
- DoDD 4140.1 Materiel Management Policy
  - Authorizes publication of DoD business rules and standards
- DoD 4140.1-R Materiel Management Regulation
  - Contains DLMSO responsibilities, policy, procedure, and guidance
- DoD 5010.12-M, “Procedures For The Acquisition And Management Of Technical Data”, (http://www.deskbook.osd.mil/)
- DoD Instruction 5000.02, Enclosure 12 (Systems Engineering), paragraph 9
- DoD 5015.02-STD, “Electronic Records Management Software Applications Design Criteria Standard”
- DoDD 5250.01, “Management of Signature Support Within the Department of Defense”

- DoDD 8190.1, DoD Logistics Use of EDI Standards:
  - Assigns DLMSO as DoD Executive Agent for logistics data interchange
  - Establishes ANSI ASC X12 as DoD standard for logistics system interchanges:
    - All new systems
    - Major modifications to existing systems
- DoDD 8320.02, December 2, 2004, "Data Sharing in a Net-Centric Department of Defense"
- OSD(AT&L) memo "Migrate to DLMS, Eliminate MILS", dtd Dec 22, 2003
- Defense Federal Acquisition Regulation Supplement (DFARS) 211.274-2
- U.S. Marine Corps, Statement of Work, CDRL, And Tracking Tool (SCATT) found at **(http://www.marcorsyscom.usmc.mil/sites/scatt/)**
- U.S. Marine Corps, website for Technical Data management, Technical Data Guidance
- Defense Systems Management College Supplemental Text, Systems Engineering Fundamentals, Para. 10.4 (December 2000/January 2001)
- Defense Acquisition Guidebook, Chapters 3.3 and 5 plus numerous other locations
- Weapons Acquisition: DoD Should Strengthen Policies for Assessing Technical Data Needs to Support Weapon Systems", GAO-06-839 July 14, 2006
- DLMSO 5 Jan.2004, Memo, "Migrate to DLMS, Eliminate MILS"
- NIST Special Publication 800-88, "Guidelines for Media Sanitization"
- STANAG-4534 Ed.1, "Technical Data for Handling Custodial Nuclear Weapons"
- STANAG-4534 ED.1, "Standardized Technical Data for the Determination of Interchangeability of Components of Artillery and Mortar Systems"
- ACMP-3 ED.1, "NATO Requirements for Configuration Control – Engineering Changes, Deviations and Waivers"
- MIL-STD-963, "Data Item Descriptions"
- MIL-STD-3008B , "Interactive Equipment Technical Manuals (IETM) Technical Data Requirements to Support the Global Combat Support System-Army (GCSS-A)"
- MIL-DTL-31000A, "Technical Data Packages"
- MIL-STD-31000, "Technical Data Packages". A Technical Data Package is a technical description of an item adequate for supporting an acquisition strategy, production, engineering, and logistics support. The description defines the required design configuration and procedures required to ensure adequacy of item performance. It consists of all applicable technical data such as drawings and associated lists, specifications, standards, performance requirements, quality assurance provisions, and packaging details.
- MIL-STD 40051, "Preparation of Digital Technical Information for Multi-Output Presentation of Technical Manuals"
- TITLE 10, Subtitle A, PART IV, Chapter 137, Section 2320, Rights in Technical Data
- Defense Federal Acquisition Regulation Supplement (DFARS) 227.71—Rights in Technical Data
- DFARS clause 252.227-7013 Rights in Technical Data--Noncommercial Items, as prescribed in DFARS 227.7103-6(a) or DFARS clause 252.227-7015 Technical Data--Commercial Items as prescribed in DFARS 227.7102-3

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8.0. Support Equipment

8.0.1. Objective

Identify, plan, resource and implement management actions to acquire and support the equipment (mobile or fixed) required to sustain the operation and maintenance of the system to ensure that the system is available to the Warfighter when it is needed at the lowest Total Ownership Cost (TOC).

8.0.2. Description

Support equipment consists of all equipment (mobile or fixed) required to support the operation and maintenance of a system. It includes but is not limited to associated multiuse end items, ground handling and maintenance equipment, tools metrology and calibration equipment, test equipment and automatic test equipment. It also includes the acquisition of logistics support for the support equipment itself. During the acquisition of systems, program managers are expected to decrease the proliferation of support equipment into the inventory by minimizing the development of new support equipment and giving more attention to the use of existing government or commercial equipment.

Product Support Manager Activities

8.1 Level of Sharing of Support Equipment

8.1.1 Common

Common Support Equipment (CSE) includes items that are currently in the DoD inventory and are applicable to multiple systems. Because CSE is already in the DoD inventory, its technical documentation, support requirements, provisioning records and maintenance requirements are cataloged as part of the federal logistics information system.

8.1.2 Special or Unique

Peculiar Support Equipment (PSE) includes items that are unique to the system and have no other application in DoD. PSE requires development of technical documentation in federal cataloging records. PSE will require support; support that is currently not available in the DoD system but will have to be developed concurrently with development of the major systems.

8.2 Categories of Support Equipment

8.2.1 Automatic Test Systems (ATS)

An Automatic Test System (ATS) includes Automatic Test Equipment (ATE) hardware and its operating software, Test Program Sets (TPS) which include the hardware, software and documentation required to interface with and test individual weapon system component items, and associated software development environments. The term "ATS" also includes on-system automatic diagnostics and testing.

Automatic testing of electronic systems or components is required due to the complexity of modern electronics. In the early days of electronics maintenance, a technician could troubleshoot and repair an electronic system using an analog volt-ohm meter, an oscilloscope and a soldering iron. Today, electronics are very complex, with multi-layer circuit boards densely packed with high-speed digital components that have many different failure modes. Manually testing all components and circuit paths in typical modern systems is virtually impossible.

Automatic Test Systems are used to identify failed components, adjust components to meet specifications, and assure that an item is ready for issue.

DoD has appointed the Assistant Secretary of the Navy (Research, Development & Acquisition) to serve as the DoD ATS Executive Director to implement policy relative to automatic testing. DoD has designated several automatic test systems as DoD ATS Families. These ATSs are the test systems of choice for all DoD testing needs. Using other than these ATSs or COTS components that meet defined ATS capabilities requires approval by the program's milestone decision authority. The analysis process and tools available to assist the PM in selection of the appropriate ATS to satisfy a particular program's test requirements is covered in the ATS Selection Process Guide. The Home Page of the DoD Automatic Test Systems Executive Directorate, found at http://www.acq.osd.mil/ats/ats.htm.

8.2.1.1 Automatic Test Equipment (ATE)

The term Automatic Test Equipment (ATE) refers to the test hardware and its accompanying software. The hardware itself may be as small as a man-portable suitcase or it may consist of six or more six-foot high racks of equipment weighing over 2,000 pounds. ATE is often ruggedized commercial equipment for use aboard ships or in mobile front-line vans. ATE used at fixed, non-hostile environments such as depots or factories may consist purely of commercial off-the-shelf equipment.

The heart of the ATE is the computer which is used to control complex test instruments such as digital voltmeters, waveform analyzers, signal generators, and switching assemblies. This equipment operates under control of test software to provide a stimulus to a particular circuit or component in the unit under test (UUT), and then measure the output at various pins, ports or

connections to determine if the UUT has performed to its specifications. The basic definition of "ATE", then, is computer controlled stimulus and measurement.

The ATE has its own operating system which performs housekeeping duties such as self-test, self-calibration, tracking preventative maintenance requirements, test procedure sequencing and storage and retrieval of digital technical manuals.

8.2.1.2 Test Program Sets (TPS)

Test Program Sets consist of the test software, interface devices and associated documentation. The computer in the Automatic Test Equipment (ATE) executes the test software, which usually is written in a standard language such as ATLAS, Ada, C+ or Visual Basic. The stimulus and measurement instruments in the ATS have the ability to respond as directed by the computer. They send signals where needed and take measurements at the appropriate points. The test software then analyzes the results of the measurements and determines the probable cause of failure. It displays to the technician the component to remove and replace.

Developing the test software requires a series of tools collectively referred to as the software development environment. These include ATE and Unit Under Test (UUT) simulators, ATE and UUT description languages, and programming tools such as compilers. ATE is typically very flexible in its ability to test different kinds of electronics. It can be configured to test both black boxes (called either Line Replaceable Units (LRUs) or Weapons Replaceable Assemblies (WRAs)) and circuit cards (called either Shop Replaceable Units (SRUs) or Shop Replaceable Assemblies (SRAs)). ATE is also used to test All Up Round weapons and weapon sections. Since each UUT likely has different connections and input/output ports, interfacing the UUT to the ATE normally requires an interconnecting device known as an Interface Device (ID) which physically connects the UUT to the ATE and routes signals from the various I/O pins in the ATE to the appropriate I/O pins in the UUT.

An objective of the ATE designer is to maximize the capability inherent in the ATE itself so that IDs remain passive and serve to only route signals to/from the UUT. However, since it is impossible to design ATE which can cover 100% of the range of test requirements, IDs sometimes contain active components which condition signals as they travel to and from the ATE. The more capable the ATE, the less complex the IDs must be. ATE with only minimal, general capability leads to large, complex and expensive IDs. Some IDs contain complex equipment such as pneumatic and motion sources, optical collimators, and heating and cooling equipment.

The TPS Standardization developed a new MIL-PRF to guide Test Program Set development across DoD. Click here to download MIL-PRF-32070.

8.2.2 Ground Support Equipment

Ground handling and maintenance equipment is typically managed as its own separate category for aviation systems to recognize the many unique requirements related to flight operations. Each DoD Service maintains policies and guidelines for management of ground handling and maintenance equipment.

For example, consider the U.S. Navy's Naval Supply Systems Command's Aviation Support Equipment organization supporting all the NAVAIR PMO's. The website is found at https://www.navsup.navy.mil/navsup/ourteam/navicp/prod_serv/aviation/support_equipment. Support Equipment (SE) is the largest NAVICP Philadelphia weapons division in most categories of measurement. If it is not an airframe, engine, or avionics, it is most likely managed by SE and has a major supporting role in naval aviation mission. The list of SE includes, but is not limited to:

- Peculiar and Common Ground Support Equipment - yellow gear, cranes, jacks;
- Avionics Test Equipment (ATE) such as CASS, CAT RADCOM, VAST, HTS/ATS;
- Aircraft Launch & Recovery Equipment (ALRE) - catapults, arresting gear, jet blast deflectors, landing systems;
- Aviation Life Support Systems (ALSS) - helmets, life rafts, nights vision goggles, aircraft ejection seats, oxygen systems, parachutes;
- Meteorological Gear;
- Photographic Equipment;
- Training Simulators/Devices;
- Other - Aircraft Tie Down Chains, Aircraft Covers, De-Icers, etc.

8.2.2.1 Power Systems

Electric power, provided primarily by mobile generator sets in the combat zone, is the lifeblood of the Armed Forces. For without it, all the technical wizardry of modern warfare -- the Weapons' Systems, the Command, Control, Communications and Intelligence (C3I) Systems, and Logistics Support Systems -- are useless. To enhance interoperability, logistics support, and reduce acquisition costs, it is DoD policy that all Armed Forces use the Standard Family generator sets to the maximum extent possible -- and that DoD Components will obtain a Waiver Approval from PM-MEP prior to developing or procuring non-Standard generator sets.

8.2.2.2 Other Ground Equipment

Each of the DoD Components maintains a wide variety of ground equipment in support of its missions. The below items are examples from the NAVAIR website, http://www.navair.navy.mil/index.cfm?fuseaction=home.display&key=62D5ECE7-CB1C-41FD-B241-4B7BCC59E2C0.

8.2.2.2.1 Aircraft Fluid Service Units

The Aircraft Fluid Service Units (AFSUs) are a family of portable fluid servicing units used for servicing aircraft engines, gearboxes, transmissions, and hydraulic systems with appropriate engine oils, transmission, and hydraulic fluids used by the Organizational and Intermediate levels of maintenance both at sea and ashore. Each type AFSU is color coded and provided specific bulk servicing characteristics to minimize the risk of incorrect fluid servicing and reduce hazardous material procurement and hazardous waste disposal costs. Initial Operating Capability (IOC) achieved May 2009.

8.2.2.2.2 Automatic Wire Test Set

The AWTS provides automatic test functions to detect wire faults and to determine the distance to the faults within wire bundles at Navy I- and D-Level maintenance activities and at Air Force

flight line and back shop facilities. It replaces the obsolete Wire Test Set (WTS) at USN I-Level Wire Repair facilities.

8.2.2.2.3 Common Radio Frequency Communication / Navigation Test Set

The Common Radio Frequency Communication/Navigation Test Set (CRAFT) is an O-Level test set used to test Automatic Carrier Landing Systems (ACLS), Link4A Data Link, Tactical Air Navigation (TACAN)/Distance Measurement Equipment (DME), Omni-Directional Radio Range (VOR)/Instrument Landing System (ILS)/Glide Slope (GS)/Marker Beacon (MB)/Localizer (LOC), all Identification Friend or Foe (IFF) capability including Mode 5 & Mode S enhanced, and Sonobuoy RF data link.

8.2.2.2.4 Consolidated Automated Support System

The Consolidated Automated Support System (CASS) is the Navy's standard automatic test equipment family. It provides intermediate, depot and factory level support, both ashore and afloat, of all Navy electronics from aircraft to ships and submarines. 713 stations are used by Naval aviation. CASS is also in use at Naval Sea Systems Command activities and in nine foreign countries.

8.2.2.2.5 Heavy Maintenance Crane

The Heavy Maintenance Crane will be used for general aircraft maintenance (removal of wings, engines, transmissions, helicopter rotor heads, etc.) on AV-8B, C-130, CH-53 and V-22 aircraft.

8.2.2.2.6 Hydraulic Power Supplies

The Hydraulic Power Supplies (HPS) are mobile units (A/M27T-14, Electric & A/M27T-15, Diesel) that provide a source of hydraulic power for the check out, maintenance and servicing of the aircraft hydraulic systems while the aircraft is on the ground.

8.2.2.2.7 Intermediate Level TACAN Test Set

The Intermediate Level TACAN Test Set (ITATS) will be used at the intermediate level for testing and troubleshooting Tactical Air Navigation (TACAN) systems employed by Navy aircraft platforms. The test set shall include all peripheral accessories, components, and storage case.

8.2.2.2.8 Jet Engine Test Instrumentation

Jet Engine Test Instrumentation (JETI) is an integrated, computer based automated test system for the purpose of "I" level testing of turbofan/ jet gas turbine engines with the capability to test either indoors or outdoors, aboard ship or in land-based environments.

8.2.2.2.9 Large Land-based Air Conditioner

The Large Land based Air Conditioner is a diesel powered, trailer mounted, cooling and dehumidifying unit that will be used to supply conditioned air to aircraft equipment and avionics compartments during ground maintenance. It will be used on P-3, P-8, C-9, C-40, C-130 and E-6B aircraft.

8.2.2.2.10 Mid Range Tow Tractor

The Mid Range Tow Tractor (MRTT) is a modified Commercial off the Shelf (COTS) unit that is used shore-based at the organizational maintenance level and maintained at the intermediate maintenance level to provide aircraft handling on the flight line and in hanger bays for aircraft up to 80,000 pounds.

8.2.2.2.11 Shipboard Helo Handler

The Shipboard Helo Handler (SHH) is a highly maneuverable, low profile towbarless helicopter handling vehicle that replaces the current hangar bay spotting dolly and attaches to and lifts a helicopter's single tail landing gear.

8.2.3 Hand Tools

The DoD buys significant quantities of hand tools each year for use in performing maintenance and repair work at military installations worldwide. In fiscal year 1993, the DoD spends about $155M to purchase tools from the GSA, the federal manager for and tools. Military units spent an additional undeterminable amount for local tool purchases. DoD regulations state that use of established supply sources, such as GSA, should be maximized. If the supply system cannot be used, local purchases may be considered if they are in the best interest of the government in terms of the combination of quality, timeliness, and cost.

8.2.4 Metrology & Calibration

Calibrated Test Measurement Diagnostic Equipment (TMDE) used in DoD maintenance replicates the precision, performance, and safety that are built into equipment during the manufacturing process. The capability of DoD weapon platform mechanical systems, radios and communication devices, radar systems, targeting devices and fire control systems, missiles, and aviation platforms to operate accurately and effectively depend on the synchronization of these precise measurements against known standards. The calibration measurement requirements need to be linked to the measurement performance requirements of the TMDE. The measurement traceability from the prime system measurement requirement through the TMDE to the calibration reference standards is documented in a Calibration, Measurement and Requirements Summary (CMRS) format. When not linked to system measurement requirements, the resulting tendency is to calibrate to incorrect specifications than what is required.

The below discussion relies on Army and Navy Component information. Product Support Managers should check with their respective Component for appropriate METCAL processes and traceability requirements.

The DoD uses calibration equipment and sets as the transfer mechanism to reflect national and international standards in TMDE and ultimately weapon platforms, and to ensure standards are consistently maintained. The chain of custody (traceability, reference MIL–STD-1839) for these standards begins at NIST. Because of this critical requirement, materiel acquisition will not be accomplished without carefully reviewing existing capability and coordinating with (to use an Army example) the TRADOC, USATA, and the product manager TMDE for calibration and repair support requirements early in the acquisition life cycle.

Naval Aviation TMDE / Support Equipment (SE) is used for testing, measuring and diagnosing systems, equipment, devices and environmental conditions under which systems and personnel

operate. Calibration of TMDE/SE is essential to ensuring prime systems meet their design specification and intended performance. Naval Aviation requires periodic calibration to ensure the readiness of TMDE/SE to perform accurate measurements and these measurements are traceable to U. S. National Standards, U. S. Naval Observatory, Natural Physical Constants, and to National Institute of Standards and Technology. Technical authority, measurement integrity oversight and metrology/calibration products and services supporting the Naval aviation community are maintained within the Naval Aviation Metrology and Calibration Program. These products and services include (but are not limited to): METCAL related acquisition/logistics support, including the Calibration Requirements Analysis; standardized reference calibration standards, Instrument Calibration Procedures, periodic calibration recall intervals for calibration standards and TMDE/SE, calibration facility requirements, measurement science and calibration services, and training.

Naval Aviation Systems Command METCAL Product Support Team (PST) manages, maintains and procures all reference Calibration Standards for Naval aviation calibration laboratories. Acquisition programs are responsible for development and implementation of NAVAIR METCAL ILS elements, including development and procurement of reference CALSTDs for initial outfitting and site activation as required by the NAVAIR METCAL PST. Policy guidance can be found in NAVAIRINST 13640.1(series).

8.2.5 Industrial Plant Equipment (IPE)

IPE is that part of plant equipment with an acquisition cost of $3,000 or more (see Defense Acquisition Circular 76-36 for policy applicable to contractors); used for the purpose of cutting, abrading, grinding, shaping, forming, joining testing, measuring, heating, treating, or otherwise altering the physical, electrical, or chemical properties of materials, components, or end items entailed in manufacturing, maintenance, supply, processing, assembly, or research and development operations and IPE is identified by Federal Supply Class in Appendix 1A and by descriptive name in Joint DoD Handbooks, DLAH 4215 series. http://www.dla.mil/dlaps/dlam/m4215.1.pdf.

8.2.6 Other

Other types of support equipment include:

- Ammunition support equipment to include various types of material handling equipment, special tools, trailers, etc.;
- Medical / life support equipment;
- Special inspection equipment and depot maintenance plant equipment, which includes all equipment and tools required to assemble, disassemble, test, maintain, and support the production and/or depot repair of end items or components;
- Plus many other types.

8.3 Support Equipment Life Cycle Management

8.3.1 Acquisition

Acquisition logistics efforts should strive to reduce or eliminate the number of tools and support equipment required to maintain the system. If tools and/or support equipment are shown to be absolutely necessary, standardization should be considered. Support equipment is identified and

developed concurrent with the equipment development. The objective of this element is to ensure that the necessary support equipment is available at the correct operational site and maintenance echelons for operation and maintenance of materiel equipment throughout their life cycle. Support equipment considerations also include the identification, analysis, and acquisition of logistics support for the support equipment itself.

8.3.1.1 Requirements

Each of the DoD Services has processes and systems in place for managing requirements determination for support equipment. For example, NAVAIR's site, http://navair.navy.mil/logistics/autoserd/index.cfm, features the Automated Support Equipment Requirements Document (AutoSERD). AutoSERD maintains an online active inventory system of fleet Support Equipment (SE) requirements for all Warfighter platforms. The primary data record for the acquisition of SE is an approved SE requirements document and without it, SE cannot be procured. The primary objective of AutoSERD is to provide a consistent and coordinated SE requirement process and pass accurate SE source data to the SE resources management information system for production of the individual materials readiness lists.

8.3.1.1.1 Support Equipment Requirements Document (SERD)

The Support Equipment Recommendation Data (SERD) is a contract deliverable document that lists recommended specific items of support equipment to support a weapon system or item of equipment.

8.3.1.1.2 Special Purpose Electronic Test Equipment Requirements List (SPETERL)

The inventory of assigned test equipment is directly related to the Ship Configuration and Logistics Support Information System (SCLSIS). The allowance of test equipment for a ship is contained in the Ships Portable Electrical/Electronic Test Equipment Requirements List (SPETERL). The SPETERL identifies the latest known requirements for Portable Electrical/Electronic Test Equipment (PEETE). New SPETERLs are forwarded to the commands before the start of any shipyard overhaul and before the start of any availability in which major electronic change-outs will occur. Comparison of SCLSIS documents to the SPETERL can help to identify both excesses and deficiencies.

8.3.1.2 Design

Support equipment identification starts during the Technology Development phase with initiation of the collection and assessment of data on the projected sustainment demand, standardization of platforms, and required support equipment. Support equipment requirements, sourcing, operational performance and costing continue into the Engineering & Manufacturing Development phase. The Critical Design Review occurs during this phase. The CDR brings closure to technical risk mitigation and alternate design paths in detailed system design.

Once the product baseline is established, opportunities to improve performance or reduce life-cycle costs are severely limited. Changes to support equipment, training requirements, logistics and supply elements, interoperability, and performance can only be accomplished through a formal Engineering Change Proposal. All technical risk should be reduced to acceptable levels and remaining program execution risk resulting from resource or schedule shortfalls should be addressed quickly or it will jeopardize program success.

Completion of the CDR should provide the following:

- An established system initial product baseline;
- An updated risk assessment for EMD;
- An updated CARD (or CARD-like document) based on the system product baseline;
- An updated program development schedule including fabrication, test and evaluation, and software coding, critical path drivers;
- An approved Life-cycle Sustainment Plan updating program sustainment development efforts and schedules based on current budgets, test evaluation results and firm supportability design features.

8.3.1.2.1 Built-in-Test (BIT) / Built-in-Test Equipment (BITE)

An important component of Diagnostics, Prognostics and Health Management, discussed in the DoD ATS Architecture Guide, is Built-In-Test (BIT) and the underlying Built-In-Test Equipment (BITE). BIT/BITE data can serve as a trigger for later maintenance actions, often taken during operations or in environments that cannot be duplicated or transferred to later maintenance levels.

Built-In-Test data (BTD) is considered critical in Automatic Test Systems (ATS) architecture because of the potential impact it has to improve the quality of diagnostics during test and repair actions. BTD working with diagnostic tools can reduce test and repair actions by starting the test program further along in the process. This is sometimes referred to as a “directed TPS” which will start its testing at different places depending on symptoms or other input information. The monitoring of BTD can help identify “bad actors” or incipient failure modes as well as prognostics.

8.3.1.2.2 Standardization

Standardization of support equipment is managed by the DoD from both a Joint and an individual Component perspective. Standardization can be from different perspectives:

- Functional
- Technical
- Operational
- Logistics requirements

For example, the Army’s AR70-12, “Research, Development, and Acquisition, Fuels and Lubricants
Standardization Policy for Equipment Design, Operation, and Logistic Support”, states that having similar military and commercial fuels is intended to simplify the total logistic support. Vehicle and equipment operating characteristics will permit full operation with minimum restrictions on fuel properties. This will minimize the number of fuels required in joint and combined operations and identify and maximize use of locally available fuels. Vehicle and equipment fuel and lubricant characteristics will be coordinated during the design and development phases to ensure maximum flexibility. Referee fuels will be used during the research, development, testing, and evaluation of military and commercial equipment and materiel. This applies to Army activities that design, develop, operate, modify, test, or evaluate

weapon systems or combat support equipment. This process includes fuel storage and distribution equipment that will be used in combat.

8.3.1.3 Procurement and Delivery

Support equipment procurement is managed by each of the DoD Components. With the increasing emphasis on commonality, standardization and "Jointness", PSM's should check with other programs and with DoD agencies such as DLA for support equipment procurement. Several examples are below.

Defense Logistics Agency's Troop Support's Heavy Equipment Procurement Program (HEPP), found at http://www.dscp.dla.mil/ce/HEPP/, is designed to support the acquisition of "commercial-type" heavy equipment used by a variety of military and other federal government agencies. The program features multi-award commercial requirements contracts, or long-term agreements, with many major suppliers of heavy equipment in the United States to support most types of heavy equipment. The equipment is available with the full range of manufacturer options and acquisitions made through the program are quick and simple.

The Army's Product Support Integration Directorate, found at http://ilsc.natick.army.mil/spsid.htm, provides innovative, robust and streamlined total life cycle logistics and materiel readiness support to all DoD organizations. The Soldier Product support Integration Directorate supports the full spectrum force through the development, acquisition, testing, systems integration, product improvement, and fielding the best soldier systems. The S-PSID consists of the Life Cycle Logistics (LCLG) and Soldier Systems Support Group (SSSG).

8.3.1.3.1 Storage Considerations

Many types of support equipment have special storage considerations related to motors, batteries, storage on type of flooring, use of jacks, environmental requirements, etc.

Storage considerations are especially important for the DoD due to the significant amount of prepositioning of equipment to support the deployment of forces. Prepositioning plays a critical role in rapidly equipping forces deploying to major theaters of war and to smaller scale contingencies. There are two basic types of prepositioning: prepositioning ashore and prepositioning afloat. Prepositioning ashore allows heavy equipment to be kept in-theater, near the point at which it will be needed. Prepositioning afloat allows for forward prepositioning of sustainment stocks, unit equipment, and port opening capabilities on Military Sealift Command (MSC) vessels based in Diego Garcia and Guam. These vessels can cruise worldwide in response to any contingency.

8.3.2 Support of Support Equipment

Support equipment requires its own infrastructure of supply, maintenance, test and calibration, manpower, etc. The DoD and each of its Components maintains organizations, occupational specialties/ ratings/specialty codes, and even facilities and support equipment to sustain their support equipment throughout its life cycle.

- Examples of support equipment organizations include:
    - Metrology and calibration repair centers, found in all DoD Components

- Project Manager - Mobile Electric Power (PM-MEP)
- DoD Automatic Test Systems Executive Directorate

- Examples of job categories:
  - Air Force: 2A6X2 - Aerospace Ground Equipment
  - Army: 91D - Power Generation Equipment Repairer
  - Navy: AD - Aviation Machinist's Mate

Support Equipment in the Life Cycle

A. Purpose

Items that are required to support the operation or maintenance of a system are called support equipment. Support Equipment can be mobile or fixed but is not an integral part of the system. Support equipment categories include:

- Ground support equipment
- Materials handling equipment
- Tool kits and tool sets
- Metrology and calibration devices
- Automated test systems (includes TMDE, ATE, TPS, General Purpose Electronic Test Equipment, Special Purpose Electronic Test Equipment)
- Support equipment for on-equipment maintenance and off-equipment maintenance
- Special inspection equipment and depot maintenance plant equipment

Support and test equipment can be segmented into “common” and “peculiar” categories. Common Support Equipment (CSE) includes items that are currently in the DoD inventory and are applicable to multiple systems. Because CSE is already in the DoD inventory, its technical documentation, support requirements, provisioning records and maintenance requirements are cataloged as part of the federal logistics information system.

Peculiar Support Equipment (PSE) includes items that are unique to the system and have no other application in DoD. PSE requires development of technical documentation in federal cataloging records. PSE will require support; support that is currently not available in the DoD system but will have to be developed concurrently with development of the major systems.

a. **Why Support Equipment is Important**

The Product Support Element of Support Equipment is important to understand because each piece of equipment may represent its own “mini-acquisition” process within the weapon system program. The ultimate goal of The Product Support Manager is to minimize or eliminate support equipment through design influence or technology refresh. For that support equipment necessary for operations and sustainment, The Product Support Manager must ensure that is it meets all the criteria of human systems integration, reliability, availability, cost optimization, and that overall it “makes sense” on how and where it is used.

When support equipment is required, CSE is the preferred source.

Historically, Support Equipment activities have been the primary responsibility of engineering and product development, with resulting logistics activities being planned and implemented often under separate contract line items. The current view of integrated product support requires that the Life Cycle Sustainment Plan include and implement an integrated strategy, inclusive of all the Product Support Elements, that is reviewed and reported on throughout the acquisition life cycle.

The current view represents support equipment activities being heavily influenced prior to system deployment by the design interface activities which focus on ensuring that the program KPP's are achieved through design to optimize availability and reliability at reduced life cycle cost. After deployment and during Operations and Sustainment (O&S), the activities of sustaining engineering (including product improvement, reliability fixes, continuing process improvements and technology refresh) continue those of design influence and integrate both back with engineering and manufacturing activities and forward to collect and validate system operational performance with the user. The Product Support Manager is thus capable of implementing a total enterprise sustainment strategy inclusive of all acquisition phases and all product support element scopes.

Support equipment (SE) is not only for maintenance. Material handling equipment is used in storage facilities and computers are often necessary for support personnel to perform their jobs. Many operational missions are in environments highly corrosive to support equipment. An excerpt from a Navy website is below,

"operating at sea, aboard a small, moving, crowded ship imposes severe requirements on the design of Navy SE. Space limitations force the SE to be used close to other powerful electronic equipment such as radar systems requiring that the SE satisfy exacting electromagnetic interference and compatibility standards. There is nothing more corrosive than … exactly what the SE is subjected to in the middle of the Indian Ocean. The SE must satisfy rigorous shock and vibration standards. Electrical requirements are unusually stringent as are fire prevention standards. And by the way, the equipment must be light and compact, must be able to operate on a rolling, pitching flight deck moving at thirty knots, must be extremely reliable and, if it breaks, must be repairable by a 19 year old seaman who has just completed a 12 hour shift."

b. Summary of Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

Note that the Logistics Analysis (LA), also known as an independent logistics analysis, is part of each Milestone Decision Package and is a requirement for type classification. The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Support Equipment IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, includes in the left column a listing of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	**Support Equipment Major Activities**
User Need / Technology Opportunities & Resources	Understanding user support equipment needs in terms of performance and minimizing life cycle cost is essential in developing a meaningful product support strategy because changes to the CONOPS or the sustainment approach may impact the effectiveness, suitability, or cost of the system. Market analysis is also performed to assess the availability of qualified suppliers to meet specific support equipment requirements. The Product Support Manager must be able to understand and forecast support equipment requirements to actual product support sustainment activities and outcomes. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Because support equipment may require its own acquisition processes, identification of requirements early reduces future risk. Key Products: • Requirements • Metrics • Support equipment strategy • Market analysis of potential supply base of support equipment
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. The AoA requires, at minimum, full consideration of possible trade-offs among cost, schedule, and performance objectives for each alternative involving support equipment is considered. Inputs to Milestone review documents include the impacts on initial sustainment cost estimates, the initial Life Cycle Sustainment Plan (LCSP) and related sustainment metrics.

	Specific analysis focuses on the approach for achieving the required enabling support equipment capabilities, infrastructure and technologies to implement the product support strategy and achieve the support equipment sustainment metrics. Risks to achieving the necessary support structure for the time frame of the program by IOC should be identified and a mitigation strategy outlined. The specific enabling support equipment technologies should be identified along with the corresponding plan to technically mature each one. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of Milestone Decision Review required documents. Key Products: • Support Equipment Requirements Document (SERD) • Support equipment strategy
Technology Development	The support equipment plan should evolve from a strategy to a management plan describing the support equipment required for system design and the acquisition processes. At Milestone B, the LCSP evolves into a detailed execution plan to include how support equipment is to be designed, acquired, sustained, and how sustainment for the support equipment will be applied, measured, managed, assessed, modified, and reported from system fielding through disposal. The Product Support Manager is required to also provide support equipment information on other acquisition documents. Key Products: • Trade-off studies • Support equipment plan • Long lead items identified and acquisition processes started as required
Engineering & Manufacturing Development	During this phase, The Product Support Manager goal is to influence design for supportability. Supportability requirements designed earlier in the acquisition process should be validated and those that were not defined are assessed for impact, i.e., If a particular depot level repair capabilities is to be utilized so as not to incur new facilities, equipment, tools, training, etc., to validate whether the requirements have been met and would occur during this phase. Any final engineering changes as a result of support equipment analysis must be implemented no later than this phase to achieve maximum benefit. Support equipment changes may be required to the product support package

	to achieve the objective sustainment metrics including major support provider changes. The support equipment information should be in sufficient depth to ensure the acquisition, design, sustainment, and user communities have an early common understanding of the support equipment sustainment requirements, approach, and associated risks. Key Products: • Support equipment detailed plan • Long lead items identified and acquisition processes continued as required • Identification of logistics support requirements for support equipment • Special Purpose Electronic Test Equipment Requirements List (SPETERL) • Delivery of support equipment for test and evaluation
Production & Deployment	Support equipment activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, taking part in planning activities that may be on-going already for product improvement, and acquisition of support equipment. Fielding occurs during this phase and proof of early planning is now being validated as the system deploys to the operational site. Key Products: • Support Equipment Plan • Procurement, calibration and delivery of support equipment for IOC
Operations & Support	Support equipment activities continue throughout the system's operations and support phase as each piece of support equipment potentially has its own sustainment requirements. Support equipment availability, reliability and ownership costs all impact the primary program outcome metrics and should be factored in to all program forecasts and analysis. The Product Support Manager 's responsibility is to continue reviewing system performance while looking for opportunities to improve design of both the system itself, the system's support equipment and the support infrastructure to optimize cost versus availability. Key Products: • Delivery of support equipment • Sustainment of support equipment • Continuing upgrades and reduction of support equipment needs

Table 8.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

- DI-ALSS-81529, "Special Tools and Test Equipment List (STTEL)"
- DI-ILSS-80454, "Support Equipment Installation Data (SEID)"
- DI-SESS-80294B, "Maintenance Test and SUPPORT EQUIPMENT Requirements List"

C. OSD Proponency, Policy, Regulations and U.S. Statutes

Support and test equipment is largely controlled by the policies, regulations and guidance that governs the acquisition of other ILS products, e.g., spares and repair parts.

The DoD has created an Executive Directorate (ED) for the acquisition of Automatic Test Systems, http://www.acq.osd.mil/ats/. Policy and handbooks found at this site include:

- Policy memo, Under Secretary of Defense, dated Jul 28 2004, DoD Policy for Automatic Test Systems, http://www.acq.osd.mil/ats/USDATL_MEMO_to_SAEs_-_DoD_ATS_Policy.pdf;
- Automatic Test Systems Joint Memorandum of Agreement Among Service Acquisition Executives, subject: Automatic Test Systems Acquisition Procedures, 2004, http://www.acq.osd.mil/ats/2004_Joint_ATS_MOA.pdf;
- DoD Automatic Test Systems Handbook, 2004, http://www.acq.osd.mil/ats/DoD_ATS_Handbook_2004.pdf.

Each of the DoD Services' maintains a Test, Measurement and Diagnostic Equipment (TMDE) or Metrology and Calibration (METCAL) organization to service its equipment.

U.S. Air Force: http://www.robins.af.mil/library/factsheets/factsheet.asp?id=8361
U.S. Army TMDE: http://pdtmde.redstone.army.mil/
U.S. Marine Corps TMDE: http://www.marcorsyscom.usmc.mil/sites/pmtmde/.
U.S. Navy: http://www.navsea.navy.mil/nswc/corona/default.aspx

The mission areas of the DoD Component TMDE/METCAL organizations generally fall into the following areas listed below:

- Automatic Test Systems;
- Test Equipment Modernization;
- Calibration Reference Standards or Calibration Sets;

- Foreign Military Sales.

PSMs should become knowledgeable of how their respective Service manages TMDE programs. Many Service specific tools are available for planning and management functions. For example, the Navy sponsors the Metrology Automated System for Uniform Recall and Reporting (MEASURE), found at http://www.navair.navy.mil/logistics/measure/index.cfm.

The Office of the DoD Project Manager- Mobile Electric Power's (MEP) mission is to manage a coordinated Inter-Service effort for developing, acquiring and supporting DoD's mobile electric power generator sets -- to include establishing/maintaining a DoD Standard Family of MEP Generator Sets from 0.5kW portable generator sets to 920kW Prime Power generating systems.

Major Products of the DoD PM- MEP include:

- Military Tactical Generator (MTG), 2kW
- Tactical Quiet Generator (TQG) (3, 5, 10, 15, 30, 60, 100 and 200kW);
- Power Units and Power Plants (PU/PP) (trailer mounted generator sets);
- Advanced Medium Mobile Power Sources (AMMPS) (5-60kW);
- Deployable Power Generation and Distribution System (DPGDS) (840kW);
- Power Distribution Illumination System Electric (PDISE) (cabling and circuit protection distribution components);
- Improved Environmental Control Units (IECU) (9k, 18k, 36k and 60k BTUH) (heating, cooling, dehumidification components).

For Support Equipment Marking Systems: the Air Force uses ASETDS consistently for all its aeronautical and support equipment; the Navy uses its MARK/MOD numbering system for most equipment used in naval aviation; and the Army uses the Army Nomenclature system for all its equipment.

The Product Support Manager should review the references in section 8.12. and also the DoD Proponent organization's respective website for specific guidelines and policy.

D. Who Develops, Delivers and Manages Support Equipment

The Sustainment Implementation Plan section of the Life Cycle Sustainment Plan (LSCP) describes the content of and approach for managing the fielding of the product support package. As it related specifically to SE, this section of the LSCP describes the process and management approach for developing and fielding the capabilities to test and service the system. The LCSP section also describes the management structure / software capabilities being put into place to improve the built in test, prognostics and diagnostics capabilities.

The acquisition team must consider numerous factors that can and will influence the selection of support equipment to be used on a system. Among these are:

- Maintenance concept;
- Deployment concept;
- DoD inventory / commercial assets;
- Life cycle costs (LCC);
- Supportability analyses.

Acquisition logistics efforts must strive to reduce or eliminate the amount of support equipment required to maintain the system.

Each piece of support equipment has its own unique supportability requirements. Therefore, the more support equipment there is, the more complex the overall system support solution will be.

During Operations & Sustainment, support equipment management practices will be impacted by the owning organization's policies and guidelines, funding sources, and operational environment.

E. When Is Support Equipment Delivered and Managed in the Life Cycle

Support equipment planning must start as soon as the need or requirement is identified due to the potential long lead times for budgeting, acquisition, and the need to have the support equipment read to use at the start of the designated operation (test, maintenance, storage, etc.). During the acquisition life cycle, support equipment plans are required to be included in the CSP with requirements identified by Milestone B. Specific lead times and planning cycles are further discussed below.

Early coordination must occur with those Government organizations with Proponency for specific types of support equipment, such as power generation and automatic test equipment. These organizations have their respective processes and policies and The Product Support Manager must ensure that all support equipment requirements are integrated and coordinated with the appropriate supporting organizations.

F. How Support Equipment Is Developed, Established and Managed

The below checklist for addressing support equipment concerns is found in the U.S. Air Force Materiel Command's Acquisition Sustainment (AS) Tool Kit, AS Kneepad Checklist, 1 Aug 2009, Task #2.37.3. Minor edits have been made for clarity. Other services have equivalent documentation requirements and the steps outlined are broadly adaptable across the services. When Engineering / Configuration changes impact the support for SE, update the Technical Orders (TO) and Calibration Requirements Analysis (CRA) to reflect approved changes.

- Establish Support Equipment (SE) IPT and Depot Maintenance Activation Working Group (DMAWG) to include Air Logistics Command (SSM and SE Manager), Program Office, MACOM, Prime Contractor, etc;
- Minimize the proliferation of system-unique equipment while ensuring the maintenance and deployment requirements of existing and developing systems are met. Acquire SE,

to include Automatic Test Systems (ATS), that is to the maximum extent common and interoperable with other Services and across multiple weapon systems and munitions. Peculiar SE, to include ATS, shall be developed only as a last alternative;

- Plan for Technical Orders (TO), support for SE (include all Product Support elements), Supply Support, Configuration Management, IUID, testing and validation/certification, and scheduling. [Plan for technical manuals, to include TOs (USAF) and Instrument Calibration Procedures (ICPs) (Navy)];
- Ensure cost estimate is completed. Make POM inputs;
- Process Support Equipment Recommendation Data (SERD). Ensure review with SE IPT;
- Ensure testing is planned and accomplished;
- Ensure equipment is delivered and fielded;
- Plan for Sustainment of Support Equipment:
    - Identify additional requirements through the requirements determination process;
    - Develop acquisition program for required replacements and to fill new shortages; Address all IPS Elements during planning stages to ensure supportability of newly acquired SE. Both investment and O&M funded items;
    - Input to the budget process;
    - Accomplish required SE modifications by budgeting process;
    - Respond to safety issues or changes by accomplishing required TO update;
    - Perform required repair actions;
    - POM inputs- Prepare justification to include TDY, supplies, provisioning, other funding;
    - Coordinate Calibration requirements;
    - Update Technical Order (TO) and plan for TO updates when field submits changes and changes are approved or new instruments are included in systems. When a new configuration is procured, the TO must be updated;
    - Obsolete Items Plan for diminishing manufacturing should be addressed by contacting the commodity PM to identify the preferred replacement item;
    - Modification must be planned and implemented;
    - Perform Analysis of Refurbish or Replenish or Replacement when a system is plagued by obsolete items and/or bad actors; this analysis should determine if the system needs a mid-life upgrade or there should be a total system replenishment.
    - Disposal-send to DRMO (DLA Disposition Services);
- Consider Environmental, Safety & Occupational Health (ESOH) impacts.

G. Communities of Interest and Practice

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- PM e-Tool Kit Performance Learning Tools found at https://pmtoolkit.dau.mil/
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, ACQuire Search)
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook)
- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02)

- Web enabled new JCIDS Instruction and Guidebook
- Best Practices Clearing House (With addition of Multimedia Assets – video, audio)
- ACQuipedia
- Acquisition Community Connection (CoPs and Special Interest Areas)
- PM Certification Course materials and PM Continuous Learning Modules
- Probability of Program Success (PoPS) Model and Service Implementations
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation)
- DoD IG Audit Guides for Acquisition and Contracting
- Service and Agency PMO support sites
- Contract Management Processes Guide
- Leadership Support Center (Requires ACC log-in)

The Defense Logistics Agency (DLA) provides a website called "Assist Online" which is a search engine for Data Item Deliverables, found at https://assist.daps.dla.mil/online/start/

The following website contains Army TMs. It is managed by the US Army Logistics Support Activity, operating out of Huntsville, Alabama at Redstone Arsenal: https://www.logsa.army.mil/etms/online.cfm

The DoD PM-MEP user annual conference website is found at https://www.pm-mep.army.mil/conference/index.html

H. Lessons Learned / Best Practices

*The Defense Acquisition University's Best Practices Clearinghouse. T*his clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;
- Useful information and tools to help find, select and implement practices appropriate to specific programs;

- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

Ground Support Equipment Omnibus Supply Support Program for Legacy (GOSSPL) . The Naval Inventory Control Point (NAVICP) GOSSPL team developed an innovative Memorandum of Agreement (MOA) with NAVAIR 3.1.B.2 which is expected to decrease costs, improve turn-around-time, and reduce customer wait time for legacy ground support equipment.

*Support Equipment Resources Management Information System (SERMIS). T*his system is Navy's automated source of information on naval aviation support equipment assets currently in use. SERMIS maintains financial and management information on support equipment valued at $5.3 billion in fiscal year 1995.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

NAVAIR Software Logistics Primer (For Training Purposes Only), April 2010. This short primer is intended to be a knowledge and awareness builder with emphasis placed on what the logistician needs to [Know], what to [Do], and where to [Go] for more information. This is a living document, which will be improved upon over time as NAVAIR builds its body of knowledge in this critical support area. It includes fundamental principles and references necessary for software acquisition logistics planning and some pointers to sources of information that will enhance the logistician's ability to plan and execute software support.

I. Training Resources

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

Support equipment topics are primarily covered under the Life Cycle Logistics courses such as LOG 101Acquisition Logistics Fundamentals

Also see the information in Section 1.11 of this Guidebook for an extensive list of DAU training assets.

J. Key References

- DoD Directive 5000.01, "The Defense Acquisition System", Nov 07
- DoD Instruction 5000.02, "Operation of the Defense Acquisition System", Dec 08

- CJCS Instruction 3170.01G, "Operation of the Joint Capabilities Integration and Development System"
- The Defense Standardization Program. The Website is http://www.dsp.dla.mil/APP_UIL/policy.aspx?action=content&accounttype=displaypolicy&contentid=79.
- Defense Acquisition University "Acquisition Logistics Guide" (1997), 7.2.10; 7.2.5
- MIL-S-8512D(2) NOT 2 , "Support Equipment, Aeronautical, Special, General Specification For The Design Of".
- MIL-HDBK-300M NOT 1, "Technical Information File of Support Equipment". This document is intended to provide a hyperlink to the MIL-HDBK-300 data base which provides technical and pictorial information for comparison of DoD In-inventory (stock listed) support equipment used on aircraft and missile weapon systems. This handbook is for guidance only. This handbook cannot be cited as a requirement.
- MIL-HDBK-2097A, "Acquisition Of Support Equipment and Associated Integrated Logistics". This standard prescribes the requirements for the identification of common and peculiar support equipment for aerospace weapons systems, subsystems, or major end articles.
- QAP-99 ED.1, ISDA, "Technical Data Packages Required To Support Equipment Throughout The Life-Cycle".
- SAE-ARP1247, 1730, "Support Equipment, Aerospace Ground, Motorized and Non-motorized, General Requirements for". This SAE Aerospace Recommended Practice (ARP) outlines the basic general design requirements for ground support equipment used in the civil air transport industry.
- MIL-STD-1839, "DoD Standard Practice Calibration and Measurement Requirements".
- DoD Directive 4151.18, Mar 31, 2004, "Maintenance of Military Materiel".
- "2004 DoD ATS Selection Process Guide", Director, DoD ATS Executive Directorate, found at http://www.acq.osd.mil/ats/DoD_ATS_Selection_Process_Guide_-_2009.pdf .
- "DoD Automatic Test Systems Master Plan", DoD Automatic Test Systems Executive Directorate, http://www.acq.osd.mil/ats/2009_DoD_ATS_Master_Plan.pdf, 2009.
- Technical Manual DTD Abstracts website, **http://www.asrl.com/cnstruct/tm/tm_abs.htm**
- Automatic Test Systems Joint Memorandum of Agreement Among Service Acquisition Executives, Subject: Automatic Test Systems Acquisition Procedures, found at http://www.acq.osd.mil/ats/2004_Joint_ATS_MOA.pdf.
- DLA Directive 5025.30, "One Book", Chapter 12, Support Equipment, website found at http://www.dla.mil/dlaps/ or http://www.dla.mil/a-76/contracting/documents/DLABOOK_maint.doc.
- DAU Defense Acquisition Portal, this website contains links to sample acquisition documents, policy and many other implementation guides, found at https://dap.dau.mil/policy/Lists/Policy%20Documents/Organizations%20USD%20%20AT%20L.aspx?tag=USD%20%20AT%20L&group=Organizations.
- Air Force Instruction 63-201, "Automatic Test Systems and Equipment Acquisition". This publication has been substantially revised and must be completely reviewed. This version consolidates and supersedes AFI 10-602, AFI 20-104, AFI 21-133(I), AFI 21-303, AFI 21-401, AFI 21-403, AFI 62-201, AFI 63-101, AFI 63-105, AFI 63-107, AFI

63-111, AFI 63-201, and AFI 63-801 incorporating guidance and procedures for the development, review, approval, or management of systems, subsystems, end-items and services within the ILCM Enterprise. A major change includes a shift from multiple functional guidance documents to a concise set of ILCM guidance that reduces duplicative and obsolete guidance.

- Air Force Materiel Command's "Acquisition Sustainment (AS) Tool Kit, AS KNEEPAD Checklist" pg. 60 5.48; Appendix A pg. 126-127; pg. 40 4.16; pg. 42 4.20; pg. 51 5.15; pg. 53 5.20; pg. 60 5.49.
- Air Force Pamphlet, AFPAMPHLET 63-128, "Guide to Acquisition and Sustainment Life Cycle Management", 3.14/pg. 49; 3.8/pg. 43.
- Army Regulation 750–43, "Army Test, Measurement, and Diagnostic Equipment".
- AR 700-127, "Integrated Logistics Support", Table 3-1 pg. 15.
- OPNAVINST 3960.16 Series, "Navy Test and Monitoring Systems (TAMS)".
- OPNAVINST 4790.2 Series, "The Naval Aviation Maintenance Program (NAMP)".
- NAVAIRINST 13640.1 Series, "Naval Aviation Metrology and Calibration Program".
- MCO 4733.1 Series, "Marine Corps Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Maintenance Program (CAMP)".
- GAO report, "Controls Over Hand Tools Can Be Improved", Jan 1995, http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA290900&Location=U2&doc=GetTRDoc.pdf.

9.0 Training & Training Support
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9.0 Training & Training Support

9.0.1. Objective

Plan, resource, and implement a cohesive integrated strategy to train military and civilian personnel to maximize the effectiveness of the doctrine, manpower and personnel, to fight, operate, and maintain the equipment throughout the life-cycle.

As part of the strategy, plan, resource, and implement management actions to identify, develop, and acquire Training Aids Devices Simulators and Simulations (TADSS) to maximize the effectiveness of the manpower and personnel to fight, operate, and sustain equipment at the lowest Total Ownership Cost (TOC).

9.0.2. Description

Consists of the policy, processes, procedures, techniques, Training Aids Devices Simulators and Simulations (TADSS), planning and provisioning for the training base including equipment used to train civilian and military personnel to acquire, operate, maintain, and support a system. This includes New Equipment Training (NET), institutional, sustainment training and Displaced Equipment Training (DET) for the individual, crew, unit, collective, and maintenance through initial, formal, informal, on the job training (OJT), and sustainment proficiency training. Significant efforts are focused on NET which in conjunction with the overall training strategy shall be validated during system evaluation and test at the individual, crew, and unit level.

Training is the learning process by which personnel individually or collectively acquire or enhance pre-determined job-relevant knowledge, skills, and abilities by developing their cognitive, physical, sensory, and team dynamic abilities. The "training/instructional system" integrates training concepts and strategies and elements of logistic support to satisfy personnel performance levels required to operate, maintain, and support the systems. It includes the "tools" used to provide learning experiences such as computer-based interactive courseware, simulators,

and actual equipment (including embedded training capabilities on actual equipment), job performance aids, and Interactive Electronic Technical Manuals. It is critical that to ensure alignment between system design and training program, any and all changes must be evaluated as to the impact on the training program. The training products themselves may require separate configuration management and supportability.

The Product Support Manager needs to understand the requirements for training related to the civilian and military workforce for weapon systems acquisition and the training required for civilians and military to lead, operate and sustainment the weapon system being fielded.

Training performed by the DoD can be viewed as focused according to specific outcomes:

- Institutional training for the military and civilian workforce;
- Weapon system acquisition-related training is developed and implemented to specifically support the fielding of new systems or major modifications of systems;
- Operational and field training primarily as part of individual, unit and organizational training typically conducted at home station, during major training events and while operationally deployed;
- Self-development training where individuals seek additional knowledge growth that complements what has been learned in the classroom and on the job.

Product Support Manager Activities

9.1 Types of Training

Each of the DoD Components organizes, develops and executes training as determined to be most effective. Below are some generic types of training which may or may not reflect exactly how training is organized in any specific organization.

9.1.1 Formal vs. Informal

The term informal learning is widely used to describe the many forms of learning that takes place independently from instructor-led programs: books, self-study programs, performance support materials and systems, coaching, communities of practice, and expert directories.

Informal learning can be characterized as:

- It usually takes place outside educational establishments;
- It does not follow a specified curriculum and is not often professionally organized but rather originates accidentally, sporadically, in association with certain occasions, from changing practical requirements;
- It is not necessarily planned pedagogically conscious, systematically according to subjects, test and qualification-oriented, but rather unconsciously incidental, holistically problem-related, and related to situation management and fitness for life;
- It is experienced directly in its "natural" function of everyday life.
- It is often spontaneous.

While the DoD maintains a significant infrastructure for formal learning opportunities to support the continued development of the person throughout their careers, it is the responsibility of each person to continue learning, adapting and improving to be successful. Learning is a career-long

process. Training and education in the institution and in units cannot meet the needs of every individual. When preparing for current operations or full spectrum operations, military personnel and civilians must continuously study Service and Joint doctrine, lessons learned, observations, key insights, and best practices. Commanders and other leaders create an environment that encourages subordinates to maximize self-development as an investment in their future.

9.1.2 Individual vs. Team

Collective, or team, training involves more than one person and supports the unit mission. It includes training at home station, training at designated training centers or sites, training while deployed, and unified action training exercises. Collective training must develop or sustain the unit's capability to deploy rapidly and accomplish any mission across the spectrum of conflict. Commanders are responsible for unit readiness. Subordinate leaders assist commanders to achieve training readiness proficiency goals by ensuring training is conducted to standards in support of the unit's designated task lists.

Individual training is typically oriented towards the training of individuals (either as a group or alone) through a formal instructor led training program where the individual, not the team, is tested and assessed.

Many programs in formal learning institutions develop programs where both individual and team training occur in order to maximize the learning experience.

9.1.3 New Equipment Training (NET)

The NET provides for the initial training and transfer of knowledge from the program office or contractor to the tester and user. It represents the knowledge that is needed for operation, maintenance, and logistic support during testing and initial introduction of new materiel into the Army inventory.

The NET will assist commanders in achieving operational capability in the shortest time practical by training soldiers/crews and maintainers how to operate and maintain the new/improved equipment. It also provides unit leaders with training support components needed to sustain the proficiency of operators and maintainers of the new/improved equipment. Begin planning for NET at the onset of program initiation. NET is provided as needed prior to testing and handoff of equipment to the gaining commands based on the System Training Plan (STRAP) which documents all NET requirements.

An important component of preparing for and executing NET is the Train-the-Trainer program established by the PM/PSM. Ensuring that those individuals who will conduct the training are not only subject matter experts but also knowledgeable in actual teaching / training practices is important. Trainers must be knowledgeable in all forms of training delivery to include classroom instruction, field training, and computer-assisted simulation including embedded training and distributed learning. The U.S. Navy has a "Train the Trainer Guide" found at http://nawctsd.navair.navy.mil/Resources/Library/Acqguide/traingde.htm to assist in preparation and execution of this training.

9.1.4 Factory Training / Training With Industry

Factory training or TWI is a non-degree producing program designed to provide training and/or skills in best business procedures and practices not available through existing military or advanced civilian schooling programs for identifiable DoD requirements. The Department of Defense continues to pay normal pay and allowances to the individual while assigned outside the Department. In return for selection to this program, the individual is required to serve with the Department of Defense for the period specified in this Instruction and the agreement with the Secretary concerned under References (e) or (f), as applicable.

Per DoDI 1322.06, November 15, 2007, the DoD Components may establish TWI programs for military and civilian personnel to provide training and/or development of skills in private sector procedures and practices not available through existing military or advanced civilian education programs or other established training and education programs.

9.1.5 Displaced Equipment Training

Training provided by the Program Manager on the operation and maintenance of previously fielded equipment that is scheduled for redistribution as a result of modernization processes.

9.1.6 Joint Training

Joint training uses joint doctrine, tactics, techniques, and procedures, and the training involves more than one Service component. However, two or more Services training together using their respective service doctrine, tactics, techniques, and procedures are Service-sponsored interoperability training.
Although, not classified as joint training, Service sponsored interoperability is a vital component of joint proficiency and readiness.

9.1.7 Multinational Training

Multinational training is based on applicable multinational, joint and/or service doctrine and is designed to prepare organizations for combined operations with allied nations.

9.1.8 Institutional Training

Institutional Training primarily includes initial training and subsequent professional military education (PME) for military service members and DoD civilians. It is conducted at schools and centers on various military installations across the United States and through a number of distant learning / digital venues.

9.1.9 Refresher Training

Refresher training is a specific form of training for updating knowledge or reviewing information to maintain proficiency.

9.1.10 On-the-Job Training

On-the-job training takes place in a normal working situation, using the actual tools, equipment, documents or materials that trainees will use when fully trained.

9.1.11 Unit Sustainment Training

Unit training includes individual and collective training conducted by and within a unit, or organization, upon completion of NET/DET to ensure continued expertise on the operation, maintenance, and employment of fielded equipment under the control of the unit commander.

9.2 Training Requirements

9.2.1 Needs Analysis

Each of the DoD Services maintains needs analysis processes. Below are two descriptions of selected capabilities from the Army and the Navy. PSMs should contact their respective Component training centers for additional information and support.

The Army Training Requirements and Resources System (ATRRS) is the Department of the Army Management Information System of Record for managing student input to training. The ATRRS website is at https://www.atrrs.army.mil/. This on-line system integrates manpower requirements for individual training with the processes by which the training base is resourced and training programs are executed. This automation support tool establishes training requirements, determines training programs, manages class schedules, allocates class quotas, makes seat reservations, and records student attendance. It supports numerous Department of the Army processes which include the Structure Manning Decision Review (SMDR). The product of the SMDR is the Army Program for Individual Training (ARPRINT), the mission and resourcing document for the training base.

ATRRS supports the Training Requirements Division of the Office of the Army G-1 in its Army-wide mission to integrate all phases of input to training management, during peacetime and mobilization. The system supports the planning, programming, budgeting, and program execution phases of the training process and is utilized by the agencies responsible for those phases.
ATRRS is the central authoritative source for all data and statistics that impact total Army input to training. ATRRS provides critical support for these three primary objectives:

- Centralization of training requirements and resources data;
- Management of input to training;
- Evaluation of program execution.

Within the Naval Air Systems Command, the Naval Air Warfare Center Training Systems Division (NAWCTSD) is the Navy's source for a full range of innovative products and services that provide complete training solutions. Front-end analysis (FEA), also referred to as Training Systems Requirements Analysis, is the structured process used to examine training requirements and identify alternative approaches to training job tasks. Using the process, the NAWCTSD identifies job tasks to be performed, analyzes the skills and knowledge needed to perform them, assesses the technologies available for training the skills and knowledge, performs a media analysis to recommend the best mix of delivery media and provides cost and lead-time comparisons for the feasible alternatives.

The purpose of the analysis is to provide the customer with enough information to meet training needs within budgetary and other constraints. The analysis offers a recommendation, but also includes a number of options, each with a different training potential and cost estimate. This

allows the program sponsor to make sound training decisions based on relevant and thoroughly analyzed data. Early planning permits a full range of options, to include embedded training, and to even consider the impact operational equipment designs will have on training- increasing or decreasing the training problem. Generally, to keep costs at a lower level, built-in or embedded training capability must be designed into the operational hardware during the initial phase of development. Therefore, it is important to consider training needs early in the design of any new weapon system. The FEA documentation forms the basis for the life cycle investment strategy and subsequent system evaluation.

FEA can be applied not only to new systems, but also to existing systems which are being upgraded and modified. In fact, whenever there is a training problem, a change in mission/doctrine, a change to the weapon system, a need to integrate newer technology into the classroom, or to move training from the classroom, a front end analysis should be conducted to determine whether, and the extent to which, the training needs to be modified. Training options can vary widely, from computer based training, to electronic performance support systems (EPSS), to complex, high-fidelity simulators, to traditional stand-up lectures and classroom aids, etc. The FEA documentation provides the justification supporting the development/procurement of the selected training system. More information can be found at http://nawctsd.navair.navy.mil/Programs/Capabilities/FrontEnd.cfm.

9.2.2 Competencies

A competency is that set of skills, knowledge and experience which allows an individual or group to be successful at their job or mission. Competency is sometimes thought of as being shown in action in a situation and context that might be different the next time a person has to act. In emergencies, competent people may react to a situation following behaviors they have previously found to succeed. To be competent a person would need to be able to interpret the situation in the context and to have a repertoire of possible actions to take and have trained in the possible actions in the repertoire, if this is relevant. Regardless of training, competency would grow through experience and the extent of an individual to learn and adapt. Each of the DoD Component training organizations is responsible for the development and validation of those competencies identified for each job position.

9.2.3 Proficiencies

Proficiencies are the skills, knowledge and experience defined in a job position's competencies broken down by level of ability. There are accepted scales or levels which are used to describe proficiencies. Below are several examples of proficiency models being used.

The DoD Defense Civilian Personnel Advisory Service (DCPAS), website found at http://www.cpms.osd.mil/FAS/HRPCF/competencyProficiencyLevels.aspx, uses a proficiency level scale taken from the Office of Personnel Management (OPM) Human Resources Management (HRM) expert survey results for the HRM Competency Model. The proficiency level is assigned by competency per grade level (grades 5 through 15). Each competency in their model is defined in terms of five proficiency levels:

- Proficiency level 1 (Awareness) and proficiency level 2 (Basic) is mostly assigned to the 5, 7, and 9 grades since these grade levels would have an awareness or basic understanding of the knowledge, skills, and abilities associated with the competency, but

would not actually possess the knowledge, skills, and abilities to perform the competency in difficult or complex situations.

- Proficiency level 3 (Intermediate) is mostly assigned to the 11, 12 grades since these grade levels have more than an awareness or basic understanding of the knowledge, skills, and abilities associated with the competency, and actually possess some of the knowledge, skills, and abilities to perform the competency in difficult or complex situations.
- Proficiency level 4 (Advanced) is mostly assigned to the 12, 13 grade levels since these grade levels are advanced their understanding of the knowledge, skills, and abilities associated with the competency, and actually posses much of the knowledge, skills, and abilities to perform the competency in difficult or complex situations.
- Proficiency level 5 (Expert) is mostly assigned to the 14 and 15 grade levels and beyond since these levels are more than advanced in the knowledge, skills, and abilities associated with the competency, and actually possess all of the knowledge, skills, and abilities to perform the competency in difficult or complex situations.

A popular proficiency framework is based on the "levels of cognition" in Bloom's taxonomy (Bloom 1984), presented below in order from least complex to most complex.

- Remember – Recall or recognize terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, etc.;
- Understand – Read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.;
- Apply – Know when and how to use ideas, procedures, methods, formulas, principles, theories, etc.;
- Analyze – Break down information into its constituent parts and recognize their relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario;
- Evaluate – Make judgments about the value of proposed ideas, solutions, etc., by comparing the proposal to specific criteria or standards;
- Create – Put parts or elements together in such a way as to reveal a pattern or structure not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn.

Other examples of proficiency levels include the INCOSE competency model, with proficiency levels of: awareness, supervised practitioner, practitioner, and expert. (INCOSE 2010) The U.S. National Aeronautics and Space Administration (NASA), as part of the APPEL (APPEL 2009), has also defined proficiency levels: technical engineer/project team member, subsystem lead/manager, project manager/project systems engineer, and program manager/program systems engineer.

Competency levels can also be situationally based. The levels for the U.S. Department of Defense (DoD) Systems Planning Research, Development, and Engineering (SPRDE) competency model are based on the complexity of the situation to which the person can appropriately apply the competency (https://acc.dau.mil/adl/en-US/406176/file/54338/SPRDE-SE-PSE%20Competency%20Assessment%20Employees%20Users%20Guide_DAU.pdf):

- No exposure to or awareness of this competency;

- Awareness: Applies the competency in the simplest situations;
- Basic: Applies the competency in somewhat complex situations;
- Intermediate: Applies the competency in complex situations;
- Advanced: Applies the competency in considerably complex situations;
- Expert: Applies the competency in exceptionally complex situations.

9.2.4 Learning Objectives

9.2.4.1 Terminal Learning Objectives (TLO)

Terminal learning objectives describe the learner's expected level of performance by the end of the course/training and describe results and not processes. Terminal learning objectives will assist in focusing efforts and to develop the subordinate enabling learning objectives. If a course or training is offered in a traditional form and online, both forms should have the same terminal learning objectives as they both have the same desired outcomes.

9.2.4.2 Enabling Learning Objectives (ELO)

Enabling Objectives define the skills, knowledge, or behaviors students must reach in order to successfully complete terminal objectives. Enabling objectives help us track student competency thanks to three components that include performance (or task), condition, and standards.

- Performance (or task): states what the student will be doing and how he/she will demonstrate the knowledge, skill or behavior. Performance is best described through action verbs.
- Condition: defines the circumstances under which learners perform the desired tasks.
- Standards: define what level the student must perform the task at. This might involve physical measurement, and time among others measurements.

9.2.5 Student Assessment (Testing)

Assessment can be based on writing an individual paper, preparing a group presentation, class participation, attendance, homework problem sets, exams (essay, short answer, multiple choice, true/false), and so on. When a student performs a task rather than taking a test, it is generally called performance assessment. Examples of performance assessment include: debating a topic; demonstrating a skill; conducting an experiment and writing the results; doing a project; or compiling a portfolio of work.

Ideally the assessment process informs the teacher and the learner about learner progress. In theory, good assessment:

- measures meaningful learning outcomes;
- does so in a fair, reliable, accurate way;
- is easy to administer, score, and interpret;
- informs the teacher about student performance and how they are interpreting course experiences;
- results in meaningful feedback to the learner;
- is itself a learning experience.

For example, the Defense Acquisition University employs a mastery (level required for graduation) system. Students must meet prescribed mastery standards to successfully complete a DAU course.

9.2.6 Instructor Certifications

Licensure is a credential normally issued by federal, state or local governmental agencies. A license is issued to individuals to practice in a specific occupation. Licenses are typically mandatory for employment in selected fields and federal or state laws or regulations define the standards that individuals must meet to become licensed.

Certification is a credential normally issued by non-governmental agencies, associations, schools or industry-supported companies. A certification is issued to individuals who meet specific education, experience and qualification requirements. These requirements are generally established by professional associations, industry or product-related organizations. Certification is typically an optional credential, although some state licensure boards and some employers may require a specific certification(s).

Each of the DoD learning organizations maintain instructor certification programs. For example, the Community College of the Air Force (CCAF), http://www.au.af.mil/au/ccaf/certifications.asp , offers the CCAF instructor Certification Program for qualified instructors who teach CCAF collegiate-level courses at a CCAF affiliated school. The purpose of the certification is to recognize the instructor's extensive faculty development training, education and qualification required to teach a CCAF course and formally acknowledges the instructor's practical teaching experience. The CIC Program consists of three specific levels of achievement:

- CIC-I: formally recognizes individuals as a qualified CCAF instructor and their professional accomplishment.
- CIC-II: formally recognizes the instructor's advanced professional accomplishment beyond the CIC-I.
- CIC-III: formally recognizes the instructor's advanced professional accomplishment beyond the CIC-II or Occupational Instructor Certification (OIC).

9.3 Training Development

Each DoD Component has specific policy and processes to ensure training is developed and fielded when needed. PSM's should check with their respective Component's training organizations for further information.

For example, the Army's system is termed Training Requirements Analysis System (TRAS). The TRAS is a long-range planning and management process for the timely development of peacetime and mobilization individual training. The TRAS integrates the training development process with the Planning, Programming, Budgeting, and Execution system (PPBE) by documenting training strategies, courses, and related resource requirements. The TRAS ties together related acquisition systems for students, instructors, equipment and devices, ammunition, dollars, and facilities. Army website is found at http://www-tradoc.army.mil/tpubs/regs/r350-70/350_70_ii_8.htm.

9.3.1 Course Development

More information on the below course development items are found at the Army's website found at http://www-tradoc.army.mil/tpubs/regs/r350-70/350_70_ii_8.htm.

9.3.1.1 Individual Training Plan (ITP)

The ITP is a long-range planning document which outlines the resident and nonresident training strategy for an occupational specialty or separate training program, while ensuring that the organization's training development and management process is integrated with the sources of training needs, the PPBES, evolving training initiatives, and related resource acquisition systems.

The ITP is also justification for initiating acquisition actions. The justification for submitting resource acquisition documents should reference the ITP in which the resource requirements were identified and the process should be started as soon as the requirements have been approved by the proponent and coordinated with HQ TRADOC. Before submitting an ITP, the proponent must ensure the resource requirements identified in the ITP are coordinated at the installation level so they can be entered expeditiously into the appropriate resource acquisition systems.

The ITP is also used to develop course administrative data for new or revised courses.

9.3.1.2 Course Administrative Data (CAD)

The CAD is prepared for each formal course and used to prepare the preface page of a Program of Instruction (POI). Separate phases of a course must have separate CADs and preface pages.

9.3.1.3 Program of Instruction (POI)

A Program of Instruction (POI) is a requirements document that provides a general description of course content, duration of instruction, and methods and techniques of instruction, and lists resources required to conduct peacetime and mobilization training. The POI includes critical tasks and supporting skills and knowledge taught, including distance learning phases of the course. The mobilization portion of a POI is termed a Mobilization POI (MOB POI).

9.3.1.4 Curriculum and Use of Sharable Content Object Reference Model (SCORM)

Sharable Content Object Reference Model (SCORM) is a collection of standards and specifications for web-based e-learning. It defines communications between client side content and a host system called the run-time environment, which is commonly supported by a learning management system. SCORM also defines how content may be packaged into a transferable ZIP file called "Package Interchange Format". SCORM is a specification of the Advanced Distributed Learning (ADL) Initiative, which comes out of the Office of the United States Secretary of Defense.

9.3.2 Course Validation

In order to secure a high quality of educational and academic experience for students, and to ensure that the standards set at validation are still being met and enhanced and that curricula are both up to date and relevant, learning institutions may adopt several related processes such as below:

- Validation: the development of new courses, new pathways to courses or new modes of study;

- Revalidation: restructure or rewrite existing courses including any major change that requires a staged development with input from external and internal peers;
- Review: update existing courses when no major changes are proposed;
- Major Changes: make structural changes to an existing course that is not due for review, without altering the fundamental nature of the course.

9.3.2.1 Pilots

During the process of course validation, a “pilot” or test training course may be run with a selected student group, composed of both subject matter experts and those who are new to the material, to attend the training course and provide feedback on the quality of the course content, methods of delivery and other course related attributes.

9.3.2.2 Metrics

Feedback on understanding the value which a course actually gives to the community is important. Developing the metrics to allow for that understanding is often difficult and requires some custom tailoring to the specific requirements of the community and the deployed courseware. Some rules for developing sound metrics include:

- Measurable
- Actionable
- Understandable
- Easily collect the right data for evaluation
- Focused and unambiguous
- Contain the appropriate granularity

9.4 Training Deployment

9.4.1 Classroom Instruction

Classroom instruction is a form of training usually associated with traditional methods with includes one or more instructors conducting the training with students present in a designated room or facility for the period of time required to complete the training. Classroom training is also called resident training.

9.4.2 Embedded Training

Training accomplished through the use of the trainee’s operational system within a live virtual constructive (LVC) training environment. Per DoDD 1322.18, January 13, 2009, PSM should ensure training system acquisitions and embedded training capabilities comply with the open, net-centric, interoperable standard.

Per the DAG (Section 6.3.3), both the sponsor and the program manager should give careful consideration and priority to the use of embedded training as defined in DoD Directive 1322.18: "Capabilities built into, strapped onto, or plugged into operational materiel systems to train, sustain, and enhance individual and crew skill proficiencies necessary to operate and maintain the equipment." The sponsor's decisions to use embedded training should be made very early in the capabilities determination process.

Analysis should be conducted to compare the embedded training with more traditional training media (e.g., simulator based training, traditional classroom instruction, and/or maneuver training) for consideration of a system's Total Operating Cost. The analysis should compare the costs and the impact of embedded training (e.g., training operators and maintenance personnel on site compared to off station travel to a temporary duty location for training). It should also compare the learning time and level of effectiveness (e.g., higher "kill" rates and improved maintenance times) achieved by embedded training.

When making decisions about whether to rely exclusively on embedded training, analysis should be conducted to determine the timely availability of new equipment to all categories of trainees (e.g., Reserve and Active Component units or individual members). For instance, a National Guard tank battalion that stores and maintains its tanks at a central maintenance/training facility may find it more cost effective to rely on mobile simulator assets to train combat tasks rather than transporting its troops to the training facility during drill weekends. A job aid for embedded training costing and effectiveness analyses is: "A Guide for Early Embedded Training Decisions," U.S. Army Research Institute for the Behavioral and Social Sciences Research Product 96-06.

9.4.3 Distributed Learning

Distributed learning occurs as a portion of the standard contact hours of a course and is an organized teaching/learning event that occurs outside of the physical presence of the teacher. Distributed learning is technology based and can be either synchronous (occurs at a specific time) or asynchronous (occurs at various times). The foundation of distributed learning is the matching of instructional strategies, delivery systems and materials to learner characteristics and course content. Distance learning, a related term, employs training methods and technology which deliver teaching, often on an individual basis, to students who are not physically present in a traditional educational setting such as a classroom. Distance learning, when used in conjunction with an on-site workshop or other on-site activity is called “blended learning”.

The Advanced Distributed Learning (ADL) Initiative, http://www.adlnet.org/, was established in 1997 to standardize and modernize training and education management and delivery and is part of the Department of Defense (DoD) Office of the Deputy Assistant Secretary of Defense (Readiness). The vision of the ADL Initiative is to provide access to the highest quality learning and performance aiding that can be tailored to individual needs, and delivered cost effectively at the right time and at the right place.

The ADL Initiative has laboratories in two locations: Alexandria, VA and Orlando, FL. These Collaborative Laboratories (Co-Labs) provide the opportunity to prototype and test the latest learning technologies and innovations for the development and delivery of ADL technologies for the DoD. Research and prototyping at the two Co-Labs is primarily focused on various efforts to enhance the next-generation learning environment for the next-generation learner. Products and services provided at these facilities include:

- Next Generation Learning Environment
- Federal Learning Registry (FLR)
- Games for Training
- Instructional Design

- Intelligent Tutors
- Mobile Learning
- Adaptive Training Research
- Learning Data Standardization (S1000D)
- ADL Registry
- SCORM ® – Learning Standards
- SCORM ® Testing
- Virtual Worlds
- 3D Repository

9.4.4 Simulation Training

High costs in live training, expanding simulation capabilities, and the desire to decrease wear and tear on operational assets is moving training execution away from live training toward virtual and constructive training, or toward a more efficient mix of live, virtual, and constructive training. In all segments of the training area – virtual, live, constructive/ command, control, communications, computers, intelligence, surveillance, reconnaissance (C4ISR), and education, there are opportunities to acquire less expensive, but more effective training through simulation avenues. Each of the DoD Components and Agencies have groups dedicated to the integration of training devices and simulators as part of weapon system specific training programs. PSMs should check with their respective Component / Agency for existing capabilities and guidelines.

9.5 Training Assets

Training systems and devices (or trainers) are acquired to satisfy training deficiencies, reduce training costs, enhance training effectiveness or as an approved strategy such as the Army's Combined Arms Training Strategy. They are broadly categorized as either system or non-system trainers. They may be standalone, embedded, component level, or appended training devices.

Each DoD Component maintains an extensive portfolio of training devices for many of its major weapon systems. Below are some representative Service websites.
Air Force: http://www.militarynewcomers.com/BARKSDALE/resources/03.html contains an extensive list of training organizations and describes their use of training devices.
Navy: http://nawctsd.navair.navy.mil/ contains an extensive list not only of Navy training systems, but also for Coast Guard, Fire Fighting, etc.
Army: The Army breaks out training assets into Training Aids, Devices, Simulators and Simulations as described in TRADOC Regulation 350-70.
http://www.gordon.army.mil/tsc/TADSS.htm.

- Training aids are items that assist in the conduct of training and the process of learning;
- Training devices are three-dimensional objects that improve training. Generally, devices do this by giving the soldier something that substitutes for actual equipment that cannot be provided otherwise;
- Simulators are a special category of training devices that replicate all or most of a system's functions;
- Simulations provide leaders effective training alternatives when maneuver and gunnery training opportunities are limited. When used properly, simulations can create the environment and stress of battle needed for effective command and battle staff training.

9.5.1 Instructors

Each DoD training organizations maintain an instructor training and credentialing program. Instructors will be expected to have a minimum formal educational level, experience and demonstrated skills in the relevant area of expertise. For specific information, contact the specific training organization.

9.5.2 Simulators

Modeling and simulation for training is an important function. Each of the Services has an organization focused on maximizing the effectiveness of simulation in the training environment. Additionally there is a National Center for Simulation in Orlando, FL (described below) in which all the DoD Services participate.

Within the Naval Air Systems Command, the Naval Air Warfare Center Training Systems Division (NAWCTSD) is the Navy's source for a full range of innovative products and services that provide complete training solutions. This includes requirements analysis, design, development and full life cycle support. Of significance is NAWCTSD's ability to provide continuous learning across a wide variety of applications (aviation, surface, undersea, etc.). NAWCTSD integrates the science of learning with performance-based training and measurement of training effectiveness focused on improving the performance of Sailors and Marines. Website is found at http://nawctsd.navair.navy.mil/.

National Center for Simulation. In 1985, the Governor and Cabinet of the State of Florida issued a resolution recognizing and endorsing the Center. The resolution stated, in part, that the Center "has the finest talent available, nationwide industrial support with over 75 firms represented in the Central Florida area, an annual budget of over $1 billion, academic and community support, and a national asset second to none." Further, the resolution endorsed the continued development of such high-technology industry.

In a subsequent letter to NAWCTSD, then-Florida Governor Bob Graham stated, "Simulation training should be established as the number one state target of industrial development." The following organizations are included in the Center.

- NAWCTSD
- Naval Reserve Units
- Army PEO for Simulation, Training and Instrumentation (PEO STRI)
- Army Research Laboratory
- Army Research Institute - Simulator Systems Research Unit
- Naval Personnel Research and Development Center (NPRDC)
- Air Force Agency for Modeling and Simulation (AFAMS)
- Marine Corps Systems Command, PM Training Systems (PMTRASYS)
- State and Local Government
- University of Central Florida Institute for Simulation and Training
- The National Center for Simulation
- Industry (approximately 140 firms represented)

Simulation and training technology in Orlando is on the brink of a new era brought about by combining the strengths of the military, academic, and industrial communities with State and

local endorsements under the Center of Excellence banner.
http://nawctsd.navair.navy.mil/AboutUs/CenterofExcellence.cfm

9.5.3 Computer Based Training (CBT)

CBT uses computers as a primary means to impart training, monitor trainee progress, provide feedback, and assess training results. CBT is also known as Computer Aided Instruction (CAI) and is employed to implement distance learning. See Section C.a for DoD Proponency information on CBT, Distance Learning and other Distributed Learning assets, links, tools, and information.

9.5.4 Knowledge Management

Knowledge Management is the collection of processes that govern the creation, dissemination, and utilization of knowledge. In one form or another, knowledge management has been around for a very long time.
Listed below are several Defense Acquisition University (DAU) / Department of Defense developed knowledge sharing resources. These are known as the AT&L Knowledge Management Systems.
Acquisition Community Connection (ACC) https://acc.dau.mil is the collaborative arm of the AT&L Knowledge System, it consists of publicly accessible knowledge communities (Communities of Practice (CoPs) and Special Interest Areas (SIG)) whose goal is connection people with know-how across all DoD organizations and industry. Take a virtual tour of the ACC http://www.dau.mil/about-dau/virtual_tour/acc/index1.html

Defense Acquisition Portal https://dap.dau.mil The Defense Acquisition Portal (DAP) enhances the focus of acquisition to include "Big Acquisition," encompassing all phases of the acquisition process: requirements generation, budget development, and forces such as organization, workforce, and industry. As a portal, the DAP provides access to golden sources for mandatory and discretionary instructions, directives, guidebooks, handbooks, manuals, and other knowledge libraries within the DoD and associated Service portals.

Defense Acquisition Guidebook https://akss.dau.mil/dag is an interactive, web-based site designed to provide users with discretionary guidance and support for the DoD Directive 5000.01 and the DoD Instruction 5000.02. Take a virtual tour of the Defense Acquisition Guidebook http://www.dau.mil/about-dau/virtual_tour/dag/index1.html

The Integrated Defense Acquisition, Technology and Logistics Life Cycle Management System Chart https://akss.dau.mil/ifc is an essential aid for defense acquisition professionals and a workflow learning tool for AT&L professionals and Defense Acquisition University (DAU) Courses. It serves as a pictorial roadmap of most key activities in the systems acquisition process. The chart is based on information in the Defense Acquisition Guidebook and key DoD policy documents such as the 5000 Series and CJCS instructions.

Program Managers e-Tool Kit https://pmtoolkit.dau.mil The Program Managers e-Tool Kit puts program management tools at your fingertips in a dynamic new format. This Web-enabled tool lets you search the entire contents of this popular handbook from the menu bar, access continually updated content, and jump directly to current policy documents, aggregated

resources related to the topics, and relevant communities of practice.

Ask A Professor (AAP) https://akss.dau.mil/aapis a Department of Defense resource for asking acquisition and logistics questions concerning policies and practices.

ACQuire Search Engine https://acquire.dau.mil this is the best search engine to find content located on the various DAU/DoD knowledge sharing Website and other selected acquisition focused Website.

DAU Virtual Library https://www.dau.mil/Library/ Take a virtual tour of the DAU Virtual Library http://www.dau.mil/about-dau/virtual_tour/vl/index1.html

The DoD Acquisition Best Practices Clearinghouse (BPCh) https://bpch.dau.mil/Pages/default.aspx facilitates the selection and implementation of systems engineering and software acquisition practices appropriate to the needs of individual acquisition programs. The BPCh uses an evidence-based approach, linking to existing resources that describe how to implement various best practices. These linked resources also provide descriptions of the practical results (both good and bad) of applying the practices in various contexts, from which users can learn about the results to be expected in their environment. All evidence stored is also contextualized, so that users will be guided to the lessons relevant to their program, type of problem, or specific situation.

Additional Knowledge Management portals managed by the DoD Components can be found at the Defense Acquisition University Community of Practice website at https://acc.dau.mil/CommunityBrowser.aspx?id=24678.

9.6 Support of Training Systems

Most DoD training systems require a life cycle support system just as the primary weapon system does. Each DoD Component determines, funds and executes the training system's life cycle support to align to its respective organizational operations and requirements. For example, the Navy policy memo, found at http://doni.daps.dla.mil/Directives/03000%20Naval%20Operations%20and%20Readiness/03-500%20Training%20and%20Readiness%20Services/3502.5A.pdf , OPNAVINST 3502.5A,N87, 5 Mar 07, directs the management of the life cycle support of the submarine training system program to include planning, funding, and execution.

Training and Training Support in the Life Cycle

A. Purpose

Training is the learning process by which personnel individually or collectively acquire or enhance pre-determined job-relevant knowledge, skills, and abilities by developing their cognitive, physical, sensory, and team dynamic abilities. The "training/instructional system" integrates training concepts and strategies and elements of logistic support to satisfy personnel performance levels required to operate, maintain, and support the systems. It includes the "tools" used to provide learning experiences such as computer-based interactive courseware, simulators,

and actual equipment (including embedded training capabilities on actual equipment), job performance aids, and Interactive Electronic Technical Manuals. It is critical that to ensure alignment between system design and training program, any and all changes must be evaluated as to the impact on the training program. The training products will require separate configuration management and supportability.

Training is one of the twelve Integrated Product Support Elements. The activities occurring within the scope of this area should be integrated with other product support element areas in keeping with KPP and KSA optimization goals and constraints.

1. Why is Training and Training Support Important

The Product Support Manager needs to understand the requirements for training related to the civilian and military workforce for weapon systems acquisition and the training required for civilians and military to lead, operate and sustainment the weapon system being fielded.

Training performed by the DoD can be viewed as focused according to specific outcomes:

- Institutional training for the military and civilian workforce;
- Weapon system acquisition-related training is developed and implemented to specifically support the fielding of new systems or major modifications of systems;
- Operational and field training primarily as part of individual, unit and organizational training typically conducted at home station, during major training events and while operationally deployed;
- Self-development training where individuals seek additional knowledge growth that complements what has been learned in the classroom and on the job.

2. Summary of Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

Note that the Logistics Assessment (LA), also known as an independent logistics assessment, is part of **each** Milestone Decision Package and is a requirement for type classification.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Training & Training Support IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, includes in the left column a listing

of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	**Training and Training Support Activities**
User Need / Technology Opportunities & Resources	Performance-based life-cycle product support implementation begins in the JCIDS process with the exploration of capabilities. Every system is acquired to provide a particular set of capabilities in a specific concept of operations, sustained to an optimal level of readiness. Understanding user needs in terms of performance is an essential initial step in developing a meaningful product support strategy because changes to the CONOPS or the sustainment approach may impact the effectiveness, suitability, or cost of the system. The Product Support Manager (PSM) must be able to understand and forecast training and training support requirements to actual product support sustainment activities and outcomes via both materiel and non-materiel solutions. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Key Products: • Requirements • Metrics
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. Depending upon where the Program enters the DAS, the Program Manager (PM) should have an Initial NTSP prior to Milestone A, a Draft NTSP prior to Milestone B, and an Approved or updated NTSP prior to Milestone C.The training strategy is developed based on the initial capabilities document and the chosen materiel solution(s). The training strategy should consider the various means for deploying training, i.e., embedded training, institutional training, unit level training, and various forms of distance learning. The outcomes of the training strategy should impact the achievement of higher system availability, higher reliability at an optimized life cycle cost. Key Products: • Updated training requirements • Training strategy • Initial Training Systems Plan (see NAVAIR SWP6753-001 for more information)

	• Inputs to required acquisition document
Technology Development	The training concept is developed and should provide specific recommendations for how training will be developed, deployed, conducted and assessed. Trade-off studies are completed to validate and forecast training and training support sustainment outcomes as a result of design of the system and its intended sustainment footprint encompassing all twelve product support elements. For system training, the AoA should consider alternatives that provide for the individual, collective, and joint training for system operators, maintainers, and support personnel. The training system includes simulators and other training equipment, as well as supporting material such as computer-based interactive courseware or interactive electronic technical manuals. Where possible, the alternatives should consider options to exploit the use of new learning techniques, simulation technology, embedded training (i.e., training capabilities built into, strapped onto, or plugged into operational systems) and/or distributed learning to promote the goals of enhancing user capabilities, maintaining skill proficiencies, and reducing individual and collective training costs. Market analysis is also performed to assess the availability of qualified suppliers to meet specific sustainment requirements. Risks to achieving the necessary training and training support structure for the time frame of the program by IOC should be identified and a mitigation strategy outlined. The specific enabling support technologies should be identified along with the corresponding plan to technically mature each support element. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of Milestone Decision Review required documents. Training is a domain of Human Systems Integration. The Product Support Manager will also have significant input into the Systems Engineering Plan due to the impacts on design engineering from supportability analysis. The PSM should provide an overview of the System Training Plan (STP) addressing training required for the system (including operations and maintenance) for all training locations. In addition to lesson plans, courses and training materials the discussion should include the training equipment and its support. Training devices and systems are identified. Key Products: • Training Needs Analysis • Training Concept

	• Draft Training Systems Plan • Inputs to Systems Engineering Plan • Training devices and systems identified • Inputs to required systems acquisition documents
Engineering & Manufacturing Development	The training activities during this phase include the development of the New Equipment Training Plan, training issues identified early in the test and evaluation process, resident and On-the-Job (OJT) training requirements are developed, and validation of training systems is accomplished as part of the logistics demonstration and developmental/operational testing process. Training devices and training systems are finalized and acquisition planning occurs. Significant changes may be required to the training and training support portion of the product support package to achieve the objective sustainment metrics including major support provider changes. As the program matures, the LCSP is updated to reflect increasing levels of detail as they become available. Key Products: • Approved or updated Training Systems Plan • Training for Test and Evaluation conducted • Final Training Needs Analysis • Training systems and products finalized with the acquisition process underway
Production & Deployment	Training and training support activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, taking part in planning activities that may be on-going already for product improvement, and developing long term plans for training and training support improvements for both the system and its support infrastructure as part of the LCSP. New Equipment Training (NET) is deployed as part of the system fielding process. Fielding occurs during this phase and proof of early planning is now being validated as the system deploys to the operational site. Key Products: • Final Training Plan • Training Curriculum • Training systems and devices acquisition • Personnel qualification system • New equipment training executed during system fielding
Operations & Support	Training programs are implemented along with their training systems and infrastructure. System training plans and related materials are updated to

	align to weapon system and sustainment changes. The Product Support Manager's responsibility is to continue reviewing system performance while looking for opportunities to improve training and training support of both the system itself and the support infrastructure to optimize cost versus availability. Key Products: • Training systems and devices fielded • Training delivered • Training updates to reflect new requirements

Table 9.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DI-FNCL-80342, Performance and Cost Allocation Reporting for Contractor Logistics Support (CLS) of Training Devices
DI-ILSS-80502, List of Faults for Training Purposes
DI-ILSS-80872, Training Materials
DI-ILSS-81070, Training Program Development and Management Plan
DI-ILSS-81089, Training Facilities Report
DI-MISC-81184, Training Equipment Summary
DI-MISC-81421, Maintenance Training Activity Report
DI-MISC-81460, Electronic Warfare (EW) Training Equipment Report
DI-SESS-81520, Instructional Media Design Package
DI-SESS-81527, Training Systems Support Documentation
MIL-PRF-29617B, Training Documentation
DI-SESS-81517B, Training Situation Document
DI-SESS-81518B, Instructional Performance Requirements Document
DI-SESS-81519B, Instructional Media Requirements Document
DI-SESS-81521B, Training Program Structure Document
DI-SESS-81522B, Course Conduct Information Package
DI-SESS-81523B, Training Conduct Support Document
DI-SESS-81524B, Training Evaluation Document
DI-SESS-81525B, Test Package
DI-SESS-81526B, Instructional Media Package
DI-SESS-81527B, Training System Support Document
DI-SESS-81637, Training Planning Process Methodology (TRPPM) Report

C. OSD Proponency, Policy, Regulations and U.S. Statutes

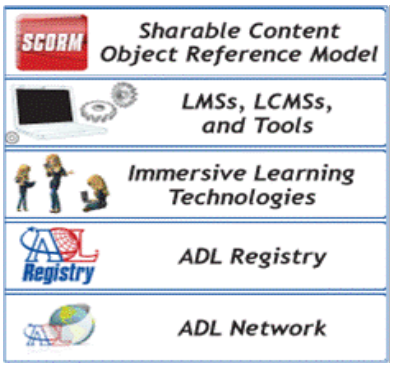
a. Proponency

- The Department of Defense Human Resources Activity (DHRA) is a DoD-wide Field Activity chartered to support the Under Secretary of Defense for Personnel and Readiness (USD (P&R)). Advanced Distributed Learning (ADL): This program develops the technologies to make learning and performance support available to service members, anytime, anywhere. The ADL concept enables the ability to migrate online learning content to multiple hardware and software applications using the DoD's Sharable Content Object Reference Model (SCORM) standard. It has become the de facto standard and is moving through international bodies for global accreditation; its use is mandatory throughout the Department of Defense (DoD Instruction 1322.26).

  The ADL program continues to develop US and international partnerships with public education, vocational training, and life-long learning programs. Policy oversight is managed by the Office of the Deputy Under Secretary of Defense / Readiness (Readiness and Training Policy and Programs). Recent work has established a single registry where all online learning content developed by the Department can be discovered for re-use. A fourth edition of SCORM was released in May 2009. In FY2010, guidelines for integrating technical manuals to SCORM will be published and a strategic plan will be in place to incorporate advances from social networking and other "Web 2.0" technologies into the ADL framework.

- For the U.S. Army, system trainers may be either acquired by a system PEO/PM or the Program Executive Office for Simulation, Training and Instrumentation (PEO STRI) for the PEO/PM. The PEO STRI has the responsibility to conduct concept formulation for all training devices (system and non-system). The system PEO/PM normally provides funding for concept formulation for system training devices. System trainer requirements are analyzed as a part of new equipment acquisitions. The training system/device capabilities document is prepared by the CAPDEV and provided to the PEO STRI. Training system/device acquisitions must comply with DoDD 5000.1, DoDI 5000.2, AR 70-1, and AR 71-9. PEO STRI has the mission for life-cycle management of all training systems/devices that are LCCS and must ensure that funding requirements are included in the POM. OMA funds are used for LCCS.

- The Joint Advanced Distributed Learning Co-Laboratory (JADL) is located in Orlando, Florida. JADL's mission is to enable the DoD Components' education and training communities and acquisition programs to realize the ADL vision. JADL serves as the ADL Initiative's organization for adopting and implementing ADL across DoD Component organizations. The Product Support Manager is encouraged to visit their website for further research. The ADL operates under the direction of the Office of the Secretary of Defense (OSD). Its website is at http://www.adlnet.gov/About/Jointcolab/default.aspx.



- The U.S. Army Simulation and Training Technology Center's (STTC) mission is to enhance Warfighter readiness through simulation research and technology development for learning, training, testing and mission rehearsal for the Department of Defense and the Department of Homeland Security. The website is http://armytechnology.armylive.dodlive.mil/index.php/the-army-technology-team/simulation-and-training-technology-center/. Their mission includes:
  - Managing Science and Technology contracts;
  - Conducting research, development, demonstrations, experimentation and building of prototypes;
  - Searching for the latest and greatest technology innovations for training;
  - Synchronizing and collaborating with academia, customers and labs all across the Army and Sister Services;
  - Rapid support fielding as needed to support the Warfighter.

b. Policy, Regulations and U.S. Statutes

- DoDD 5000.01, "The Defense Acquisition System", November 2007
- DoDI 5000.02, "Operation of the Defense Acquisition System", December 2008
- CJCS Instruction 3170.01, "Operation of the Joint Capabilities Integration and Development System"
- Defense Acquisition Guidebook, Chpt 6.3.3 and various sections of Chapter 5
- MIL-HDBK-29612-1A, -2A, -3A, & -4A, "DoD Handbook: Guidance for Acquisition of Training Data Products and Services", Aug 2001, may be used as a guide for Instructional Systems Development/Systems Approach to the training and education process for the development of instructional materials.
- "FY09 Department of Defense Human Systems Integration Management Plan", Version 1.0, found at http://www.acq.osd.mil/se/docs/FY09-DoD-HSI-Management-Plan.pdf
- Strategic Plan for Transforming DoD Training, May 8 2006, Office of the Under Secretary of Defense for Personnel and Readiness, Director, Readiness and Training Policy and Programs
- DoDD 1322.18, "Military Training", Jan 2009
- DoDI 1322.20, "Development and Management of Interactive Courseware for Military Training," March 14, 1991
- DoDI 1322.26, "Development, Management, and Delivery of Distributed Learning"

D. Who Develops, Delivers and Manages Training & Training Support

Army

Per AR350-1, Chapter 6, new, improved, and displaced equipment is provided to DoD organizations by planning, acquiring and fielding a unit set (to include training capability) to a designated active or reserve component unit during a single modernization window. To the extent possible, a system-of-systems approach is used for capabilities and requirements generation, materiel development and acquisition, manpower and personnel, funding, testing, fielding, transfer, training, sustainment and support facilities. The modernization process should

occur where possible to enable units to train on new equipment as early in the life cycle as possible. When synchronized unit set fielding is not possible, as during rapid acquisition to meet urgent operation needs, every effort must be made to initiate early identification and development of the required training capabilities. Early parallel development of training capabilities-especially during rapid acquisition-is essential to the planning, programming, fielding, and sustainment of complete training capabilities.

A materiel system's training and training support requirements are established under the purview of AR 71-9, Materiel Requirements, are documented under the purview of AR 71-32, Force Development and Documentation, are developed and fielded under the purview of AR 70-1, Army Acquisition Policy, are supported under the purview of AR 700-127, Integrated Logistics Support, and are released for fielding under the purview of AR 700-142, Type Classification, Materiel Release, Fielding and Transfer. AR 350-38, Training Device Policy and Management, provides guidance for Training Devices, Aids, Simulators and Simulations (TADSS), both system and non-system.

The following categories of training are used to define responsibilities for the provision of training and training support:

(1) New Equipment Training. The initial transfer of knowledge on the operation and maintenance of new and improved equipment from the Materiel Developer to the tester, trainer, supporter, and user;
(2) Displaced Equipment Training. Training provided by the Program Manager on the operation and maintenance of previously fielded equipment that is scheduled for redistribution as a result of Army Modernization processes;
(3) Doctrine and Tactics Training. Training development provided b the training developer on employment, tactics, and interoperability of new or displaced equipment;
(4) Sustainment Training. Individual and collective training conducted by and within a unit, or organization, upon completion of NET/DET to ensure continued expertise on the operation, maintenance, and employment of fielded equipment.

Key players. The following agencies have distinct responsibilities for the provision of training and training support. The Product Support Manager must ensure these stakeholders are part of the training and training support activities to ensure successful development, fielding and implementation of training:

(1) Program Manager or Product Support Manager. The PM/PSM is the agent charged with the fielding of a supportable system to each gaining organization and charged with planning, programming, budgeting, and executing associated funding;
(2) Materiel Developer. The agency responsible for research, development, and production validation of a system;
(3) Training and Doctrine Command Capabilities Manager. The TCM manages the development of select high-priority programs and associated products and coordinates development of home station and institutional training for individuals, crews and units. The TCM also coordinates development and fielding of training aids, devices, simulations and simulators for use in training in the institution, home station, and combat training centers;

(4) Combat Developer (CAPDEV). The agency that determines Warfighter requirements to achieve future operational capabilities. CAPDEV develops materiel requirement documents and serves as the user's representative in the materiel acquisition process. CAPDEV is the overall integrator of doctrine, training, materiel, leader development, organization, and user requirements and products.
(5) Training Developer. The Army agency that determines requirements for a system's training subsystem and formulates, develops, and documents associated training concepts, strategies, plans and required training support. Serves as the user's representative during development and acquisition of a system's training subsystem.
(6) New Equipment Training Manager. Official designated by the PM responsible for planning, coordinating, and conducting NET.

Per AR 350-1, Table 6–1. Responsibility for Training Development and Support If Needed for the Conduct of NET/DTT

Training Support Components for NET/DTT	Identify Training Requirements For	Approve Requirements For	Program/ Budget For	Develop/ Produce
How-to-Fight Doctrine	CAPDEV	CAPDEV	CAPDEV	CAPDEV
Soldiers Manuals (SMs)/CS	TNGDEV	TNGDEV	TNGDEV	TNGDEV
TMs	MDEV	PM	PM1	MDEV
NET Weapon Training Strategy2	TNGDEV2	TNGDEV2	PM1&2	TNGDEV2
DTT Weapon Training Strategy	TNGDEV	TNGDEV	TNGDEV	TNGDEV
Ammo for NET	TNGDEV	HQDA G–3/5/7 TR	PM1	PEO AMMO/JMC
Ammo for DTT	TNGDEV	HQDA G–3/5/7 TR	TNGDEV	PEO AMMO/JMC
Ranges/Targetry for NET/DTT	TNGDEV thru ACP	HQDA G–3/5/7 TR	HQDA G–3/5/7 TR	PEO–STRI4
Training facilities (other than ranges) for NET/DTT	TNGDEV thru ACP	HQDA G–3/5/7 TR	HQDA G–3/5/7 TR	ACSIM COE3 ARNG
Trainers for NET	TNGDEV	MDEV	PM1	MDEV
Trainers for DTT	TNGDEV	TNGDEV	TNGDEV	TNGDEV
Training Support Packages for NET	TNGDEV	TNGDEV	PM	PM

Training Support Packages for DTT	TNGDEV	TNGDEV	TNGDEV	TNGDEV
Ground/Air OPTEMPO Integrated Log Spt	MDEV in compliance with TNGDEV	ASA (ALT)	PM1	PM
Non-system TADSS for NET/DTT System TADSS for NET/DTT	TNGD V TNGV	DAMO–CI in compliance with G–3/5/7 TR	HQDA G–3/5/7 TR PM1	PEO–STRI4 MDEV4

Notes:

[1] The PM/PSM must provide the required training components identified in the capabilities document and System Training Plan, unless the Army acquisition executive approves an exemption.

[2] Strategy itself - not resources required to execute it.

[3] Strategy is developed within HQDA (G–3/5/7 TR) approved resource limits and approved by HQDA (G–3/5/7 TR).

[4] Design approved by TNGDEV.

Air Force

Per AFI 36-2251, training systems are developed using the integrated management framework outlined in DoDD 5000.01 *Defense Acquisition*. Within this framework, three principal decision support systems forge a close and effective interface to acquire the quality products needed by the nation's Armed Forces. These support systems are: 1) the Requirements Generation System, 2) the Defense Acquisition System, and 3) the Planning, Programming, and Budgeting System. The management of Training Systems spans all Commands and many organizations. In addition, DoDD 1322.18, *Military Training*, and DoDD 1430.13, *Training Simulators and Devices*, provide additional overarching guidance with respect to the acquisition and fielding of training systems. The following concepts and terms are included to communicate DoD perspective and intentions.

Per AFPD 36-22, *Military Training*, AFPD 10-9, *Lead Operating Command Weapon Systems Management*, AFPD 63-1 and AFI 63-101, *Acquisition System*, the Assistant Secretary of the Air Force for Manpower & Reserve Affairs (SAF/MR) is responsible for Air Force military training policy matters.

The Assistant Secretary of the Air Force for Acquisition (SAF/AQ) serves as the Air Force Acquisition Executive for non-space related programs and the Air Force Senior Procurement Executive (SPE), oversees all non-space related acquisition programs through the Program Executive Officer (PEO) or Designated Acquisition Commander (DAC), and issues Program Management Directives (PMD) for all non-space related acquisition programs.

The Under Secretary of the Air Force serves as the Air Force Acquisition Executive for space related programs, the Milestone Decision Authority (MDA) for all DoD Space Major Defense

Acquisition Programs (MDAP) and the DoD Executive Agent for Space, oversees all space related acquisition programs through the Program Executive Officer (PEO) and issues Program Management Directives (PMD) for all space related acquisition programs.

The PEO/DAC manages acquisition program costs and scheduling to meet all performance requirements within approved baselines, program direction, and acquisition strategy; directs all Program Managers and ensures program offices focus on satisfying operational requirements.

The PEO/DAC makes sure that program offices exercise contracting authorities and responsibilities according to the Federal Acquisition Regulation (FAR) and Department of Defense Federal Acquisition (DFARS) and implemented in the AFFARS.

The Deputy Chief of Staff, Personnel (HQ USAF/DP) develops, coordinates, and executes personnel policy and essential procedural guidance for the management of military training programs.

Headquarters Air Force Offices of Primary Responsibility (OPR) will designate the LC for Prime Mission Systems.

Headquarters US Air Force Deputy Chief of Staff for Air and Space Operations, AF/XO, (for Air or Space Crew Training Devices) or the Deputy Chief of Staff for Installations and Logistics, AF/IL, (Maintenance Management Division) oversees the management of and policies for functional training, training devices, and STPs, as appropriate. They appoint career field managers to ensure development, implementation, and maintenance of Career Field Education and Training Plans for Air Force specialties.

As functional training manager, HQ USAF/XOOT shall review all ACAT I and ACAT II System Training Plans (may be part of the Single Acquisition Management Plans (SAMP) or Human System Integration (HSI) documentation).

HQ USAF/XOOT shall advocate for funding of flight trainers.

HQ USAF/XOSO shall advocate for space trainers. These include Aircrew / Spacecrew Training Systems as a whole, and Aircrew / Spacecrew Training Devices and Part Task Trainers in particular.

HQ USAF/ILMM shall advocate for funding Maintenance Training Systems as a whole, and Maintenance Training Devices in particular.

For primary weapon systems, support and training systems, the Lead Command (LC) / User Command (UC) will as appropriate:

- Advocate for the weapon system and respond to issues addressing weapon system status and use. Advocacy includes planning, programming, and budgeting for designated system-wide unique equipment, modifications, initial spares, replenishment spares, and follow-on test and evaluation;

- Provide appropriate operational and support agency representation in the requirements and modification process. Follow established directives when establishing and prioritizing modification requirements;
- Oversee weapon systems configuration following established Major Command (MACOM) and weapon system single program manager procedures. Although the weapon system program manager is responsible for maintaining systems engineering integrity; the lead command is responsible for fleet-wide interoperability and commonality. Therefore, both the lead command and the single manager must first approve any implementation of permanent modification for which there was no previously validated need;
- Establish standards, tasks, and formal training requirements for both operations and maintenance training systems;
- User commands retain responsibility for accomplishing these duties for command or mission unique equipment, modifications, and requirements.

Major Commands (MACOM), field operating agencies, and direct reporting units identify military training and resource requirements, establish supplementary training programs, and execute their programs to comply with these policies, and report unit cost and student production data for all training programs.

Commanders at all levels identify, document, and track training requirements. They determine the priorities for training requirements at their level and systematically address shortfalls in resources to support those requirements. Requirements not addressed by current resources should be forwarded through the Chain of Command from the squadron level to the LC for every system.

Air Education and Training Command (AETC) acts as the Air Force's primary focal point for training technology, training development, and formal training programs. As such, and as a UC of most training systems, AETC will provide ISD advice and expertise to the LC, Program Manager, and Training Planning Team. As the Air Force's Trainer, AETC has a vested interest in the acquisition of systems and should be consulted in the development and validation of training requirements**.**

The Air Force Materiel Command (AFMC) is responsible for providing manpower, training, organizing and equipping acquisition / sustainment programs assigned to the Electronic Systems Center, Air Armament Center, Air Logistics Centers and Aeronautical Systems Center. Air Force
Space Command (AFSPC) is responsible for acquisition/sustainment programs assigned to the Space and Missile Center.

AFMC and AFSPC create integrated product teams that include full user participation at laboratories, and test, product, and logistics centers. One PM is in full charge of all aspects of an acquisition / sustainment program throughout its life cycle. AFMC usually allocates manpower resources necessary for SPD manning to support DAC and PEO acquisition activities. Depending where a product is relative to its lifecycle, the PM may reside at a product center or a logistics center.

AFMC and AFSPC support the PM by providing technical assistance, infrastructure, test capabilities, laboratory support, professional education, training and development, and all other aspects of support for AFAE, PEO, DAC, and PM functions; and supports long-range priorities and systems support planning.

AFMC and AFSPC work closely with users to formulate long-term objectives and integrate systems; support users by defining concepts and developing evaluation and integration studies; and develop, with users, affected PEOs, and DACs, alternative solutions to validated needs and integrate life-cycle cost estimates to support proposed alternatives.

Navy

Per Department of the Navy, OPNAVINST 1500.76B, "Naval Training Systems Requirements, Acquisition, and Management", Navy Training System Plans (NTSPs) are Navy and integrated Navy/Marine Corps documents which communicate Manpower, Personnel and Training gaps and needs in support of new acquisition and or modernization programs. To ensure adequate planning, programming, and budgeting of sustainment training throughout the Future Years Defense Program, resource sponsors are required to obtain concurrence from Director, Training and Education Division (OPNAV (N15)) prior to approving a final or updated NTSP. Once a final or updated NTSP is approved by the resource sponsor, the NTSP shall be used as the official record of the training planning process that facilitated enterprise(s) definition of the system's MPT requirements.

Below is an excerpt from OPNAVINST 1500.76B which addresses PM responsibilities:

PMs/PSMs shall:

(1) Identify, plan, budget, and submit all system and resource requirements, including the development of the NTSP in accordance with reference (r), and coordinate current and future FY cost estimates and priorities for training solutions with OPNAV (N15). Include MPT resource requirements in the Planning, Programming, Budgeting, and Execution system.

(2) Document training planning in an NTSP to include all MPT requirements for all Navy and integrated Navy/Marine Corps ACAT I through IV programs, non-programs of record, fleet modernization, and AAP, NDI, COTS, RDC and JUON programs, and modernized acquisition systems across the entire training continuum (ashore, pier-side, and afloat). Provide the NTSP to the resource sponsor to meet the schedules described in paragraphs 5 and 6 of this instruction.

(3) Liaison with other program executive officers (PEOs), PMs, Training Agency (TAs), and NAVMAC for programs that may interface with the new development and modernization. Advise the other PM(s), via the chain of command, of any unresolved issues.

(4) Support IPTs and the fleet assessment and certification in the modernization process.

(5) Perform comprehensive FEA (using enclosure 1) that identifies the gaps between the baseline comparison MPT requirements and the new equipment/system/sub-system MPT requirements, develops a training device decision coordinating paper (TDDCP) providing a technical assessment of potential training systems in support of the training media selection process, and develops MC documents for the approved TDs. (Note: Forward MC documents to resource sponsors for funding approval and POM submissions, per references (b) and (r)).

(6) Establish MPT advisory board. See enclosure (1) FEA guidance. (Note: The TRPPM advisory board, if convened, can fulfill this function).

(7) Identify and implement approved training resource requirements.

(8) Develop training solutions for initial and follow-on training.

(9) Provide all required training, equipment, and support up to RFT.

(10) Provide a list of NTSPs to be developed, updated, or recommended for cancellation in the current and following year to SYSCOMs and resource sponsors.

(11) Develop NTSPs as directed by resource sponsor(s) and ensure distribution to the NTSP principals.

(12) Announce, host, and provide administrative support for NTSPCs when directed by the resource sponsor.

(13) Advise resource sponsor and other NTSP principals of progress, schedule delay, and revisions affecting development or implementation of NTSPs.

(14) Program and budget resources for required new and updated curricula and training materials development as identified in the NTSP. Develop and maintain training until RFT as identified in the NTSPs. Develop training for major revisions required due to engineering change proposals and or modifications to system(s).

(15) Program and budget resources to provide initial or other specified training identified in the NTSP. Coordinate with the TA responsible for follow-on training. Arrange inter-service training support, per reference (s), if required.

(16) Program and budget for alteration, conversion, and restoration of TA training facilities when installing and removing training equipment.

(17) Program, and budget to develop, procure, deliver, install, overhaul, and modernize TTE, TD, stimulators and other training material requirements identified in the NTSP throughout the life cycle of the system.

(18) Develop technical manuals, documentation, and updates for use in initial and follow-on training. Distribute technical documents to the TSA, TA, and learning centers throughout the life cycle.

(19) Develop and coordinate job task analysis for operator and maintainer training requirements with the TSA, TA, and learning centers.

(20) Provide the TA with all new and updated curricula materials, technical manuals, maintenance requirement cards, maintenance index pages, and maintenance assist modules for training equipment and PQS and or equivalent Marine T&R Program products.

(21) Provide the TA with initial outfitting of repair parts for new or modified training equipment prior to RFT date(s).

(22) Advise the resource sponsor as to whether a new acquisition system requires a TEEP, per reference (b), and develop as applicable.

(23) Submit funding requirements to the OPNAV (N15) and TA a minimum 2 years prior to RFT, for TTE, TD, and simulator/stimulator COMS requirements via OPNAV 1500/40 Technical Training Equipment (TTE) Sustaining Delivery and Support Form, per reference (b).

(24) Plan, program, budget, and procure approved TTE, TD, stimulators and related support, including TTE depot level support for a minimum of 1 year after RFT date, per reference (t).

(25) Fund, procure, and install modifications to TTE, TD, stimulators, training materials, technical documentation, and logistic support items (parts, tools, test equipment, etc.) to coincide with changes to operational equipment and in coordination with the TA.

(26) Provide the TA with disposition instructions for excess TTE, TD, and stimulators.

(27) Provide TTE, TD, and stimulators technical assistance when requested by the TA via impaired training equipment report or casualty report message.

(28) Procure pre-faulted modules, fault insertion devices, and operational/diagnostic software for training equipment.

(29) Develop and submit general purpose electronic test equipment requirements for new acquisitions and modernizations. Procure special purpose electronic test equipment and special purpose tools prior to the RFT date. Fund, requisition, and distribute electronic test equipment to the TA prior to the RFT date.

(30) Comply with interservice training procedures for joint and joint service requirements identified in reference (s) as applicable.

(31) Transition training system from the TSA to the TA for life cycle support requirements prior to the RFT date, per reference (t).

(32) Maintain relevant source data documents, including FEA products, assumptions and trade-off data for the life of the program.

(33) Develop and manage curriculum, interactive courseware, distributed learning and content until RFT MS, per references (u), (v), and (w).

(34) Identify and coordinate training system shore facility requirements, planning, installation, and transition training responsibilities from the TSA to the TA, per references (n), (s), and (t).

(35) Assess HSI domains during the cost benefit analysis (CBA), and use this information to affect technology development and AoA prior to development of the JCIDS initial capabilities document (ICD), capability development document (CDD), and capability production document (CPD) HSI sections, per reference (c). Ensure that job task analysis and manpower workload analysis results are certified by the technical authority, and subsequent updates to NTSPs are provided during systems engineering technical reviews and Logistics Assessments.

(36) Establish and maintain procedures that provide equipment to support adequate training prior to IOC. Provide interim training solution (e.g., vendor training) if delays in the development of the training system will not allow compliance. Document the interim training solution in the NTSP.

(37) Plan, program, coordinate, install, and manage alterations and modernizations at training activities prior to fleet installations and ensure configuration and concurrency management of TTE, TD, simulators, and stimulators.

(38) Notify the resource sponsor, OPNAV (N15), USFLTFORCOM, the fleet user (i.e., fleet commander), the TSA, and the TA, by traceable means (e-mail, letter or Navy message) in sufficient time to allow appropriate risk mitigation action (e.g., manpower, equipment, and resources) in the event that a training solution is not adequately funded. If there is legal risk involved, notify the Office of General Counsel.

(39) Review NTSPs as program changes dictate, and, at a minimum, annually determine if updates are required. Report results to the resource sponsor. Minimum required data to be reported is:

(a) Title and number of the NTSP.
(b) Date of completed review.
(c) PM point of contact.
(d) Updated NTSP required/not required.
(e) If required, the FY the NTSP will require an update.

(40) Review NETC human performance readiness review messages and other TA/fleet/resource sponsor feedback for action items associated with the NTSPs, and address those action items during annual reviews and future revisions.

(41) Provide initial operational equipment, alternative media, and technical manuals to the training commands for those items required to train personnel in the operation, maintenance, employment, and support of that equipment.

(42) Participate in training effectiveness evaluations (TEEs) as requested by the resource sponsor.

(43) Develop a training transfer plan documenting the formal security accreditation for courseware, and the transition of all individual and fleet training requirements and resourcing from the resource sponsor(s) and program office(s) to the TSA and TA.

E. When Is Training & Training Support Delivered and Managed in the Life Cycle

The JCIDS process addresses joint training parameters for military (Active, Reserve, and Guard) civilian and contractor support personnel who will operate, maintain, and support the system.

Training programs should employ a cost-effective solution, consisting of a blend of capabilities that use existing training programs and introduces new performance-based training innovations. This may include requirements for school and unit training, as well as new equipment training, or sustainment training. This also may include requirements for instructor and key personnel training and new equipment training teams. Please visit https://dag.dau.mil for current guidance.

Training should be considered early in the capabilities development process beginning with the analyses that supports development of the Initial Capabilities Document and continues with development of the Capability Development Document. It should also be considered in collaboration with each of the other Human Systems Integration (HSI) domains in order to capture the full extent of the human integration issues that need to be accommodated.

The training community must be specific in translating capabilities into system requirements. They must also set training resource constraints. These capabilities and constraints can be facilitated and worked through system integration efforts in several of the other Human Systems Integration domains. Examples include:

- The training community should consider whether the system be designed with a mode of operation that allows operators to train interactively on a continuous basis, even when deployed in remote / austere locations;
- The training community should consider whether the system be capable of exhibiting fault conditions for a specified set of failures to allow rehearsal of repair procedures for isolating faults or require that the system be capable of interconnecting with other (specific) embedded trainers in both static and employed conditions;
- The training community should consider whether embedded training capabilities allow enhancements to live maneuvers such that a realistic spectrum of threats is encountered (e.g., synthetic radar warnings generated during flight);

- The training community should consider whether the integrated training system be fully tested, validated, verified, and ready for training at the training base as criteria for declaring Initial Operational Capability.

From the earliest stages of development and as the system matures, the program manager/PSM shall emphasize training requirements that enhance the user's capabilities, improve readiness, and reduce individual and collective training costs over the life of the system. This may include requirements for expert systems, intelligent tutors, embedded diagnostics, virtual environments, and embedded training capabilities.

Examples of training that enhances user's capabilities follow:

- Interactive electronic technical manuals provide a training forum that can significantly reduce schoolhouse training and may require lower skill levels for maintenance personnel while actually improving their capability to maintain an operational system;
- Requirements for an embedded just-in-time mission rehearsal capability supported by the latest intelligence information and an integrated global training system/network that allows team training and participation in large scale mission rehearsal exercises can be used to improve readiness.

In all cases, the paramount goal of the training/instructional system should be to develop and sustain a ready, well-trained individual/unit, while giving strong consideration to options that can reduce life-cycle costs and provide positive contributions to the joint context of a system, where appropriate.

Training devices consist of the hardware and operating system software designed specifically to facilitate instruction, examples are simulators, Part Task Trainers (PTT), and Mission Task Trainers (MTT), which are built and maintained to the platform/community current configuration and curriculum standard. Training devices and simulators can be complex systems themselves that, in some cases, may qualify for their own set of HSI requirements. For instance, the training community may require the following attributes of a training simulator:

- Accommodate "the central 90 percent of the male and female population on critical body dimensions;"
- Not increase manpower requirements and considerations of reductions in manpower requirements;
- Consider reduced skill sets to maintain because of embedded instrumentation;
- Be High Level Architecture compliant;
- Be Sharable Content Object Reference Model compliant;
- Be Test and Training Enabling Architecture (overview) compliant;
- Use reusable simulation objects.

F. How Training & Training Support Is Developed, Established and Managed

The Product Support Manager should review DAU Life Cycle Logistics Courseware, such as LOG 101, for a basic implementation overview for the area of training and training support.

Training and training support resource requirements are driven by the need to provide:

- Instructor and key personnel training during test and evaluation;
- Initial resident training;
- Continuing training at multiple unit sites;
- Specific deployment and in-theater training.

Training requirements should be based upon the capabilities required by the Warfighter. These capabilities are reflected in the operational, maintenance, and support concepts for weapon system employment and sustainment. Training should be targeted to the level of operator proposed for the system. Similarly, training needs to be synchronized with the appropriate repair level established in the maintenance plan. For example, training the personnel at the unit maintenance level to perform maintenance that will only be conducted at the depot level is an inefficient use of training resources.

Training support requirements should include the needs of joint force and multinational users. Training programs should leverage the commonality of system attributes in the basic training package and then provide targeted training where differences in system variants exist.

During the development of training plans for the operation and support of system and equipment, the following are critical issues to consider:

- Customer concept of training: Different DoD agencies and military organizations with different missions use different training methodologies;

- Multiple courses on the same subject: Most major repairable components will require maintenance to be performed on it at more than one level of maintenance. This ultimately requires different training courses to be developed for each level of maintenance on the same item;

- Realistic training: Training should represent the real world as closely as possible. Use the same technical data and the same support equipment. Training devices should look like and operate like the real item then operators and maintainers will see in the operational environment. The more realistic the training environment, the quicker the maintainer will attain maximum efficiency in job performance;

- Initial and follow-on training sources: Planning must commence early to identify the initial and follow-on sources of training (government or contractor). When the source is the government, it may require the acquisition of training devices and related support resources as well as the construction of training facilities;

- Timing for test and deployment: Most of the training for a system is accomplished just prior to fielding the system. However, a large number of individuals must also be trained to support the system during its initial operational testing;

- Use of technology for training: Consideration should be given to using technology to improve and reinforce the training process. For example, training courses can be delivered on CD-ROM, over the web, or even embedded in the system itself;

- Training for commercial and non-developmental items: If a commercial system is deployed and organic support is anticipated, training sources need to be identified for the operator and maintainer;

- Availability of training devices: The training of government operators and maintainers may necessitate the acquisition of training devices. When procured, it must be done with the same degree of attention to performance and supportability as would be given to the end item of the system it supports. Training devices, too, will require their own logistics support infrastructure.

In the area of training and training support, DoD policy recognizes that expertise does not lie solely within a program office. Therefore, it requires program managers (PMs) and Product Support Managers (PSMs) to work with the training community to develop options for individual, collective, and joint training for operators, maintainers, and support personnel, and where appropriate, base future training decisions on training effectiveness evaluations.

The PM/PSM shall address the major elements of training and place special emphasis on options that enhance user capabilities, maintain skill proficiencies, and reduce individual and collective training costs. The PM/PSM shall develop training system plans to maximize the use of new learning techniques, simulation technology, embedded training and distributed learning, and instrumentation systems that provide “anytime, anyplace” training type demands on the training establishment.

- Training Programs for New Equipment and Displaced Equipment Training

Note: Each Service has its own requirements for the development, integration and fielding of weapon system specific training programs.

- Training Support: Training Products, Resources and Infrastructure

Note: each Service has its own requirements for modeling and simulation, embedded training, and training devices that may be unique to a system. The Product Support Manager should research within its own organization any specific requirements related to the weapon system and any related support equipment being acquired.

Training devices may require specific sustainment functions unique to that training device or training system. PSM’s must evaluate requirements for all training devices to ensure that sustainment considerations are planned and accounted for.

G. Communities of Interest and Practice

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- PM e-Tool Kit Performance Learning Tools found at https://pmtoolkit.dau.mil/
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, ACQuire Search)
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook)
- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02)
- Web enabled new JCIDS Instruction and Guidebook
- Best Practices Clearing House (With addition of Multimedia Assets – video, audio)
- ACQuipedia
- Acquisition Community Connection (CoPs and Special Interest Areas)
- PM Certification Course materials and PM Continuous Learning Modules
- Probability of Program Success (PoPS) Model and Service Implementations
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation)
- DoD IG Audit Guides for Acquisition and Contracting
- Service and Agency PMO support sites
- Contract Management Processes Guide
- Leadership Support Center (Requires ACC log-in)

The Defense Logistics Agency (DLA) provides a website called "Assist Online" which is a search engine for Data Item Deliverables, found at https://assist.daps.dla.mil/online/start/

The Joint Advanced Distributed Learning Co-Laboratory (JADL)'s operates under the direction of the Office of the Secretary of Defense (OSD) to:

- Facilitate integrating and implementing ADL best practices to meet DoD Component training requirements.
- Providing assistance to DoD Component acquisition programs to ensure understanding, benefits, and compliance with the ADL Initiative
- Exploiting proven learning technologies that provide value to DoD readiness
- Focusing DoD ADL outreach efforts by supporting and managing ADL activities
- Interservice/Industry Training, Simulation and Education Conference (I/ITSEC)

H. Lessons Learned / Best Practices

The Defense Acquisition University's Best Practices Clearinghouse. This clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;
- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

The requirements for specific training strategies to be used to meet the Sustainment KPP, such as distance learning should be addressed. DAG, 6.3.3.

When developing the training / instructional system, the program manager should employ transformational training concepts, strategies, and tools such as computer based and interactive courseware, simulators, and embedded training consistent with current organizational strategy, goals and objectives. In addition, the program should address the requirement for a systems training key performance parameter as described in the JCIDS Manual.

Sharable Content Object Reference Model (SCORM) is a collection of standards and specifications for web-based e-learning. It defines communications between client side content and a host system called the run-time environment, which is commonly supported by a learning management system. SCORM is a specification of the Advanced Distributed Learning (ADL) Initiative.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

NAVAIR Software Logistics Primer (For Training Purposes Only), April 2010. This short primer is intended to be a knowledge and awareness builder with emphasis placed on what the logistician needs to [Know], what to [Do], and where to [Go] for more information. This is a living document, which will be improved upon over time as NAVAIR builds its body of knowledge in this critical support area. It includes fundamental principles and references necessary for software acquisition logistics planning and some pointers to sources of information that will enhance the logistician's ability to plan and execute software support.

I. Training Resources

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

J. Key References

- DoDD 5000.01, "The Defense Acquisition System", November 2007
- DoDI 5000.02, "Operation of the Defense Acquisition System", December 2008
- CJCS Instruction 3170.01, "Operation of the Joint Capabilities Integration and Development System"
- Defense Acquisition Guidebook, Chapter 6.3.3 and various sections of Chapter 5, found at https://dag.dau.mil/Pages/Default.aspx
- MIL-HDBK-29612-1A, -2A, -3A, & -4A, "DoD Handbook: Guidance for Acquisition of Training Data Products and Services", Aug 2001, may be used as a guide for Instructional Systems Development/Systems Approach to the training and education process for the development of instructional materials.
- "FY09 Department of Defense Human Systems Integration Management Plan", Version 1.0, found at http://www.acq.osd.mil/se/docs/FY09-DoD-HSI-Management-Plan.pdf
- Strategic Plan for Transforming DoD Training, May 8 2006, Office of the Under Secretary of Defense for Personnel and Readiness, Director, Readiness and Training Policy and Programs
- MIL-PRF-29612, "Performance Specification, Training Data Products"
- DoDI 1322.26, "Development, Management, and Delivery of Distributed Learning"
- DoDI 1322.20, "Development and Management of Interactive Courseware for Military Training," March 14, 1991
- DoDD 1322.18, "Military Training", Jan 2009

U.S. Army

- AR 350-1, "Army Training and Leader Development"
- AR 350-35, "Army Modernization Training"
- AR 350-38, "Training Device Policies and Management"
- AR 350-41, "Army Forces Training"
- AR 350-50, "Combat Training Center Programs"
- AR 351-9, "Inter-service Training"
- DA Pamphlet 350-40, "Army Modernization Training Plans for New and Displaced Equipment" is governed by Army Regulation 350-1, "Army Training and Education". DA Pamphlet 350-40 is designed to provide a guide for personnel who are responsible for developing, maintaining, and providing input to the new equipment training plans (NETPs) and displaced equipment training plans (DETPs). Detailed information is also provided on the Army Modernization Training Automation System (AMTAS) data base which is a centralized system that covers all aspects of training.
- AR 700-127, "Integrated Logistics Support"

- AR 700-142, **"**Logistics Type Classification, Material Release, Fielding, and Transfer"
- "A Guide for Early Embedded Training Decisions," U.S. Army Research Institute for the Behavioral and Social Sciences Research Product 96-06
- TRADOC Regulation 350-70, "Systems Approach to Training Management, Processes, and Products", contains a System Training Plan (STRAP) Format and Content

U.S. Air Force

- Air Force Instruction 36-2251, "Management of Air Force Training Systems", 20 March 2003
- Department of Defense Directive (DoDD) 1430.13, "Training Simulators and Devices"
- Air Force Policy Directive (AFPD) 36-22, "Military Training"
- AFI 36-2201, "Developing, Managing, and Conducting Training"
- Air Force Manual 36-2234, "Instructional System Development"
- Air Force Materiel Command's Acquisition Sustainment (AS) Tool Kit, "AS Kneepad Checklist", Task 2.50.4

U.S. Navy

- Department of the Navy, OPNAVINST 1500.76B, "Naval Training Systems Requirements, Acquisition, and Management"
- OPNAVINST 5310.23, "Navy Personnel Human Systems Integration (NAVPRINT)", 10 Nov 2009
- OPNAVINST 3500.34F, "Personnel Qualification Standards (PQS) Program"
- NAVMC OIR 3500.14, "Aviation Training and Readiness Program Manual"
- SECNAVINST 5400.15C, "Department Of The Navy (DON) Research and Development, Acquisition, Associated Life-Cycle Management, and Logistics Responsibilities and Accountability", 13 Sep 2007
- DoD Instruction 1322.20, "Development and Management of Interactive Courseware (ICW) for Military Training", Nov 16 1994
- DoD Instruction 1322.26, "Development, Management, and Delivery of Distributed Learning", 16 Jun 06
- NAVMC OIR 3710.6, "Marine Corps Aviation Training System (ATS)", 11 Jun 2008
- NAVAIR Standard Work Package 6753-001, "Navy Training System Plan (NTSP) Process Management", 17 Oct 2008

10.0 Manpower & Personnel
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10.0.2 Description
Product Support Manager Activities
Manpower and Personnel in the Life Cycle
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10.0.Manpower & Personnel

10.0.1. Objective

Identify, plan, resource and acquire personnel, civilian and military, with the grades and skills required: a) to operate equipment, to complete the missions, to effectively fight or support the fight, to win our nation's wars; b) to effectively support the Soldier, and to ensure the best capability is available for the Warfighter when needed.

10.0.2. Description

Involves the identification and acquisition of personnel (military and civilian) with the skills and grades required to operate, maintain, and support systems over their lifetime. Early identification is essential. If the needed manpower is an additive requirement to existing manpower levels of an organization, a formalized process of identification and justification must be made to higher authority.

The terms "Manpower" and "Personnel" are not interchangeable terms.

"Manpower" represents the number of personnel or positions required to perform a specific task. This task can be as simple as performing a routine administrative function, or as complex as operating a large repair depot. Manpower analysts determine the number of people required, authorized, and available to operate, maintain, support, and provide training for the system. Manpower requirements are based on the range of operations during peacetime, low intensity conflict, and wartime. Requirements should consider continuous, sustained operations and required surge capability.

"Personnel", on the other hand, indicates those human aptitudes (i.e., cognitive, physical, and sensory capabilities), knowledge, skills, abilities, and experience levels that are needed to properly perform job tasks. Personnel factors are used to develop the military occupational

specialties (or equivalent DoD Component personnel system classifications) and civilian job series of system operators, maintainers, trainers, and support personnel. Personnel officials contribute to the Defense acquisition process by ensuring that the program manager pursues engineering designs that minimize personnel requirements, and keep the human aptitudes necessary for operation and maintenance of the equipment at levels consistent with what will be available in the user population at the time the system is fielded. More information is found at the Defense Acquisition University's community of practice website found at https://acc.dau.mil/CommunityBrowser.aspx?id=141979.

Product Support Manager Activities

10.1 Manpower

The Undersecretary of Defense for Personnel and Readiness is the proponent for all manpower and personnel planning. Each Service has established mandatory policy and instructions for manpower and personnel management within its programs and scope of authority.

Per DoDD 1100.4, "Guidance for Manpower Management", found at http://www.dtic.mil/whs/directives/corres/pdf/110004p.pdf, manpower management shall be flexible, adaptive to program changes, and responsive to crisis situations and new management strategies. New policy, including fiscal policy, shall be evaluated before implementing to decide its effect on manpower and personnel performance. Existing policies, procedures, and structures shall be periodically evaluated to ensure efficient and effective use of manpower resources.

Long-range strategies and workforce forecasts shall be developed to implement major changes to policy, doctrine, materiel, force structure, and training, while maintaining ready forces and assuring the greatest possible productivity and effectiveness.

Manpower requirements are driven by workload and shall be established at the minimum levels necessary to accomplish mission and performance objectives. Manpower is a resource. Changes in manpower shall be preceded by changes to the programs, missions, and functions that require manpower resources.

Mobilization and crisis planning shall give priority to optimizing the use of all types of wartime manpower: military, civilians, and contractors. Activities not essential to a national emergency or military contingency shall be deferred or curtailed to allow reallocation of the personnel to higher priority tasks. During a conflict, military personnel shall be assigned only to those tasks that directly contribute to the military effort, except positions that require military incumbency for reasons of law or esprit de corps; when alternate manpower is not available; or, when military-unique knowledge and skills are required for successful performance of the duties.

The Heads of the DoD Components shall designate an individual(s) with full authority for manpower management. PM/PSM's should identify their respective Component authority for manpower planning and change management.

10.1.1 Requirements and Planning

DoD Components shall, as part of their Manpower Management program, develop a strategic manpower planning process for responding to fundamental changes to the Department's strategic objectives; roles and missions; force structure; and management and Warfighting strategies. A key objective of strategic manpower planning shall be to develop a workforce that can be reconfigured quickly to respond to changing threats and contingency plans; adjust to new mobilization plans; and evolve to support new Warfighting capabilities, business practices, and organizations. The Product Support Manager will provide inputs with supporting analysis as required by the DoD oversight component office for manpower wartime estimates of activities within the scope of Life Cycle Product Support.

10.1.1.1 Manpower Estimate Report (MER)

For major defense acquisition programs, manpower estimates are required by:

- 10 U.S.C. 2434, which directs the Secretary of Defense to consider an estimate of the personnel required to operate, maintain, support, and provide system-related training in advance of approval of the development, or production and deployment; and

- DoD Instruction 5000.02, Enclosure 4, Table 2-1, which directs development of a manpower estimate at Milestones B, C, and full-rate production.

Manpower estimates serve as the authoritative source for out-year projections of active-duty and reserve end-strength, civilian full-time equivalents, and contractor support work-years. As such, references to manpower in other program documentation should be consistent with the manpower estimate once it is finalized. In particular, the manpower estimates should be consistent with the manpower levels assumed in the final Affordability Assessment and the Cost Analysis Requirements Description (CARD).

The Manpower Estimate Report (MER) must be used in manpower planning to identify the manpower requirements necessary to field a new system. These manpower requirements include those associated with operating and maintaining the system, at sea, ashore or in the air. The definition of these manpower planning requirements must be analytically rigorous and consider the full range of manpower support options, in a total force context (active, reserve, government civilian, and contractor support). Once all manpower requirements are identified, and documented, they are submitted in the Manpower Estimate Report (MER) for review and approval by respective Services Office of Personnel, Joint and DoD staff. Among other necessary manpower planning information, the MER must describe manpower requirements to support the operating, maintenance and logistics concepts and provide manpower offsets, identifying from where the manpower is coming.

The exact content of the manpower estimate is tailored to fit the particular program under review. A sample format for the manpower estimate is displayed in the Table below. In addition, the estimate should identify if there are any resource shortfalls (i.e., discrepancies between manpower requirements and authorizations) in any fiscal year addressed by the estimate. Where appropriate, the manpower estimate should compare manpower levels for the new system with those required for similar legacy systems, if any. The manpower estimate also should include a narrative that describes the scope of each functional area (operations,

maintenance, support, and training), and the methods, factors, and assumptions used to estimate the manpower for each functional area.

Sample Manpower Estimate Format
MANPOWER ESTIMATE
(Program Title)
SERVICE

	FYxx[2]	FYxx+1	FYxx+2	FYxx+3	FYxx+4	...[3]
OPERATE:[4] Military Officers Enlisted Civilian Contractor Sub-Total						
MAINTAIN:[4] Military Officers Enlisted Civilian						
Contractor Sub-Total						
SUPPORT:[4] Military Officers Enlisted Civilian Contractor Sub-Total						
TRAIN:[4] Military Officers Enlisted Civilian Contractor Sub-Total						
TOTAL						

[1]Provide separate estimates for Active and Reserve Components for each Service.
[2]Report manpower by fiscal year (FY) starting with initial fielding and continuing through retirement and disposal of the system (to include environmental clean-up).
[3]Until fielding is completed.
[4]Provide estimates for manpower requirements and authorizations. Provide deltas between requirements and authorizations for each fiscal year.

Table 10.4.1.T1. Manpower Estimate Report Template

The MER assists Services' and contractor organizations in the development and use of manpower and personnel planning. The first section of the report covers the scope of the Qualitative and Quantitative Personnel Requirements Information (QQPRI) and the relationship of the requirements to system development. The second section describes the general constraints within which the QQPRI information is developed; examples of these constraints include technical weapon system parameters and Services' policies for personnel, training and manning. The third section of the QQPRI report covers task analyses, estimation of performance time, establishing manpower positions and determining the relationship of the positions to existing occupational specialties.

10.1.1.2 Table of Organization and Equipment (TOE)

Once weapon systems are fielded, the manpower and personnel staffing level requirements are captured in those documents that authorize unit personnel, equipment, and supplies for military forces. Examples include Tables of Organization and Equipment (TOE), Modified Tables of Organization and Equipment (MTOE), and Tables of Distribution and Allowances (TDA).

A TOE lists all the personnel slots, skills required, and Class VII equipment that the Department of the Army has authorized a specific type of unit. TOEs normally are published at the battalion or separate company level and are models. Since different commands within the military forces have different needs based on regional threats or environmental considerations, TOEs are modified to become MTOEs. For instance, a light infantry battalion in Alaska and one in Hawaii will be based on the same TOE. However, the actual MTOEs that each has will be different. The battalion located in Alaska will be authorized more cold weather gear, for example, or more maintainers due to the higher levels of maintenance required.

Tables of distribution and allowance contain the same type of information as MTOEs except TDAs provide personnel and equipment authorizations for units generally considered non-deployable. These units normally are associated with organizations that support fixed facilities like installations or hospitals.

10.1.2 Military Personnel Management

Both at the DoD and at each of the Component levels have organizations responsible for military personnel management.

The mission of the Air Force's Manpower Agency is to provide Air Force leaders at all levels tools to identify essential manpower required for the effective and efficient accomplishment of the Air Force mission. AFMA's capabilities include the following: determining manpower requirements, developing manpower programming/resourcing factors, directing Air Force performance management programs, executing the competitive sourcing program and conducting special studies.

The mission of the Army G-1 is to develop, manage and execute all manpower and personnel plans, programs and policies — across all Army Components — for the entire Army team. Our vision for the human resource enterprise is a team of HR professionals dedicated to supporting and empowering Soldiers, Civilians, Families and Veterans worldwide in an era of persistent conflict. We will recruit, retain and sustain a high quality volunteer force through innovative and

effective enterprise solutions. We will ensure HR readiness of the Total Army across the full spectrum of operations. Website is found at http://www.armyg1.army.mil/default.asp.

The mission of the Navy Personnel Command, or "BUPERS" organization serves to provide administrative leadership, policy planning, and general oversight of the Command. Website is found at http://www.public.navy.mil/BUPERS-NPC/Pages/default.aspx.

The Marine Corps Manpower & Reserve Affairs office assists the Commandant by planning, directing, coordinating, and supervising both active and reserve forces. Website is found at https://www.manpower.usmc.mil/portal/page/portal/M_RA_HOME.

10.1.3 Government Civilian Workforce Management

The Defense Acquisition University maintains a "Welcome to the Defense Acquisition Workforce Career Management Home Page" found at http://www.dau.mil/workforce/default.aspx.

The Defense Logistics Agency's Human Resources website is found at http://www.hr.dla.mil/.

10.1.4 Contractor Management

DoD Instruction 1100.22, Apr 12 2010, "Policy and Procedures for Determining Workforce Mix", specifies the appropriate mix of military and DoD civilian manpower and private sector support. This DoDI implements policy established in DoD Directive 1100.4 and provides manpower mix criteria and guidance for risk assessments to be used to identify and justify activities that are inherently governmental (IG); commercial (exempt from private sector performance); and commercial (subject to private sector performance).

It is DoD policy that the workforce of the Department of Defense shall be established to successfully execute Defense missions at a low to moderate level of risk. Accordingly, risk mitigation shall take precedence over cost savings when necessary to maintain appropriate control of Government operations and missions. The Defense workforce shall have sufficient flexibility to reconstitute or expand the capabilities of the Military Services on short notice to meet a resurgent or increased threat to U.S. National security.

The peacetime workforce shall be structured with sufficient manpower to satisfy projected mobilization and crisis demands that cannot be met in sufficient time by mobilizing, hiring, recruiting, or reassigning DoD personnel or contracting for additional support.

Manpower shall be designated as civilian except when one or more of the following conditions apply:
(1) Military-unique knowledge and skills are required for performance of the duties;
(2) Military incumbency is required by law, Executive order, treaty, or international agreement;
(3) Military performance is required for command and control, risk mitigation, or esprit de corps;
(4) Military manpower is needed to provide for overseas and sea-to-shore rotation, career development, or wartime assignments;
(5) Unusual working conditions or costs are not conducive to civilian employment.

10.2 Personnel

10.2.1 Aptitudes

Personnel capabilities are normally reflected as knowledge, skills, abilities (KSAs), and other characteristics. The availability of personnel and their KSAs should be identified early in the acquisition process. The DoD Components have a limited inventory of personnel available, each with a finite set of cognitive and psychomotor abilities. This could affect specific system thresholds.

10.2.2 User Population Description

DoD Instruction 5000.02 requires the program manager to work with the personnel community to define the performance characteristics of the user population, or "target audience," early in the acquisition process. The program manager should work with the personnel community to establish a Target Audience Description (TAD) that identifies the cognitive, physical, and sensory abilities-i.e., capabilities and limitations, of the operators, maintainers, and support personnel expected to be in place at the time the system is fielded. When establishing the TAD, Human Systems Integration (HSI) practitioners should verify whether there are any recruitment or retention trends that could significantly alter the characteristics of the user population over the life of the system. Additionally, HSI analysts should consult with the personnel community and verify whether there are new personnel policies that could significantly alter the scope of the user population (e.g., policy changes governing women in combat significantly changed the anthropometric requirements for occupational specialties).

Per DoD Instruction 5000.02, to the extent possible--systems shall not be designed to require cognitive, physical, or sensory skills beyond those found in the specified user population. During functional analysis and allocation, tasks should be allocated to the human component consistent with the human attributes (i.e., capabilities and limitations) of the user population to ensure compatibility, interoperability, and integration of all functional and physical interfaces.

Personnel requirements should be established consistent with the knowledge, skills, and abilities (KSAs) of the user population expected to be in place at the time the system is fielded and over the life of the program. Personnel requirements are usually stated as a percentage of the population. For example, the Capability Development Document might require "physically accommodating the central 90% of the target audience." Setting specific, quantifiable, personnel requirements in the Capability Development Document assists establishment of test criterion in the Test and Evaluation Master Plan.

10.2.3 Career Fields

Career fields are managed by DoD Services, each using their respective organizational structure and nomenclature using some type of character code (either numbers or alpha-numeric) to designate each type of job.

For the U.S. Army, a United States military occupation code, or a Military Occupational Specialty code (MOS), is a nine character code is used to identify a specific job. The U.S. Marine Corps separates positions into "occupational fields" in which no distinction is made between officers and enlisted Marines. The fields are numbered from 01 to 99 and include

general categories (Infantry, Logistics, Public Affairs, Ordnance, etc.) that specific jobs fall under. In the U.S. Air Force, a system of Air Force Specialty Codes (AFSC) is used. In the United States Navy, a system of naval ratings and designators is used along with a Navy Enlisted Classification (NEC) system.

PSMs should become knowledgeable of both the operational and support job category assignments for their respective programs. In some cases, a job specialty for a weapon system may not yet exist when fielding a new technology as seen during the past 10 years with electronic warfare, unmanned systems or robotics. In this situation, PSMs may be required to provide input into the development or updating of position codes and descriptions.

10.2.4 Assignment

Each of the DoD Components provides policy and guidance for manning. For example, the Army's recent active component manning guidance for FY 2011 can be found at http://www.armyg1.army.mil/docs/mp/HQDA%20FY11%20Manning%20Guidance%2017%20Dec%2010.pdf. PSMs should check with their respective DoD Component for specific guidance.

Manpower and Personnel in the Life Cycle

A. Purpose

The terms "Manpower" and "Personnel" are not interchangeable terms.

"Manpower" represents the number of personnel or positions required to perform a specific task. This task can be as simple as performing a routine administrative function, or as complex as operating a large repair depot. Manpower analysts determine the number of people required, authorized, and available to operate, maintain, support, and provide training for the system. Manpower requirements are based on the range of operations during peacetime, low intensity conflict, and wartime. Requirements should consider continuous, sustained operations and required surge capability.

"Personnel", on the other hand, indicates those human aptitudes (i.e., cognitive, physical, and sensory capabilities), knowledge, skills, abilities, and experience levels that are needed to properly perform job tasks. Personnel factors are used to develop the military occupational specialties (or equivalent DoD Component personnel system classifications) and civilian job series of system operators, maintainers, trainers, and support personnel. Personnel officials contribute to the Defense acquisition process by ensuring that the program manager pursues engineering designs that minimize personnel requirements, and keep the human aptitudes necessary for operation and maintenance of the equipment at levels consistent with what will be available in the user population at the time the system is fielded.

Manpower & Personnel is one of the twelve Integrated Product Support Elements. The activities occurring within the scope of this area should be integrated with other product support element areas in keeping with KPP and KSA optimization goals and constraints.

a. Why Manpower & Personnel is Important

For major defense acquisition programs, manpower estimates are required by

- 10 U.S.C. 2434, which directs the Secretary of Defense to consider an estimate of the personnel required to operate, maintain, support, and provide system-related training in advance of approval of the development, or production and deployment; and

- DoD Instruction 5000.02, Enclosure 4, Table 2-1, which directs development of a manpower estimate at Milestones B, C, and full-rate production.

Manpower estimates serve as the authoritative source for out-year projections of active-duty and reserve end-strength, civilian full-time equivalents, and contractor support work-years. As such, references to manpower in other program documentation should be consistent with the manpower estimate once it is finalized. In particular, the manpower estimates should be consistent with the manpower levels assumed in the final Affordability Assessment and the Cost Analysis Requirements Description (CARD).

b. Major Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Manpower & Personnel IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, included in the left column a listing of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	Manpower and Personnel Major Activities
User Need / Technology Opportunities & Resources	The PM /PSM must be able to understand and forecast manpower and personnel requirements to actual product support sustainment activities and outcomes. The Product

	Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Individual system and platform personnel requirements should be developed in close collaboration with related systems throughout the Department and in various phases of the acquisition process to identify commonalities, merge requirements, and avoid duplication. The program manager should consider the cumulative effects of system-of-systems, family-of-systems, and related systems integration in the development of personnel requirements Key Products: • Requirements • Metrics • Manpower and Personnel Strategy
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. The AoA requires, at minimum, full consideration of possible trade-offs among cost, schedule, and performance objectives for each alternative considered. Trade-off studies to validate and forecast manpower and personnel product support sustainment outcomes as a result of design of the system and its intended sustainment footprint encompassing all twelve product support elements. To ensure manpower and personnel considerations have the greatest impact on system design, they must be integrated into the system acquisition process as early as possible. Manpower and personnel analyses accomplished early in the program are especially valuable in identifying potential error- or problem-prone design features. The program manager should also address actions to combine, modify, or establish new military occupational specialties or additional skill indicators, or issues relating to hard-to-fill occupations if they impact the program manager's ability to execute the program. Inputs to Milestone review documents include impacts of manpower and personnel on initial sustainment cost estimates, the initial Life Cycle Sustainment Plan (LCSP) and related sustainment metrics. Risks to achieving the necessary manpower and personnel structure for the time frame of the program by IOC should be identified and a mitigation strategy

	outlined. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of Milestone Decision Review required documents. Key Products: • Manpower Estimate Report • Life Cycle Sustainment Plan • Inputs to Systems Engineering Plan
Technology Development	The Product Support Manager is required to provide information on many other acquisition documents as listed below under deliverables and the DAU site, https://dag.dau.mil/Pages/Default.aspx. Early analysis should assess the preliminary manpower and personnel requirements and constraints in both quantity and skill levels and the use of contractor support. The program manager should determine if the new system contains any aptitude-sensitive critical tasks. If so, the program manager should determine if it is likely that personnel in the target audience can perform the critical tasks of the job. The program manager should consider personnel factors such as availability, recruitment, skill identifiers, promotion, and assignment. The program manager should consider the impact on recruiting, retention, promotions, and career progression when establishing program costs, and should assess these factors during trade-off analyses. Key Products: • Updates to Life Cycle Sustainment Plan • Inputs to Systems Engineering Plan • Inputs to Analysis of Alternatives
Engineering & Manufacturing Development	Manpower and personnel requirements designed earlier in the acquisition process should be validated and those that were not defined are assessed for impact. Any final manpower and personnel related engineering changes as a result of design interface analysis must be implemented no later than this phase to achieve maximum benefit. The PM shall work with the manpower community to determine the most efficient and cost effective mix of DoD manpower and contract support (DoD Instruction 5000.02, Enclosure 8, paragraph 2.d.).

	Significant changes may be required to the product support package to achieve the manpower and personnel objective sustainment metrics including major support provider changes. As the program matures, the LCSP is updated to reflect increasing levels of detail. Manpower and personnel are both domains of the Human Systems Integration initiatives in the systems engineering plan which optimize total system performance and minimize total ownership cost. Consistent with DoD Instruction 5000.02, Enclosure 8, the program manager should summarize major personnel initiatives that are necessary to achieve readiness or rotation objectives or to reduce manpower or training costs, when developing the acquisition strategy. The acquisition strategy and Life-Cycle Sustainment Plan should address modifications to the knowledge, skills, and abilities of military occupational specialties for system operators, maintainers, or support personnel if the modifications have cost or schedule issues that could adversely impact program execution. The program manager should use a truly representative sample of the target population during Test and Evaluation (T&E) to get an accurate measure of system performance. A representative sample during T&E will help identify aptitude constraints that affect system use. Key Products: • Updates to the Life Cycle Sustainment Plan • Updates to the Manpower Estimate Report • Inputs to the Systems Engineering Plan for Manpower and Personnel • Inputs to cost estimates related to manpower and personnel
Production & Deployment	Manpower and personnel activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, taking part in planning activities that may be on-going already for product improvement, and developing long term plans for manpower and personnel improvements for both the system and its support infrastructure as part of the LCSP. Fielding occurs during this phase and proof of early planning

	is now being validated as the system deploys to the operational site. Key Products: • Personnel Qualification System • Updated Manpower Estimate Report • Updates to cost estimates related to manpower and personnel
Operations & Support	The Product Support Manager's responsibility is to continue reviewing manpower and personnel strategies, plans and costs as they impact system operations and support. The PSM looks for opportunities to improve design, training, tools, and other IPS Element factors of both the system itself and the support infrastructure relative to manpower and personnel characteristics to optimize KPPs and KSAs. Key Products: • Deployment of manpower for operations and support execution • Updates to Manpower Estimates and strategies to support new or changing requirements • Updates to life cycle cost estimates

Table 10.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DIDs related to Manpower and Personnel are typically for either international / foreign activities or for specific clothing or equipment usage, i.e., identification badges.

C. OSD Proponency, Policy, Regulations and U.S. Statutes

Note: please see the References at the end of this section for a more complete list of relevant materials.

The Undersecretary of Defense for Personnel and Readiness is the proponent for all manpower and personnel planning.

Each Service has established mandatory policy and instructions for manpower and personnel management within its programs and scope of authority. Manpower estimates are approved by the DoD Component manpower authority (for the military departments, normally the Assistant Secretary for Manpower and Reserve Affairs).

Per DoD Instruction 5000.02, to the extent possible-systems shall not be designed to require cognitive, physical, or sensory skills beyond those found in the specified user population. During functional analysis and allocation, tasks should be allocated to the human component consistent with the human attributes (i.e., capabilities and limitations) of the user population to ensure compatibility, interoperability, and integration of all functional and physical interfaces.

DoD policy states that manpower requirements shall be established at the minimum levels necessary to accomplish mission and performance objectives. DoD system designers automate, eliminate, consolidate, or simplify functions that drive labor-intensive tasks associated with system operations and support. For example, system components that require frequent maintenance actions should not be located in areas that require significant expenditure of effort (labor hours) just to get to it. Rather, these components should be located near access panels to facilitate rapid removal and replacement.

Determining Workforce Mix. DoD Instruction 1100.22, Apr 12 2010, "Policy and Procedures for Determining Workforce Mix", specifies the appropriate mix of military and DoD civilian manpower and private sector support. This DoDI implements policy established in DoD Directive 1100.4 and provides manpower mix criteria and guidance for risk assessments to be used to identify and justify activities that are inherently governmental (IG); commercial (exempt from private sector performance); and commercial (subject to private sector performance).

It is DoD policy that the workforce of the Department of Defense shall be established to successfully execute Defense missions at a low to moderate level of risk. Accordingly, risk mitigation shall take precedence over cost savings when necessary to maintain appropriate control of Government operations and missions. The Defense workforce shall have sufficient flexibility to reconstitute or expand the capabilities of the Military Services on short notice to meet a resurgent or increased threat to U.S. National security.

The peacetime workforce shall be structured with sufficient manpower to satisfy projected mobilization and crisis demands that cannot be met in sufficient time by mobilizing, hiring, recruiting, or reassigning DoD personnel or contracting for additional support.

Manpower shall be designated as civilian except when one or more of the following conditions apply:
(1) Military-unique knowledge and skills are required for performance of the duties.
(2) Military incumbency is required by law, Executive order, treaty, or international agreement.
(3) Military performance is required for command and control, risk mitigation, or esprit de corps.
(4) Military manpower is needed to provide for overseas and sea-to-shore rotation, career development, or wartime assignments.
(5) Unusual working conditions or costs are not conducive to civilian employment.

D. Who Develops, Delivers and Manages Manpower & Personnel

Organizational responsibilities in preparing the manpower estimate vary by DoD Component. Normally, the manpower estimate is prepared by an analytic organization in the DoD Component manpower community, in consultation with the program manager. The manpower estimates are approved by the DoD Component manpower authority (for the military departments, normally the Assistant Secretary for Manpower and Reserve Affairs).

E. When Is Manpower & Personnel Delivered and Managed in the Life Cycle

For Acquisition Category ID programs, a preliminary manpower estimate should be made available at least six months in advance of the Defense Acquisition Board (DAB) milestone review, and should be reflected in the draft CARD due at that time, in order to support the development of cost estimates and affordability assessments.

The final manpower estimate should be fully staffed and submitted to the Under Secretary of Defense for Personnel and Readiness (USD(P&R)) in sufficient time to support the Overarching Integrated Product Team (OIPT) review in preparation of the DAB meeting. Normally this would be four weeks prior to the OIPT review meeting. The USD(P&R) staff will review the final manpower estimate and provide comments to the OIPT.

DoD Instruction 5000.02 requires the program manager to work with the personnel community to define the performance characteristics of the user population, or "target audience," early in the acquisition process. The program manager works with the personnel community to establish a Target Audience Description (TAD) that identifies the cognitive, physical, and sensory abilities- i.e., capabilities and limitations, of the operators, maintainers, and support personnel expected to be in place at the time the system is fielded. When establishing the TAD, Human Systems Integration (HSI) practitioners verify whether there are any recruitment or retention trends that could significantly alter the characteristics of the user population over the life of the system. Additionally, HSI analysts consult with the personnel community and verify whether there are new personnel policies that could significantly alter the scope of the user population (e.g., policy changes governing women in combat significantly changed the anthropometric requirements for occupational specialties).

F. How Manpower & Personnel Is Developed, Established and Managed

Manpower planning addresses the job tasks, operation and maintenance rates, associated workload, and operational conditions (e.g., risk of hostile fire) that ultimately drive the number (“spaces”) and mix of personnel (“faces”) required to operate, maintain, support, and provide training for the system. As a starting point, planners use the results of the job task analyses conducted during the functional analysis and allocation process.

Manpower analysts also consider factors such as fatigue, cognitive, physical, and sensory overload; and environmental conditions such as extreme heat or cold and reduced visibility. Additionally, trade-offs such as personnel capabilities, training and human factors, must be considered.

Once weapon systems are fielded, the manpower and personnel staffing level requirements are captured in those documents that authorize unit personnel, equipment, and supplies for military forces. Examples include Tables of Organization and Equipment (TOE), Modified Tables of Organization and Equipment (MTOE), and Tables of Distribution and Allowances (TDA).

A TOE lists all the personnel slots, skills required, and Class VII equipment that the Department of the Army has authorized a specific type of unit. TOEs normally are published at the battalion or separate company level and are models. Since different commands within the military forces have different needs based on regional threats or environmental considerations, TOEs are modified to become MTOEs. For instance, a light infantry battalion in Alaska and one in Hawaii will be based on the same TOE. However, the actual MTOEs that each has will be different. The battalion located in Alaska will be authorized more cold weather gear, for example, or more maintainers due to the higher levels of maintenance required.

Tables of distribution and allowance contain the same type of information as MTOEs except TDAs provide personnel and equipment authorizations for units generally considered non-deployable. These units normally are associated with organizations that support fixed facilities like installations or hospitals.

Materials developers, working with guidance from their respective Services' Headquarters, are responsible for estimating and planning both manpower and personnel requirements for the life cycle of the program. Each of the Services develops the information necessary for the Qualitative and Quantitative Personnel Requirements Information (QQPRI) report.

Personnel requirements are established consistent with the knowledge, skills, and abilities (KSAs) of the user population expected to be in place at the time the system is fielded and over the life of the program. Personnel requirements are usually stated as a percentage of the population. For example, the Capability Development Document might require "physically accommodating the central 90% of the target audience." Setting specific, quantifiable, personnel requirements in the Capability Development Document assists establishment of test criterion in the Test and Evaluation Master Plan.

The program manager/PSM uses the target audience description (TAD) as a baseline for personnel requirements assessment. The TAD includes information such as inventory; force structure; standards of grade authorizations; personnel classification (e.g., Military Occupational Code / Navy Enlisted Classification) description; biographical information; anthropometric data; physical qualifications; aptitude descriptions as measured by the Armed Services Vocational Aptitude Battery (ASVAB)); task performance information; skill grade authorization; Military Physical Profile Serial System (PULHES); security clearance; and reading grade level.

The program manager assesses and compares the cognitive and physical demands of the projected system against the projected personnel supply. The program manager also determines the physical limitations of the target audience (e.g., color vision, acuity, and hearing). The program manager identifies any shortfalls highlighted by these studies.

The program manager determines if the new system contains any aptitude-sensitive critical tasks. If so, the program manager determines if it is likely that personnel in the target audience can perform the critical tasks of the job.

The program manager must consider personnel factors such as availability, recruitment, skill identifiers, promotion, and assignment. The program manager must consider the impact on recruiting, retention, promotions, and career progression when establishing program costs, and should assess these factors during trade-off analyses.

The program manager needs to use a truly representative sample of the target population during Test and Evaluation (T&E) to get an accurate measure of system performance. A representative sample during T&E will help identify aptitude constraints that affect system use. Individual system and platform personnel requirements should be developed in close collaboration with related systems throughout the Department and in various phases of the acquisition process to identify commonalities, merge requirements, and avoid duplication. The program manager must consider the cumulative effects of system-of-systems, family-of-systems, and related systems integration in the development of personnel requirements.

Consistent with DoD Instruction 5000.02, Enclosure 8, the program manager summarizes major personnel initiatives that are necessary to achieve readiness or rotation objectives or to reduce manpower or training costs, when developing the acquisition strategy. The acquisition strategy and Life-Cycle Sustainment Plan address modifications to the knowledge, skills, and abilities of military occupational specialties for system operators, maintainers, or support personnel if the modifications have cost or schedule issues that could adversely impact program execution. The program manager must also address actions to combine, modify, or establish new military occupational specialties or additional skill indicators, or issues relating to hard-to-fill occupations if they impact the program manager's ability to execute the program.

Personnel refers to the number of people who are authorized and on hand possessing a certain knowledge, skill, ability, and level of experience. The particular cognitive (thinking, reasoning and ability to apply knowledge) and physical requirements of the weapon system must be compared to those in this “labor pool”. Any critical skill requirement has to be measured against the current and projected availability of people possessing those skills. Additionally, security clearance requirements need to be considered and documented when necessary.

Personnel needs drive requirements that must be identified to external agencies for assessment and action. Whether it is for a military or civilian requirement, the agencies responsible for

recruiting, retention, promotions, and assignments are responsible for performing those functions to meet the needs of the system. All of these agencies are outside the control of the program manager (PM) but may contact the PM for coordination purposes.

As with all other product support requirements, operator, maintainer, and support personnel needs are largely a result of system design decisions. For example, the M9 pistol has a relatively simple design – grip assembly, slide assembly, bolt, and magazine. Users perform routine maintenance functions (disassembly, cleaning, and reassembly). Basic use and maintenance instruction takes less than an hour. Because of its simple design, the M9 does not require any significant consideration from a personnel perspective.

Personnel planning performance measures generally focus on two areas: the number of personnel and the percentage of qualified personnel. Common Manpower & Personnel metrics include: unit size, skill level limits, and ratio of on-hand vs. Required personnel.

When reviewing support activities, the program manager works with manpower and functional representatives to identify process improvements, design options, or other initiatives to reduce manpower requirements, improve the efficiency or effectiveness of support services, or enhance the cross-functional integration of support activities.

The product support strategy should document the approach used to provide for the most efficient and cost-effective mix of manpower and contract support and identify any cost, schedule, or performance issues, uncompleted studies that could impact the program manager's ability to execute the program.

G. Communities of Practice and Interest

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- PM e-Tool Kit Performance Learning Tools found at https://pmtoolkit.dau.mil/
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, ACQuire Search)
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook)
- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02)
- Web enabled new JCIDS Instruction and Guidebook
- Best Practices Clearing House (With addition of Multimedia Assets – video, audio)
- ACQuipedia
- Acquisition Community Connection (CoPs and Special Interest Areas)
- PM Certification Course materials and PM Continuous Learning Modules
- Probability of Program Success (PoPS) Model and Service Implementations
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation)
- DoD IG Audit Guides for Acquisition and Contracting

- Service and Agency PMO support sites
- Contract Management Processes Guide
- Leadership Support Center (Requires ACC log-in)

The Defense Logistics Agency (DLA) provides a website called "Assist Online" which is a search engine for Data Item Deliverables, found at https://assist.daps.dla.mil/online/start/

H. Lessons Learned / Best Practices

*The Defense Acquisition University's Best Practices Clearinghouse. T*his clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;
- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

I. Training Resources

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

The following are a few of the courses which address Manpower & Personnel:

- LOG 101 Acquisition Logistics Fundamentals
- LOG 350 Enterprise Life Cycle Logistics Management
- CLE 062 Human Systems Integration

The DAU Community of Practice web site directly links to a number of Manpower & Personnel references, including the Defense Acquisition Guidebook, for additional information and sources. It is located at https://acc.dau.mil/CommunityBrowser.aspx?id=314779.

J. Key References

For major defense acquisition programs, manpower estimates are required by

- 10 U.S.C. 2434, which directs the Secretary of Defense to consider an estimate of the personnel required to operate, maintain, support, and provide system-related training in advance of approval of the development, or production and deployment; and
- DoD Instruction 5000.02, Enclosure 4, Table 2-1, which directs development of a manpower estimate at Milestones B, C, and full-rate production. Note, Table 2-1 is found in Appendix x of this Handbook.

Additional DoD References

- DoD Human Capital Strategy Handbook
- MIL-HDBK-502, DoD Handbook on Acquisition Logistics, 4.3.2 pg. 4-16
- Defense Acquisition University Acquisition Logistics Guide (1997), 7-4
- Title 10 U.S.C. 2434, Operational Manpower Requirements
- DoD Directive 5000.01, sections E1.1.4 and E1.1.29
- DoD Instruction 5000.02, *Operation of the Defense Acquisition System*, Enclosure 4, Table 2-1
- Defense Acquisition Guidebook, found at https://dag.dau.mil/Pages/Default.aspx
- DoD Instruction 1100.22, Apr 12 2010, "Policy and Procedures for Determining Workforce Mix"

U.S. Air Force

The Air Force Manpower Agency provides Air Force leaders at all levels the tools to identify essential manpower required for the effective and efficient accomplishment of the Air Force mission as follows:

- Develops manpower standards and conducts management advisory studies to document the manpower requirements needed to support the Air Force mission;
- Develops manpower resource factors consistent with budget exercises and develops quarterly, biennial and long-range manpower requirements factors;
- Collects and analyzes Headquarters Air Force data for continuous assessment of mission performance;
- Implements the Air Force-wide commercial services management, or CSM, program to improve operation of commercial functions using a variety of management tools;

- Conducts headquarters-directed special studies that provide Air Force leaders objective information and analysis to make timely, effective manpower requirements and resource decisions.

Air Force Instruction 38-201, "Determining Manpower Requirements", has mandatory compliance. This instruction implements AFPD 38-2, Manpower. It prescribes guidance for determining manpower requirements, allocating military grades, managing rated officer positions, documenting contract manpower equivalents, managing civilian positions, and establishing statutory tour requirements. A glossary of references and supporting information is at Attachment 1 of this regulation.

See also:

- Air Force Pamphlet, AFPAMPHLET 63-128, Guide to Acquisition and Sustainment Life Cycle Management, 3.12/pg. 47
- Air Force Materiel Command's Acquisition Sustainment (AS) Tool Kit, AS KNEEPAD Checklist Appendix A pg. 98-97

U.S. Army

- AR 71-32, *Force Development and Documentation—Consolidated Policies*, provides policies for the development and documentation of Army organizational requirements through the Basic of Issue Plans (BOIP)/QQPRI, TOE systems, and the supporting Manpower Requirements Criteria (MARC) and equipment usage programs. Manpower Requirements Criteria (MARC) are Department of the Army-approved standards to determine mission-essential wartime position requirements for combat support (CS) and combat service support (CSS) functions in TOEs. MarC are derived from detailed studies performed for the various CS and CSS functions. By using the Web-based Total Army Authorization Document System software at https://webtaads.belvoir.army.mil/usafmsa/, DoD logisticians can review the MTOEs for most, if not all, units within the Army.
- See also AR 700-127, Integrated Logistics Support, Table 3-1 pg. 15

U.S. Navy

- Manpower is programmed on the basis of the manpower requirements resulting from the policies and procedures of the Navy manpower system. The Navy Manpower Requirements Program encompasses three subsystems whose purpose is to determine and document quantitative and qualitative manpower requirements for the Navy. These subsystems include the Ship Manpower Document (SMD) Program; the Squadron Manpower Document (SQMD) Program; and the shore requirements, standards, and manpower planning system (SHORSTAMPS).

- Authorization documents set forth minimum manning requirements for ships, air squadrons, and shore stations. The CNO determines these requirements from the Navy's Required Operational Capabilities (ROC) and Projected Operational Environment (POE). The Navy uses three authorization documents: Ship Manpower Document (SMD), Squadron Manpower Document (SQMD), and Shore Manpower Document (SHMD). They display in detail the manpower requirements and the rational for determination of the requirements.

- Manpower as shown in the manpower documents is termed "organizational manning" and serves as the basis for manpower authorization. Manpower estimates serve as the authoritative source for out-year projections of active-duty and reserve end-strength, civilian full-time equivalents, and contractor support work-years. As such, references to manpower in other program documentation must be consistent with the manpower estimate once it is finalized. In particular, the manpower estimates must be consistent with the manpower levels assumed in the final Affordability Assessment and the Cost Analysis Requirements Description (CARD).

11.0 Facilities & Infrastructure
11.0.1 Objective
11.0.2 Description
Product Support Manager Activities
Facilities and Infrastructure in the Life Cycle
A. Purpose
B. Data Item Description (DID) Deliverables
C. OSD Proponency, Policy, Regulations and Statutes
D. Who Develops, Delivers and Manages It
E. When Is It Delivered and Managed in the Life Cycle
F. How It Is Developed, Established and Managed
G. Communities of Interest and Practice
H. Lessons Learned / Best Practices
I. Training Resources
J. Key References

11.0. Facilities & Infrastructure

11.0.1. Objective

Identify, plan, resource, and acquire facilities to enable training, maintenance and storage to maximize effectiveness of system operation and the logistic support system at the lowest TOC. Identify and prepare plans for the acquisition of facilities to enable responsive support for the Warfighter.

11.0.2. Description

Consists of the permanent and semi-permanent real property assets required to support a system, including studies to define types of facilities or facility improvements, location, space needs, environmental and security requirements, and equipment. It includes facilities for training, equipment storage, maintenance, supply storage, ammunition storage, and so forth.

Product Support Manager Activities

11.1 Types of Facilities

The DoD has a Real Property Classification System (RPCS) that is a hierarchical system of real property types and functions that serves as the framework for identifying, categorizing and analyzing the department's inventory of land and facilities around the world. This system is comprised of a 5 tier structure represented by numerical codes. Each Component has established its own set of codes to represent each type of facility in its inventory. The DoD has also established a higher-level facility classification that groups facilities and similar functions and units of measure from each Military Department into common facility analysis categories. More information can be found at http://www.acq.osd.mil/ie/fim/programanalysis_budget/tool_metrics/RPCS/rpcs.shtml.

Facility unit costs include installed (built-in) building equipment and furnishings normally funded with MILCON funds. The UFC 3-701-09 15 September 2009 breaks out facility types for acquisition and sustainment management into the following categories:

- Satellite Communications Center
- Aircraft Operation Building
- Airfield Fire and Rescue Station
- Operations Buildings
- Applied Instruction Buildings
- Hangars
- Shops
- Storage Facilities
- DoD Medical Facilities
- Administrative Facilities
- Barracks, Dormitories
- Unaccompanied Officers Quarters
- Dining Facility
- Fire Station, Community
- Chapel Center
- Commissary
- Family Support
- Family Housing
- Physical Fitness Training Center
- Main Exchange
- Service Clubs
- Libraries
- Recreation Centers
- Bowling Centers
- Dependent Schools
- Temporary Lodging Facilities

11.1.1 Fixed Facilities

Fixed facilities, also called permanent facilities, are buildings and facilities designed and constructed to serve a life expectancy of more than 25 years.

11.1.2 Semi-permanent or Temporary

Current DoD and Service policy is to keep re-locatable or temporary facilities to an absolute minimum; as short-term as possible; and only in use until the permanent facility is built or the mission no longer requires their use.

11.1.3 Major Ranges and Test Facility Base (MRTFB)

MRTFB is the designated core set of DoD Test and Evaluation (T&E) infrastructure and associated workforce that must be preserved as a national asset to provide T&E capabilities to support the DoD acquisition system. DoDD 3200.11, December 27, 2007, “Major Range and Test Facility Base (MRTFB)”.

As a national asset, the MRTFB shall be sized, operated, and maintained to provide T&E information to DoD Component T&E users in support of the DoD Research, Development, Test and Evaluation and acquisition process set out in DoD Directive 5000.1 (Reference (g)).

- The MRTFB shall provide a broad base of T&E capabilities sufficient to support the full spectrum of DoD T&E requirements, but shall not be unnecessarily duplicated;
- The MRTFB shall be managed and operated under uniform guidelines across the DoD Components;
- The MRTFB shall be financed through a combination of appropriated (institutional) funds and user charges in accordance with DoD 7000.14-R (Reference (h));
- The MRTFB may be used by other DoD users (including DoD training users), and by users outside the Department such as U.S. Government Agencies, State and local governments, allied foreign governments, and commercial entities;
- Use of the MRTFB by non-DoD users shall not increase the institutional costs to the Department of Defense to operate the MRTFB;
- Scheduling of the MRTFB shall be based upon a priority system that gives equitable consideration to all DoD Components and accommodates DoD acquisition program priorities;
- When a test requires the support of more than one MRTFB activity, a lead activity will serve as the principal point of contact with the user for planning, execution, and reimbursements, and will coordinate with other activities to obtain total support for the test.

11.1.4 Mobile or Expeditionary Facilities

Expeditionary Force is a generic name sometimes applied to a military force dispatched to fight in a foreign country. Expeditionary support facilities may be designated for logistics, medical, forensics or other purposes. Expeditionary forces and their support organization may be joint or under the control of a single Service. Increasingly, government civilian (http://www.cpms.osd.mil/expeditionary/cew-list.aspx?jCat=cocom) or contractors are used to support expeditionary activities.

For example, a report by the U.S. Army War College discussed global logistical challenges during Operation Desert Storm/Shield and Operation Iraqi Freedom which highlight the volatile, uncertain, complex, and ambiguous threats the United States, its allies, and coalition partners will face in the 21st century. Today, U.S. Military forward presence relies heavily on foreign access, infrastructure, and host nation support to generate large stockpiles of supplies to sustain joint force operations. To mitigate the fore mentioned logistical risks, i.e., foreign access, infrastructure, and host nation support, and to further enhance joint force interoperability, the U.S. Secretary of Defense has directed that Department of Defense spending be aimed at making the best use of resources through the development of joint systems and capabilities. http://www.strategicstudiesinstitute.army.mil/pdffiles/ksil364.pdf

11.1.5 Government vs. Contractor Ownership & Operation

11.1.5.1 Government Owned – Government Operated (GOGO)

The term GOGO refers to a manufacturing plant that is both owned and operated by the government. Note that per 10 USC 2464, the DoD shall maintain a core logistics capability that

is Government-owned and Government-operated (including Government personnel and Government-owned and Government operated equipment and facilities).

11.1.5.2 Government Owned – Contractor Operated (GOCO)

The term GOCO refers to a manufacturing plant that is owned by the government and operated by a contractual civilian organization.

11.1.5.3 Contractor Owned – Government Operated (COGO)

A manufacturing facility owned and operated by a private contractor performing a service, under contract, for the government.

11.1.5.4 Contractor Owned – Contractor Operated (COCO)

The term GOGO refers to a manufacturing plant that is both owned and operated by the government.

11.2 Infrastructure

11.2.1 Utilities

The OSD Installations and Environment Facilities Investment and Management Directorate lists on its website initiatives to improve facilities management. One initiative covers utilities and is titled "Utilities Privatization". The objective of this initiative is to privatize utility services for military installations worldwide. This program is in accordance with Department of Defense Reform Initiative Directive #49 – Privatizing Utility Systems. The project will identify utility systems that would be more economically advantageous to the government if they were privately owned and servicing the Military Services.
http://www.acq.osd.mil/ie/fim/programanalysis_budget/studies.shtml#Utilities.

Additionally, each DoD Service is required to manage the infrastructure of facilities under its control. For the U.S. Navy, http://www.cnic.navy.mil/CNIC_HQ_Site/WhatWeDo/BaseSupport/FacilitySystemInvestment/FacilitiesSupportServicesBranch/index.htm, the Facility Support Services Branch consists of the following:

- FACILITY SERVICES (FX). Janitorial, pest control, refuse collection, recycling, grounds maintenance, street sweeping, snow removal;
- FACILITY MANAGEMENT (FP). Management and Administration, Installation Plans and Engineering, Collateral Equipment, Real Estate;
- TR BASE SUPPORT, VEHCILES & EQUIPMENT (BSV&E). Management and administration, railroads, cranes, Vehicles, GSE/MHE, construction equipment;
- UTILITIES (UT). Utilities commodities: electricity, steam, potable water, salt water, compressed air, natural gas, coal, heating oil, wastewater, solid waste disposal;
- ENERGY & UTILITIES. Utilities privatization, policy input, energy conservation, use and rates monitoring.

Planning, Programming, Budget and Execution

The Energy & Utilities sub branch assembles and participates in Integrated Process Teams, developing action plans through metrics and matrices such as Service Level Descriptors,

Required Operational Capabilities, and Capability levels, to determine funding requirements for energy and utilities. Energy & Utilities uses data from the Capability Based Budget, Utilities Requirements Model, Program Objectives Memorandums, Utilities Pricing Data, Program Budget Information System and historical databases to provide input and analysis of Regional utilities data.

Policy

The Energy & Utilities sub branch works with other Department of Defense (DoD) and Navy Facilities Offices affecting overall DOD policy. An example is the need for effective and efficient metering of Navy installations, which impacts how billing data is collected and energy resources are managed across the Navy Regions. References: Energy Policy Act of 1992 and Executive Order 13123.

Utilities Privatization

The Energy & Utilities sub branch efforts towards utilities privatization consist of the following:

- SECNAV Utilities Privatization Program - Review and approve funding. Coordinate supporting documentation. Participate in joint service working groups to develop Navy policies regarding utilities privatization;
- Energy Conservation and Awareness - Promulgate guidance and share technical knowledge and lessons learned within Navy Regions. Participate in the Energy Special Projects Team Meetings and DoN Shore Energy Policy Board;
- DoN Shore Energy Business Plan - Our long-term strategy for success. The three Focus areas are: Management, Innovation, and Execution;
- Alternatively Financed Energy Projects - Review projects for their suitability;
- Mobile Utilities Support Equipment- Energy & Utilities provides approvals of utilities equipment for deployment to Navy Installations to support the Warfighter.

PSM's should check with their respective Components for specific policy and guidance.

11.2.2 Heating, Ventilation and Air Conditioning (HVAC)

Demand for HVAC equipment and services is driven by the needs of the individual installations. HVAC services are required to install, maintain and service new and existing HVAC equipment. Currently, installations vary in terms of the amount of preventive maintenance conducted based on budget and priorities. For HVAC equipment, new purchases are driven by failure of old equipment, major building renovations, and new construction (purchase of equipment for most new construction is outside of the project scope, but maintenance of the resulting equipment is in scope). Currently, the DoD does not have an enterprise-wide agreement for purchasing new HVAC equipment. Because HVAC equipment purchases are project-driven and often awarded to different contractors over time, there is a diverse mix of provider equipment throughout the Services as well as within individual installations.

11.2.3 Facility Components and Special Equipment

Facility components and special equipment requirements are determined by the needs of the individual facility. Examples of special equipment include medical equipment, environmental regulation for dust-free laboratories or manufacturing areas, hardware restoration equipment such as paint booths or metal shops, information technology infrastructure, usage of hazardous

materials such as in battery manufacturing, high voltage requirements, security requirements such as soundproofing, high security monitoring systems, etc.

11.3 Facilities and Infrastructure Life Cycle Management

11.3.1 Facilities and Infrastructure Planning and Inventory

To forecast funding requirements for sustainment, the DoD has developed the Facilities Sustainment Model (FSM). FSM uses standard benchmarks drawn from the private and public sectors for sustainment costs by facility type and has been used to develop the Service budgets since fiscal year 2002 and for several Defense Agencies beginning in fiscal year 2004.

A key component of the DoD facility program, the Military Construction appropriation, is a significant contributor to the Department's comprehensive approach to asset management practices. Military Construction funds enable the Department to transform in response to Warfighter requirements, to enhance mission readiness, and to take care of its people. This is done, in part, by restoring and modernizing enduring facilities, acquiring new facilities where needed, and eliminating those that are excess or obsolete.

In accordance with Section 2721 of title 10 United States Code, "Real Property Records", the Military Departments and Washington Headquarters Service, the Washington area leasing field activity, maintain an accurate and complete real property inventory for all unclassified real property assets (land and facilities) in which they have real property interest. DoD currently has five independent reporting systems that feed the Office of the Secretary of Defense (OSD) Facilities Assessment Database. The Department recognized the limitations in these independent reporting systems and has developed a business enterprise architecture that will better support our Warfighter by making the data more accurate and readily available to all potential users.

The DoD, as of September 30, 2005, owns 479,648 facilities (buildings, structures and utilities), leases 10,839 facilities, and manages another 80,732. The facilities DoD manages include assets we are given rights to use but do not actually own or lease such as NATO facilities or state-owned facilities or facilities provided by other Federal agencies.

The Department provides specific instructions as to what, how and when real property inventory data is reported as directed by Section 2721 of title 10 United States Code, "Real Property Records". All assets that DoD holds interest (and there are nine different categories of interest) are reported annually to OSD. At this time, each Military Department maintains its own native database, which maintains an extensive amount of common information on each facility as well as any Service specific additions. A specific portion of this data is passed to OSD annually and serves as the basis for the Facilities Assessments Database, which is used by the Department on all matters relating to the existing real property inventory. Current business transformation efforts are significantly improving the existing inventory process through efforts to standardize data collection and capture within the Department.

Each of the DoD Components also has organizations dedicated to facilities. For example, the Naval Facilities Engineering Command, https://portal.navfac.navy.mil/portal/page/portal/navfac/, (NAVFAC) is the Systems Command

that delivers and maintains quality, sustainable facilities, acquires and manages capabilities for the Navy's expeditionary combat forces, provides contingency engineering response, and enables energy security and environmental stewardship.

11.3.2 Facilities and Infrastructure Acquisition

11.3.2.1 Acquisition Methods

Although there are other types of acquisition, UFC 1-300-08 16 April 2009 Change 2, August 2011, establishes the process required for documenting the following four methods of acquisition:

• **Acquisition by construction** - transfer and acceptance of accountability of a newly constructed real property asset from a construction agent to the receiving Service; also provides for the relief of the construction in progress (CIP) account;
• **Capital improvement to existing facilities** - transfer and acceptance of accountability for an improvement to a real property asset from a construction agent to the receiving Service; also provides for the relief of the CIP account;
• **Transfer between Services** - transfer and acceptance of real property asset accountability between the Military Services or Washington Headquarters Services (WHS);
• **Inventory adjustment** (also known as "found on site") - provides initial documentation for an undocumented real property asset found on site until sufficient documentation is located.

This UFC provides for consistent guidance throughout DoD and provides a consolidated reference that:
• Identifies the use of a draft, interim and final version of the DD Form 1354, Transfer and Acceptance of DoD Real Property;
• Describes how the DD Form 1354 is used as part of a real property business process;
• Defines the roles and responsibilities in the DD Form 1354 process; and
• Introduces the Real Property Unique Identifier (RPUID) to the DD Form 1354, consistent with Office of the Secretary of Defense (OSD) guidance, to enable improved accountability by allowing all financial transactions and physical changes to real property to be tracked at the asset level.

DoD published processes, business rules, and data standards for real property accountability in the Real Property Inventory Requirements (RPIR) document, January 2005. The RPIR was developed by representatives of the Military Departments, Defense Agencies, and was facilitated by the Office of the Secretary of Defense. The RPIR document fully describes the RPUID and its uses. RPUIDs are assigned by the Real Property Unique Identifier Registry (RPUIR), which interfaces with the authoritative source system for each Service's real property inventory. These organizations also developed the Real Property Acceptance Requirements (RPAR) document, August 2006, which clarifies the role of the RPUID in the process. All of these requirements have been integrated into DoD's Business Enterprise Architecture (BEA), the blueprint for DoD's business transformation.

11.3.2.2 Leasing

Per the DoD Financial Management Regulation 7000.14-R, Volume 12, Chapter 14, **r**eal property, and improvements thereon, under the control of a DoD Component (other than

property at a military installation designated for closure or realignment) that are determined by the cognizant Secretary of a Military Department, or Director of a Defense Agency (hereafter referred to collectively as "Heads of the DoD Components") to be excess to the needs of that activity shall be made available for transfer without reimbursement to other DoD Components.

If the property is not transferred, the DoD Component concerned shall request the Administrator of the General Services Administration (GSA) to transfer or dispose of such property in accordance with applicable laws. Proceeds generated from real property transactions or the leasing out of DoD assets under the provisions of Public Law 101-510, Sections 2805 or 2806 shall be deposited into a special fund Treasury receipt account. Funds deposited into the special fund receipt account will be distributed to the DoD Components by the Under Secretary of Defense (Comptroller) consistent with applicable appropriation acts. Under 10 U.S.C. §2401, DoD may not lease a vessel or aircraft for a period of more than five years unless it is specifically authorized by law to make such a lease. Other laws and regulations relating to DoD leases of equipment include 41 U.S.C. §11, Appendix B of Office of Management and Budget (OMB) Circular A-11, OMB Circular A-94, and the Budget Enforcement Act of 1990, which is Title XIII of Omnibus Budget Reconciliation Act of 1990 (H.R. 5835/P.L. 101-508 of November 5, 1990).1 Another legal provision — 10 U.S.C. §7309 — states that no vessel to be constructed for any of the armed forces may be constructed in a foreign shipyard.

7230.08 January 2, 2009, "Leases and Demonstrations of DoD Equipment" updates policy and responsibilities for:
(1) The leasing of DoD equipment to defense contractors and industrial associations for sales demonstrations to foreign governments in or outside the United States;
(2) The demonstration of DoD equipment to foreign governments in or outside the United States;
(3) The leasing of DoD equipment to defense contractors and industrial associations for display or demonstration at international trade shows or trade exhibitions;
(4) Direct DoD participation at international trade shows or trade exhibitions.

11.3.2.3 Design

UFC 1-300-08, 16 April 2009 Change 2, August 2011, contains specific instructions for the facilities design process.

There is a Whole Building Design Guide web site at http://dod.wbdg.org/. The Department of Defense (DoD) and the military services have initiated a program to unify all technical criteria and standards pertaining to planning, design, construction, and operation and maintenance of real property facilities. The objective of the Unified Facilities Criteria (UFC) program is to streamline the military criteria system by eliminating duplication of information, increasing reliance on private-sector standards, and creating a more efficient criteria development and publishing process. Both technical publications and guide specifications are part of the UFC program. Previously, each service had its own publishing system resulting in criteria being disseminated in different formats. UFC documents have a uniform format and are identified by a number such as UFC 1-300-1.

11.3.2.4 Construction

Acquisition through construction results in a new real property asset. UFC 1-300-08, 16 April 2009 Change 2, August 2011, contains specific instructions for the facilities construction process.

All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the more stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

11.3.3 Site Activation

Each Service has its tailored approach to site activation based upon specific mission requirements. Site Activation encompasses all of the product support elements and impacts that must be derived by the logistician when building the product support plan and is a critical component of the DoD Component's equivalent of the Material Fielding Plan.

11.3.3.1 Site Activation Task Force (SATAF)

A SATAF consists of multifunctional working groups that identify the necessary actions needed to execute the approved program. Depending on the type of action, one or more SATAFs may be required. The first normally occurs about 12 months prior to the actual start of the conversion, or as soon as possible after appropriate documentation (i.e., programmatic, BRAC, TFI, etc.) is completed and funds are available. The SATAF is a dynamic process in which the SATAF team and the field unit work together to identify timelines, shortfalls, actions, and fixes to ensure timely completion of mission changes. This process is to help bridge the funding gap between implementation and the unit reaching an Initial Operational Capability (IOC). The conversion process may consist of several actions. Normal conversion actions will last 1-3 years.

11.3.3.2 Site Readiness Review

A site readiness review is a risk assessment tool for site activation preparation. Checklists are typically constructed to meet program requirements.

11.3.4 Operations

11.3.4.1 Real Property Management

It is DoD policy that real property be acquired that will satisfy the requirement economically with as little impact as possible on the civilian economy. Property should be acquired from the private sector only when there is no government-owned land available that will meet the requirement. In addition, property cannot be acquired because it is considered a "good buy" or because it would be a good investment for taxpayers. There must be a current, anticipated requirement to use the property that is to be acquired for an identified military mission.

10 U.S.C. 2682 requires that real property used by a Defense Agency be under the jurisdiction of a military department. Ownership of real estate interest belongs to the United States of America, whereas the military department is entrusted with the *jurisdiction* or *control* of the real property.

11.3.4.2 Facilities Performance

The facilities and infrastructure performance curve under full sustainment typically is displayed as an average for an inventory of facilities and infrastructure, which presents a smooth performance degradation line over time (refer to the example shown in Figure 11.8.4.F2.).

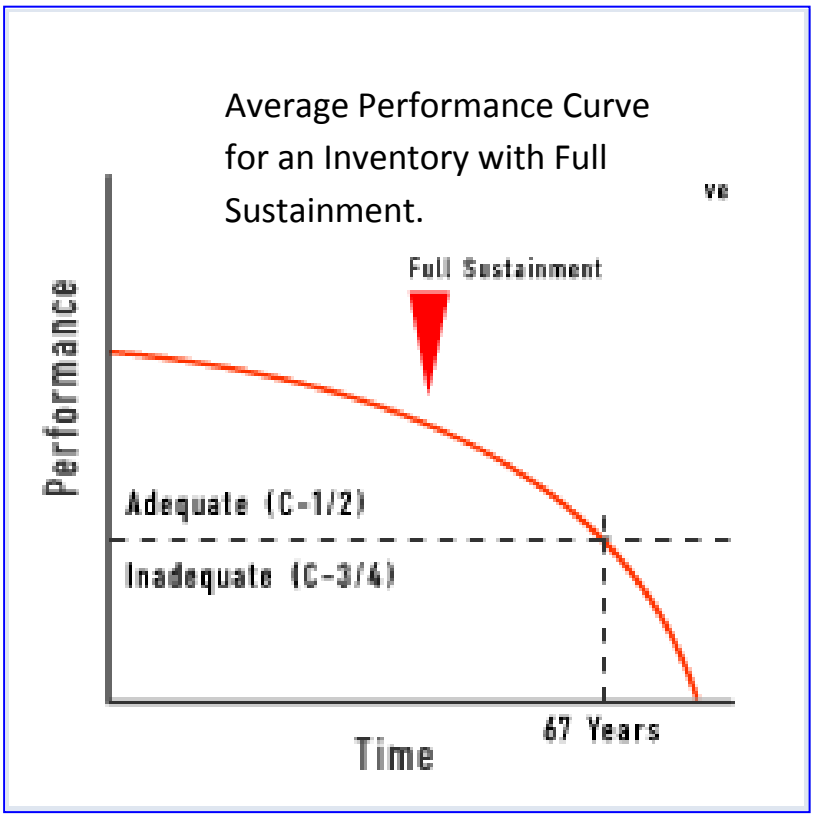


Figure 11.8.4.F2. Facilities Performance Curve

A well-sustained facility and infrastructure inventory gradually declines in performance—due primarily to aging of materials and obsolescence—and at some point (estimated to be 67 years in the case of DoD's inventory) becomes inadequate. It is important to note that the estimated 67-year average service life of DoD facilities and infrastructure will decline if investments fall below the levels required to achieve full sustainment.

11.3.4.3 Facilities Accreditation

Facilities require accreditation when used for purposes requiring specific environmental, handling, safety, occupational hazards, medical, or designated scientific purposes. PSMs should check with their local facilities / installation offices for accreditation requirements.

DoD Environmental Laboratory Accreditation Program. On December 24, 2008, the Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health) issued a memorandum establishing the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP). Effective October 1, 2009, laboratories who are seeking to

perform testing in support of the DoD environmental restoration (i.e. Cleanup) programs and who do not hold an unexpired DoD Component (Army, Navy, or Air Force) approval need to be accredited in accordance with DoD ELAP. Laboratories that have DoD Component approvals in place prior to this date will be subject to DoD ELAP requirements when those approvals expire or when additions or modifications to their scope of approval are required.

11.3.4.4 Physical Security

Per the Joint Air Force – Army – Navy Manual for Physical Security Standards for Special Access Program Facilities (JAFAN 6/9), physical security standards are established governing the construction and protection of facilities for storing, processing, and discussion of Special Access Program (SAP) information which requires extraordinary security safeguards. SAPF design must balance threats and vulnerabilities against appropriate security measures in order to reach an acceptable level of risk. Each security concept or plan must be submitted to the program security officer for approval. For the purposes of this Manual, the PSO is defined as the accreditation authority for the compartmented facility. Protection against surreptitious entry, regardless of SAPF location, is always required. Security measures must be taken to deter technical surveillance of activities taking place within the SAPF. TEMPEST security measures must be considered if electronic processing of SAP information is involved. TEMPEST is an unclassified short name referring to investigations and studies of compromising electronic emanations. The link is found at http://www.modulargenius.com/UserFiles/JAFAN.pdf.

11.3.4.5 Occupational Safety and Health (OSHA)

Occupational Safety and Health Administration (OSHA) is the administrative body created by the Occupational Safety and Health Act of 1970. Its charge is to:

- Encourage employers and employees to reduce workplace hazards and to implement new or improve existing safety and health programs;
- Provide for research in occupational safety and health to develop innovative ways of dealing with occupational safety and health problems;
- Establish separate but dependent responsibilities and rights for employers and employees for the achievement of better safety and health conditions;
- Maintain a reporting and record keeping system to monitor job-related injuries and illnesses;
- Establish training programs to increase the number and competence of occupational safety and health personnel;
- Develop mandatory job safety and health standards and enforce them effectively;
- Provide for the development, analysis, evaluation, and approval of occupational safety and health programs at the state level for those states that want to establish their own state programs.

OSHA's standards now fill several volumes in the Code of Federal Regulations under Title 29 (Labor). They form the base for OSHA's safety inspections and for citations to employers for violations. To establish a violation, OSHA must show the following:

- A hazard exists;
- The employer has actual knowledge of the hazard or it is recognized as a hazard in the employer's industry;
- The hazard is likely to cause death or serious physical harm;

- It was foreseeable;
- Workers are exposed to it;
- Corrective measures that employer should have taken to prevent the hazard can be specified.

11.3.4.6 Environmental and Hazardous (EPA)

The vision of the DoD Facilities Energy Directorate, at http://www.acq.osd.mil/ie/energy/index.shtml, is to employ cost-effective energy management technologies and techniques to assure long-term facility energy supply, enabling uninterrupted support to its worldwide forces and advancing national energy independence efforts. To realize this vision, the DoD will:

- Reduce energy consumption and spending through energy demand management and energy efficient investment;
- Promote energy innovation by working with industry, academia, and government organizations to increase on-base energy generation;
- Assure continuous power to key assets during crisis situations through community partnerships and local utility providers;
- Train service members to use emerging energy technologies and techniques, providing incentives for best practices and accountability through objective metrics.

Improved energy management will enhance energy security, reduce emissions, and produce taxpayer savings.

Environmental considerations start when the specific facilities need is first identified.

The DoD's environmental strategy is to sustain and enhance mission readiness and protect the health of military members, civilians, the public, and the environment through effective and efficient environmental management.

The Environmental support of facilities consists of:

- Planning to analyze the environmental and economic issues to create and operate facilities and infrastructure that can be sustained over time;
- Compliance so operations meet federal, state, local and host nation environmental requirements;
- Pollution prevention reducing or eliminating the creation of pollutants;
- Conservation: We must protect and enhance cultural resources, and the natural habitats and life sustaining quality of the land and waterways under our protection;
- Restoration: We must repair the damage caused by past substance releases and waste disposal practices.

The following environmental requirements must be met before the disposition of property is executed:

- Appropriate NEPA documentation should be completed. Determine if the action qualifies as a Categorical Exclusion. If it doesn't, an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) must be prepared. Most major disposal actions will require an EIS;
- De-militarization of the property;
- Asbestos must be identified and/or friable asbestos must be removed;
- If lead-based paint was used for residential structures, it must be identified and the appropriate Housing and Urban Development (HUD) forms must be completed;
- A responsible person must certify that the property does or does not contain Polychlorinated Biphenyl (PCB) transformers or other equipment regulated by the Environmental Protection Agency under 40 CFR Part 761;
- A historic, archaeological and cultural resources survey should be conducted;
- The Comprehensive Environmental Response, Compensation and Liability Act requires the federal holding agency to include a statement indicating whether or not any hazardous substance activity took place on the property during the time the property was owned by the United States (as defined by regulations issued by the Environmental Protection Agency under 40 CFR part 373);
- Based on the Finding of Suitability to Transfer (FOST) and Environmental Baseline Survey (EBS), the property will be environmentally ready to convey after the culmination of other environmental steps;
- If a conveyance of land without environmental remediation is required, a Finding of Suitability for Early Transfer must be completed;
- If the disposition of land includes natural resources, consultation with regulatory agencies is required;
- Land Use Controls (LUCS) must be disclosed before disposal.

11.3.4.7 Community Impacts

DoDD 5410.12, July 5, 2006, “Economic Adjustment Assistance to Defense-Impacted Communities”, establish policies and guidance, assigns organizational responsibilities, and guides the administration of an Economic Adjustment Program to minimize economic impacts on communities resulting from changes in Defense programs, such as base closures, realignments, consolidations, transfer of functions, and/or reduction in force.
http://www.dtic.mil/whs/directives/corres/pdf/541012p.pdf

11.3.5 Sustainment

Per the OSD Facilities and Installations site, facilities sustainment provides resources for maintenance and repair activities necessary to keep a typical inventory of facilities in good working order over a 50-year service life.
http://www.acq.osd.mil/ie/fim/sustainment/sustainment.shtml

Sustainment includes regularly scheduled adjustments and inspections, preventive maintenance tasks, and emergency response and service calls for minor repairs. It also includes major repairs or replacement of facility components (usually accomplished by contract) that are expected to occur periodically throughout the facility life cycle. This work includes regular roof

replacement, refinishing wall surfaces, repairing and replacing electrical, heating, and cooling systems, replacing tile and carpets, and similar type of work. It does not include repairing or replacing non-attached equipment or furniture, or building components that typically last more than 50 years (such as foundations and structural members).

Sustainment does not include restoration, modernization, environmental compliance, specialized historical preservation or costs related to acts of God, which are funded elsewhere. Other tasks associated with facilities operations (such as custodial services, grass cutting, landscaping, waste disposal, and the provision of central utilities) are also not included.

11.3.5.1 Maintenance

The DoD uses the term "facilities sustainment model", or FSM, to describe the annual maintenance and scheduled repairs for the inventory. Using FSM, the department can compute the annual sustainment requirements for 100% of the department's facilities and infrastructure inventory, using standard benchmarks.

Under the Facilities Sustainment Model, the amount of money that the services need to sustain their facilities and infrastructure is equal to the sum of all of their facilities and infrastructure multiplied by the appropriate Unit Cost Factor and the appropriate Area Cost Factor, and an inflation factor.

All work classified as sustainment is funded using the Facilities Sustainment model. All other work (e.g., environmental compliance, activities to bring facilities and infrastructure up to current mission requirements, etc.) requires separate funding and justification.

The basic calculations are Sustainment = (RPI Asset Quantity x unit costs1) +…where unit cost is DoD sustainment cost factors (commercial benchmarks, Means, VDOT, Whitestone, etc) and the location and inflation adjustments, RPI is Real Property and Installation, and FAC is the Facilities Assessment Category. RPI Asset Quantity – taken from OSD's Facilities Assessment Database (FAD), which is comprised on the Military Department's RPI as of 30 September each year. The commercial benchmarks are based on standard commercial criterion (unit costs) and are unique to individual facility types. The benchmarks were first published in the DoD Facilities Cost Factors Handbook, Version 2.0 (April 2000), and are updated annually. For further information, visit http://www.acq.osd.mil/ie/fim/Sustainment/Sustainment/Sustainment.shtml.

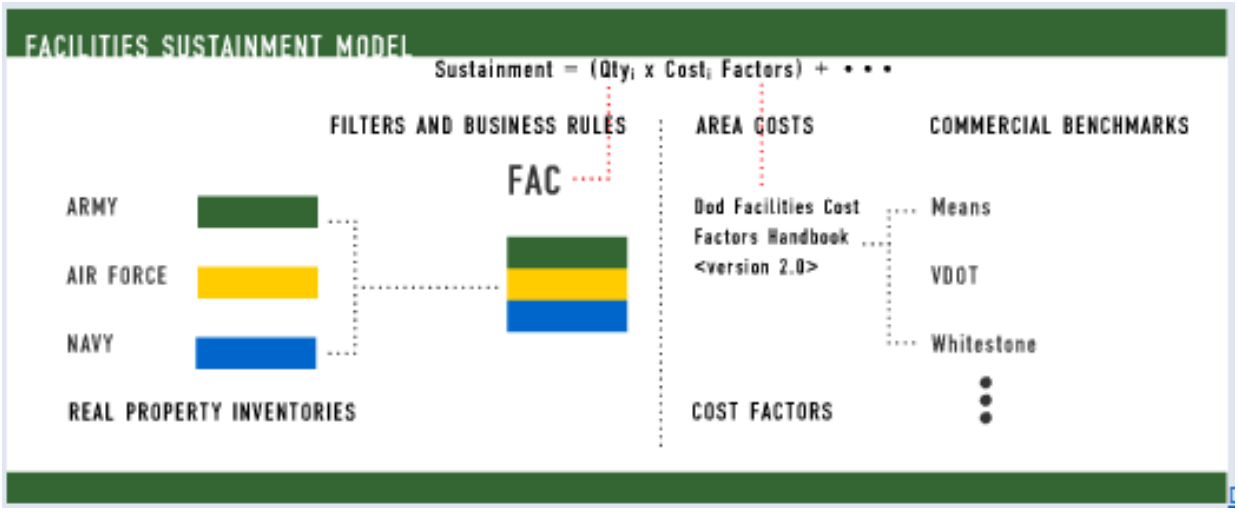


Figure 11.8.4.1. F1. Facilities Sustainment Model Graphical Depiction

11.3.5.2 Renovate

Facilities Sustainment, Restoration, and Modernization, or SRM, is the methodology in the DoD replacing the previous Real Property Maintenance (RPM) methodology for asset management and resource allocation. SRM is the result of the DoD improving its methods for computing "deferred maintenance" for facilities and infrastructure and assessing the effects of such deferrals in response to the Chief Financial Officers Act and the need for better management information.

SRM theories are based on the general assumption that facility and infrastructure performance degrades as facilities age. The rate of decay depends, in part, on the level of sustainment provided. Other contributors include the materials used in a facility's construction, weather, and creeping obsolescence caused by changes in standards and missions.

With full sustainment (defined as the completion of all activities required to keep a specific facility and infrastructure in top operating condition), facilities and infrastructure achieve their full potential and deliver acceptable performance over their expected service lives. Thus, SRM theories assume that full sustainment, although not always fully budgeted, is the most cost-effective approach to managing facilities and infrastructure because it gains the most performance over the longest time for the least investment.

11.3.5.3 Recapitalization.

Even with full sustainment, facilities and infrastructure eventually either physically wear out or become obsolete. An obsolete facility and infrastructure is one that is irrelevant to present mission requirements, regardless of its condition. According to the SRM construct, once facilities reach the end of their expected service lives, they must be recapitalized (i.e., they must be replaced or extensively renovated or modernized) if they are to continue providing adequate performance.

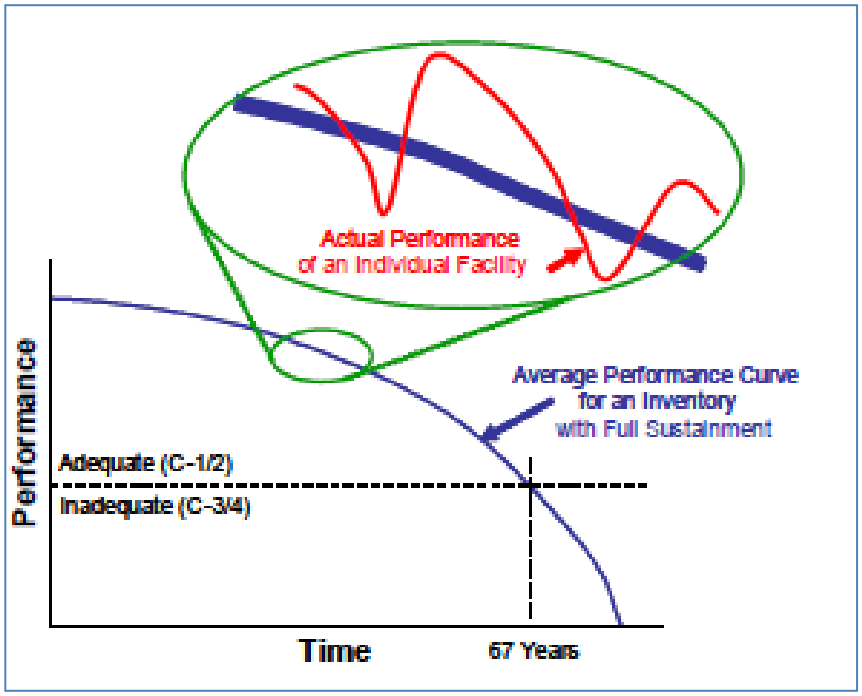


Figure 11.8.4.F3. Facilities Actual Performance Over Time

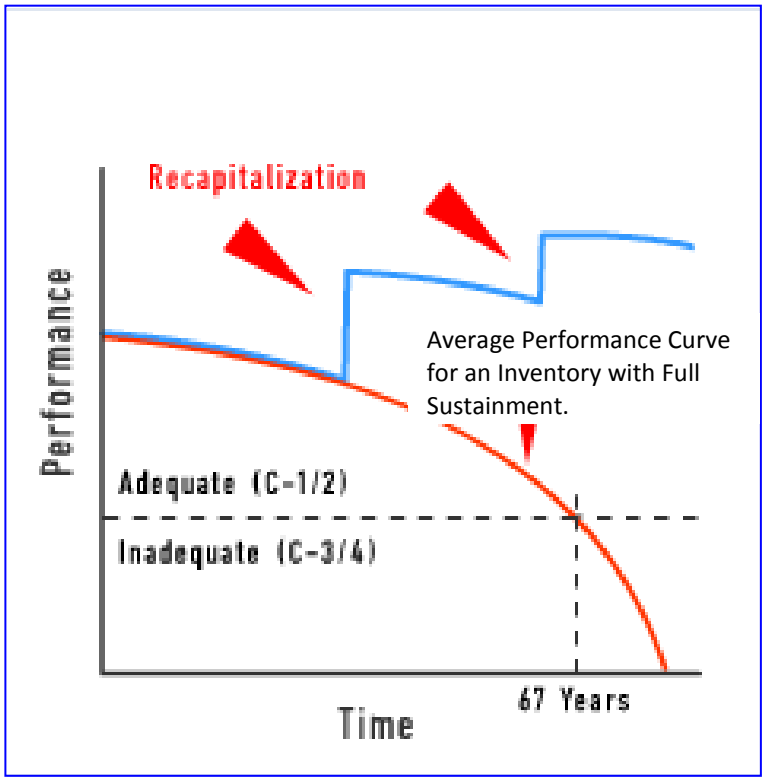


Figure 11.8.4.F4. Facilities Performance Curve with Capitalization Investments

Alternatively, recapitalization investments can be made periodically throughout a facility's and infrastructure service life, which has the effect of extending service life and delaying the need for replacement. See Figure 11.8.4.F3 and 11.8.4.F4.

11.3.5.4 Disposal

When disposal is necessary, it is normally discovered during annual utilization reviews. The conditions under which property is disposed usually include the following:

- The property is functionally or economically obsolete;
- The property has been replaced by a military construction project;
- The abandonment of in-place facilities on non-excess land has occurred;
- It is a specialty building.

Other methods used for planning for disposal include the following:

- Base Realignment and Closure (BRAC);
- Special legislation;
- Department of Justice (DOJ);
- The McKinney Act;
- Military Construction Authorizations (MCA);
- Public Private Ventures Under Special Legislation.

Disposal without land generally involves a standalone demolition of property using maintenance funds or else a demolition to make room for new construction. While real estate may be involved with the property record upkeep, this is a maintenance function.

Depending on the dollar value, the disposal may be accomplished by the base, the responsible command, real estate headquarters or the secretariat level. In certain instances the disposal must be reported to the General Services Administration.

11.3.5.4.1 Transfer

DoD usual procedures for transferring real property include:

- Transfer excess to other defense activity use;
- Transfer excess to other federal agency use;
- Transfer surplus for public benefit;
- Negotiated sale of surplus to states or local governments;
- Public sale of surplus.

After disposition is complete, the property record and installation maps must be updated to ensure the DoD meets its statutory requirements to keep a valid inventory of its real property.

UFC 1-300-08 Criteria for Transfer and Acceptance of DoD Real Property, with Change 2

11.3.5.5 Sale

The below are excerpts from “Statement of Dr. Get W. Moy, Director, Installations, Requirements and Management, Office of the Deputy Undersecretary of Defense (Installations and Environment) Before the Subcommittee on Federal Financial Management, Government

Information, and International Security of the Senate Homeland Security and Government Affairs Committee, February 6, 2006."

The management of the Department's real property inventory is, with the exception of the Pentagon Reservation, the responsibility of the Military Department that has custody of the underlying real property asset. In accordance with the Federal Property and Administrative Services Act (FPASA) of 1949, when a Military Department, such as the Army, Navy or Air Force, determines that real property under its control is excess to military requirements it must report the property to the General Services Administration (GSA) for disposal. GSA is authorized by the Act to be the real property disposal agent for the Federal Government.

Before the Military Department reports the property asset as excess to GSA, it must screen the property asset within the Department of Defense to confirm that there is no longer a military need for the property asset. If the real property asset is not needed by any other DoD Component, then the Military Department that is excessing the real property asset must complete a Report of Excess, to include the required environmental documentation, and then may formally report the real property asset as excess to GSA. GSA will screen the real property asset with other Federal agencies to determine if there are any other Federal uses for the property. If no Federal agency expresses interest, the property is determined to be surplus Federal property and then GSA will screen the real property asset with state and local governments to see if there is interest for the property at those levels. If no interest is determined, GSA will then place the real property asset up for public sale.

In direct contrast to non-BRAC real property disposals which are accomplished by GSA, the Department has been delegated authority from GSA to be the disposal agent for BRAC real property assets. Important to the success of these efforts is the flexibility each Military Department has to apply its delegated real property disposal authorities in a manner to be responsive to specific local circumstances. These disposal options, ranging from discounted conveyances for public purposes to public bid sales, enable the Department to partner with affected communities as both seek opportunities for quick civilian reuse of former military installations. A closed installation is often the affected community's greatest asset for mitigating the closure impacts and charting a future that diversifies the local economy, builds on a community's strengths, adds local tax base, and satisfies community public facility needs.

The Navy sale of property at the former Marine Corps Air Station, El Toro, California, exemplifies a highly successful BRAC property disposal in which DoD used the public sale process to dispose of property in accordance with local community redevelopment preferences. It was the largest single BRAC public sale conveyance in DoD to date -- approximately 3,720 acres. After several years of local community debate and disagreement about whether to retain airport uses of the property, in March 2002, Orange County voters approved a ballot initiative that directed a change to the County's General Plan emphasizing recreational, educational, and residential uses. The City of Irvine subsequently annexed the property, and Navy worked in very close partnership with the City to formulate plans for the public sale of the property that were consistent with the expressed will of the local community.

The Navy marketed the public sale via an Internet website that provided extensive information about the property, and conducted the sale as an Internet auction in partnership with GSA. The auction concluded in February 2005 and the successful bid was of $649.5 million, the largest BRAC land sale revenue to date. The key to the success was the important partnership between the local governments, the development community, and the Federal government. This "partnership triad" allowed the local community to determine land use planning and zoning for the property, engaged the skills and abilities of the developers to transform the property into uses that benefit the community, enabled the Federal government to fulfill its mission to convey property back into productive public use and provides economic return to the Nation's taxpayers. The sale proceeds are being used by the Navy to fund remaining environmental cleanup obligations at El Toro and other prior BRAC locations.

11.3.5.6 Deactivation and Decommissioning

The DoD and other federal government agencies have policies addressing the deactivation or decommissioning of facilities, weapon systems and infrastructure elements. Examples are listed below, PSM's should check with their local installation agencies for specific guidance.

- The DoD and Environmental Protection Agency's Safety Guide for decommissioning Halon Systems contains generic instructions for safe decommissioning of halon systems and manufacturer's specifications and instructions for handling specific equipment. http://www.halon.org/pdfs/intro.pdf

- The decontamination and decommissioning (D&D) of radiologically contaminated facilities present numerous challenges. Many tasks are involved, each of which requires adherence to a complex array of federal and state regulations and policies, attention to health and safety issues for workers and the public, monitoring and management of schedules and costs, and interaction with a potentially large number of stakeholders who have an interest in the present activities and future plans for sites undergoing D&D. For radiologically contaminated facilities, the decommissioning process generally incorporates some or all of the following activities: the deactivation and safe management of radioactive and other wastes; plant decontamination dismantling, and demolition; and site remediation. http://www.itrcweb.org/Documents/RAD5.pdf

- When a commissioned U.S. Navy ship is decommissioned, it is taken out of active service and the crew is reassigned to another ship or command. The day of the official decommissioning is established by the Fleet within the fiscal year specified by the Chief of Naval Operations. Inactivation is a process that lays up a ship for long-term storage in the event of mobilization or for safe storage pending disposal. Ship inactivation typically occurs in the three months preceding the official decommissioning date. Military Sealift Command (MSC) ship are not commissioned ship, thus are not de-commissioned. Rather, MSC ships are placed in-service when delivered and removed from service when inactivated. http://www.navsea.navy.mil/teamships/Inactiveships/Ship_Inactivation/FAQ_ship_inactivation.aspx

11.3.5.7 Demolition

A recent GAO report, GAO-11-814 September 19, 2011, addresses DoD facilities demolition. GAO has designated the Department of Defense's (DoD) management of support infrastructure as a high risk area, in part because of challenges in reducing excess infrastructure. Operating and maintaining excess facilities consumes resources that could be eliminated from DoD's budget or used for other purposes. In response to direction in House Report 111-491, GAO reviewed DoD's (1) progress toward meeting demolition program targets for fiscal years 2008 through 2013; (2) facility utilization information--a source for identifying additional excess facilities; and (3) plans for managing and disposing of excess facilities after fiscal year 2013. GAO analyzed information on excess facilities, completed demolitions, and underutilized facilities in DoD's real property inventory database; reviewed DoD's plans for demolition after the on-going program ends; and conducted site visits to selected military installations.

An excerpt from the report summary states, "DoD is on track to meet its overall targets to demolish 62.3 million square feet of facilities and about $1.2 billion in additional facilities that were not measured in square feet by the end of fiscal year 2013. Based on GAO's analysis of DoD's real property inventory database, the military services and defense organizations have all made progress in demolishing excess facilities during the first half of DoD's 6-year demolition program; however, based on DoD's projected demolition plans for the remaining years of the program, some organizations may not meet their individual demolition targets by the end of fiscal year 2013. DoD is limited in its ability to identify other potentially excess facilities, because it does not maintain complete and accurate data concerning the utilization of its facilities. "http://www.gao.gov/products/GAO-11-814.

Facilities and Infrastructure in the Life Cycle

A. Purpose

Facilities and Infrastructure is a key element of the DoD acquisition process. This discipline encompasses a variety of functions that focus on the life cycle design, construction, resourcing and maintenance of military installations, facilities, civil works projects, test ranges, airfields, roadways, maintenance depots and ocean facilities. Due to the potential long lead times in funding, acquisition or construction, and resourcing, planning must start as early in the acquisition process as possible with frequent validation to ensure requirements are aligned to facilities planning objectives.

a. Why Facilities & Infrastructure is Important

Programs' responsibilities for facilities and infrastructure vary depending on the scope and outcomes of the program. Generally, for programs delivering weapon systems, coordination with the appropriate installation, test range, or other facilities proponent organizations is required early in the acquisition process. The funding, management, sustainment, upgrade and even disposal of facilities may be the responsibilities of multiple organizations. Program leadership must examine each facilities requirement to determine the appropriate management approach.

Facilities and Infrastructure is one of the twelve Integrated Product Support Elements. The activities occurring within the scope of this area should be integrated with other product support element areas in keeping with KPP and KSA optimization goals and constraints.

b. Major Activities by Acquisition Phase

The table below describes the major activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Facilities & Infrastructure IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, includes in the left column a listing of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	**Facilities and Infrastructure Major Activities**
User Need / Technology Opportunities & Resources	Performance-based life-cycle product support implementation begins in the JCIDS process with the exploration of capabilities. The PM/PSM must be able to understand and forecast requirements to actual product support sustainment activities and outcomes. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Because facilities and infrastructure have long term funding and budget cycles, the PSM must consider requirements as early in the acquisition process as possible. The facilities and infrastructure strategy should include new build, existing organic, other government resources and existing contractor furnished facilities and infrastructure options as part of the overall solution.

	Key Products: • Requirements • Metrics • Facilities & Infrastructure strategy
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. Trade-off studies validate and forecast facilities and infrastructure sustainment outcomes. The PSM should ensure measures of habitability (those characteristics of systems, facilities (temporary and permanent), and services necessary to satisfy personnel needs) will be sufficient and affordable. Examples include: lighting, space, ventilation, and sanitation; noise and temperature control (i.e., heating and air conditioning). Risks to achieving the necessary facilities and infrastructure for the time frame of the program by IOC should be identified and a mitigation strategy outlined. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of Milestone Decision Review required documents. Key Products: • Facilities and Infrastructure strategy • Initial cost estimates
Technology Development	The LCSP will describe total facilities' requirements and the plan for providing any unique or new facilities, any facilities modifications, and any interim facilities required to support the program. The PSM should ensure requirements for Physical Security Standards for Sensitive Compartmented Information Facilities are addressed. Key Products: • Facilities & Infrastructure Plan • Updated cost estimates • Inputs into budgeting and funding cycles • Long lead item identification and planning
Engineering & Manufacturing Development	Facilities and infrastructure requirements designed earlier in the acquisition process should be validated and those that were not defined are assessed for impact, i.e., if a particular depot level repair capabilities is to be utilized so as not to incur new facilities, equipment, tools, training, etc., to validate whether the requirements have been met and would occur during this phase. Any final system engineering or support

	changes as a result of facilities and infrastructure analysis must be implemented no later than this phase to achieve maximum benefit. Key Products: • Updates to Life Cycle Sustainment Plan • Facilities and infrastructure acquisition
Production & Deployment	Facilities & infrastructure activities continue with emphasis on ensuring funding, construction or modification, and final preparations for start of sustainment activities. Fielding occurs during this phase and proof of early planning is now being validated as the system deploys to the operational site. Key Products: • Site Activation

Operations & Support	Facilities & infrastructure activity continues throughout the system's operations and support phase through multiple avenues which include: implementation of system operations and sustainment; continuing improvements in process or capital investment of the facilities & infrastructure; long term planning to accommodate any system support changes or major events, i.e., rebuild operations, relocation to forward operating areas, changes in facilities usage based on external factors.
	
	Note: 10 USC 2464 requires the establishment of the capabilities necessary to maintain and repair systems and other military equipment required to support military contingencies (i.e., core capabilities) at Government-owned, Government-operated facilities not later than four years after achieving initial operating capability.
	
	Key Products:
	• Delivery and usage of facilities and infrastructure
	• Maintenance of facilities and infrastructure
	• Updates to facilities and infrastructure due to
	  o New or changing requirements
	  o Opportunities to reduce costs or gain efficiencies
	  o Requirements for facilities renovation or upgrades

Table 11.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DI-FACR-80966, "Trainer Facilities Report"
DI-FACR-80976, "Facilities Plan"
DI-FACR-81451, "Facilities Design Criteria"
DI-ILSS-81089, "Training Facilities Report"
DI-MISC-81381, "Site Survey Report"
DI-MISC-81423, "Facilities Maintenance Report"
DI-MGMT-81825, "Facilities Requirements Data (FRD) Development for Typical Shore-based and Shipboard Sites"

C. OSD Proponency, Policy, Regulations and U.S. Statutes

a. Proponency

Within OSD, the following departments provide Facilities Management support:

- Deputy Under Secretary of Defense for Installations & Environment (DUSD(I&E));
- Director, Installation Requirements & Management (IR&M) ;
- Director, Housing & Competitive Sourcing;
- Director, Developmental Test and Evaluation (DDT&E) within the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) has responsibilities to issue guidance to and consult with the Heads of the DoD Components with respect to Live Fire Test & Evaluation (LFT&E) and related required facilities and resources; Coordinate with the Director, Test Resource Management Center (TRMC), through the USD(AT&L), on all T&E facility and resource matters as prescribed herein that affect TRMC responsibilities, as specified in DoD Directive 5105.71; and approve activities authorized under international agreements for reciprocal use of ranges and resources, cooperative T&E programs, project equipment transfers, cooperative project personnel and familiarization visits, and International Test Operations Procedures (ITOPS);
- Each DoD Service also maintains its own facilities and infrastructure management organizations. More information is included in the references lists within this section.

b. Policy and Regulations

Note: please see the References at the end of this section for a more complete list of relevant materials.

DoD policy concerning facilities and infrastructure addresses all aspects of facilities and infrastructure to include base housing, live fire test ranges, depots, international usage, contract facility management, etc. Depending on the usage and type of infrastructure required, policies and guidelines may differ widely. Program management must ensure the appropriate policies and guidelines are used in accordance with program outcomes and objectives.

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance

with USD(AT&L) Memorandum dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate.

- The DoD Facilities Cost Factors Handbook can be accessed at the following Web site: http://www.acq.osd.mil/ie/irm/index.html.
- DoD 7000.14-R, Financial Management Regulation (FMR), Volume 3, Chapter 8, Section 0802 addresses policy regarding commitments.
- DoD 7000.14-R, Financial Management Regulation (FMR), Volume 3, Chapter 8, Section 0803 addresses policy regarding obligations.
- The Misappropriation Act is also known as the Purpose Statute. (Title 31, Section 1301 U.S. Code) It requires that funds be used only for the programs and purposes for which they were appropriated.
- The Anti-Deficiency Act (3679 Revised Statutes) prohibits departments and agencies from obligating more than the amount available in an appropriation or amount permitted by agency regulations. It also prohibits obligations in advance of appropriations.
- The Bona Fide Needs rule (Title 31, Section 1502(a) U.S. Code) states that appropriated funds can only be used to obtain either of the following:
    - Goods for which a bona fide need arises during the period of the appropriation's availability for obligation;
    - Services which are performed during the period of the appropriation's availability for obligation.

The Product Support Manager should also see:

- 2007 Defense Installations Strategic Plan, http://www.acq.osd.mil/ie/download/DISP2007_final.pdf;
- Executive Order 13327, "Federal Real Property Asset Management," signed by President George W. Bush on February 4, 2004;
- Global Defense Posture and Base Realignment & Closure 2005 Mandates, Base Redevelopment and Realignment Manual (DoD 4165.66-M);
- The Unified Facilities Criteria (UFC 4-020-01) DoD Security Engineering Facilities Planning Manual which provides planning, design, construction, sustainment, restoration, and modernization criteria for facilities, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with USD(AT&L) Memorandum dated 29 May 2002.

It is DoD policy that real property be acquired that will satisfy the requirement economically with as little impact as possible on the civilian economy. Property should be acquired from the private sector only when there is no government-owned land available that will meet the requirement. In addition, property cannot be acquired because it is considered a "good buy" or because it would be a good investment for taxpayers. There must be a current, anticipated requirement to use the property that is to be acquired for an identified military mission.
10 U.S.C. 2682 requires that real property used by a Defense Agency be under the jurisdiction of a military department. Ownership of real estate interest belongs to the United States of America, whereas the military department is entrusted with the *jurisdiction* or *control* of the real property.

The following codes and statutes, based on the type and value of interest being purchased, outline the determination of authority used for the military to purchase real estate:

- 10 U.S.C. 2676, "Acquisition: limitation"
- Annual MILCON Authorization Statutes
- Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646)

Condemnations of real estate by a military department and to acquire by condemnation are covered in 10 U.S.C. 2663, and are submitted to the Department of Justice and filed in federal court by the local U.S. Attorney.

The General Services Administration performs leasing of general-purpose space within a metropolitan area. The authority to lease special and general-purpose space outside of metropolitan areas has been delegated to the Department of Defense by GSA. Leasing of facilities and family housing overseas is covered by 10 U.S.C. 2675 and 10 U.S.C. 2828c.

The National Environmental Policy Act of 1969 (NEPA) encompasses a wide variety of existing environmental legislation that impact facilities and infrastructure planning and execution including, but not limited to, the following:

- Clean Air Act
- Clean Water Act
- National Historic Preservation Act
- Endangered Species Act

Title 10 U.S.C. 2464 and DoDI 4151.20 require core logistics capability that is government-owned and government-operated (including government personnel and government owned and operated equipment, facilities and infrastructure) to ensure a ready and controlled source of technical competence with the resources necessary to ensure effective and timely response to mobilization, national defense contingency situations, or other emergency requirements. These capabilities must be established no later than 4 years after achieving IOC.

D. Who Develops, Delivers and Manages Facilities & Infrastructure

The Department of Defense (DoD) and the military services have initiated a program to unify all technical criteria and standards pertaining to planning, design, construction, and operation and maintenance of real property facilities and infrastructure. The objective of the Unified Facilities Criteria (UFC) program is to streamline the military criteria system by eliminating duplication of information, increasing reliance on private-sector standards, and creating a more efficient criteria development and publishing process. Both technical publications and guide specifications are part of the UFC program. Previously, each service had its own publishing system resulting in criteria being disseminated in different formats. UFC documents have a uniform format and are identified by a number such as UFC 1-300-1. Though unification of all DOD criteria is the ultimate goal, there are instances when a particular document may not apply to all services, or some documents may have not been fully revised to reflect all service requirements before being issued in the UFC system. The offices which administer the UFC program for the military

services are the HQ, US Army Corps of Engineers; Naval Facilities Engineering Command, Engineering Innovation and Criteria Office; and the Office of the Air Force Civil Engineer.

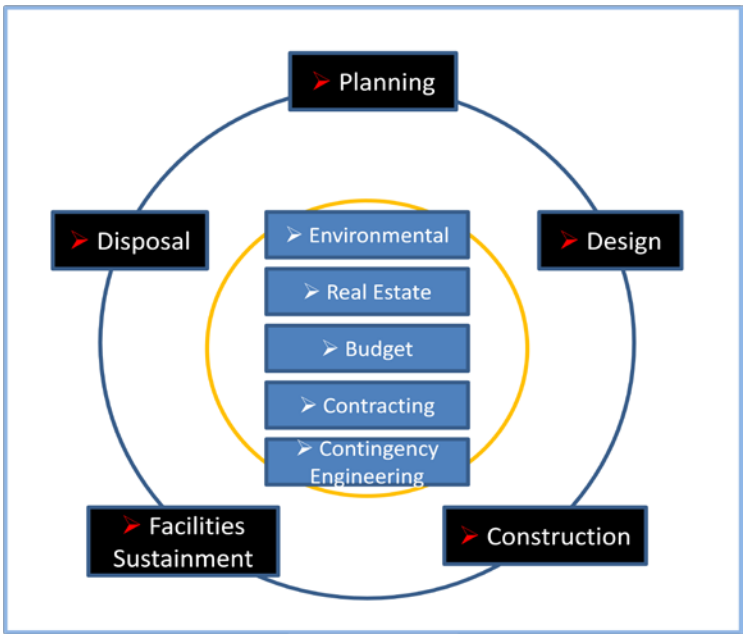
Within the Program Office, responsibility designations for developing and implementing the facilities and infrastructure plans will vary depending on the type of system being fielded, system requirements, and types of facilities under management. The Product Support Manager will generally develop requirements, conduct analysis, and provide oversight for facilities and infrastructure related to life cycle product support.

E. When Is Facilities & Infrastructure Delivered and Managed in the Life Cycle

Facilities and infrastructure planning must start as soon as the need or requirement is identified due to the long lead times for budgeting, acquisition, and the need to have the facility / infrastructure ready to use at the start of the designated operation (test, maintenance, storage, etc.). During the acquisition life cycle, the facilities and infrastructure plans are required to be included in the Acquisition Strategy with requirements identified by Milestone B. Specific lead times and planning cycles are further discussed below.

F. How Facilities & Infrastructure Is Developed, Established and Managed

a. Facilities Life Cycle Management



Facilities and associated infrastructure must sustain the regular forward and home station presence of U.S. Forces as well as provide support in training and deployment to meet the Nation's need in periods of crisis, contingency, and combat. Facilities ensure a productive, safe, and efficient workplace, and also offer a decent quality of life for military members and families, and the civilian and contactor workforce.

Facilities and infrastructure sustainment life cycle activities include the planning, design, construction, sustainment and disposal. The objective of facilities and infrastructure is to enable training, maintenance and storage to maximize effectiveness of system operation and the logistic support system at the lowest TOC. The Product Support Manager must be able to identify and prepare plans for the acquisition and sustainment of facilities and infrastructure to enable responsive support for the Warfighter. Important cross-functional areas of facilities and

infrastructure acquisition and management include environmental, real estate, budgeting, contracting, and contingency engineering.

1. RPILM Governance Processes

Real Property and Installations Lifecycle Management (RPILM) governance processes support federated management through the business owners driving business modernization and associated support IT systems.

During the Concept Refinement and Technology Development phases, facilities engineers support the acquisition process by:

- Develop initial planning concepts, identify potential facility impacts, identify constraints, and identify opportunities;
- Validate any assumptions being made regarding need for existing facilities and infrastructure to support concepts being explored;
- Provide cost estimates of any prospective facilities and infrastructure impacts so that alternative concepts may be properly assessed with respect to total ownership costs;
- Determine if there will be an impact on facilities and infrastructure acquisitions that may result in programming Military Construction (MILCON) or Operation and Maintenance funds for recapitalization through restoration or modernization (i.e., construction for a facility and/or infrastructure that will be replaced).

During System Development and Demonstration phase, facilities engineers:

- Continue to identify existing constraints and support considerations;
- Translate support requirements into facilities and infrastructure requirements and develop Basing Studies;
- Conduct preliminary site surveys;
- Compare the environmental impacts on various installations and develop appropriate environmental planning documentation (i.e., Categorical Exclusion (CATEX), Environmental Assessment (EA), or Environmental Impact Statement (EIS)).

During the Production and Deployment phase, facilities engineers:

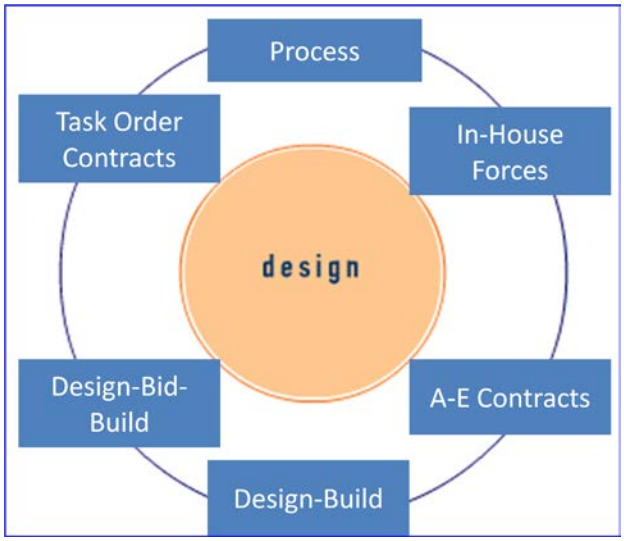
- Program Funds (MILCON) or recapitalization funds for any construction that will be required to support the system;
- Design and construct any facilities and infrastructure that will be required to support the system. (Note: the completion should coincide with delivery of the system; not too early and not too late.);
- Program operation and sustainment funding for the constructed facilities and infrastructure.

During Operations & Sustainment phase, facilities engineers:

- Operate and sustain the facilities and infrastructure;
- Restore and modernize the facilities and infrastructure;
- Dispose of the facilities and infrastructure.

2. Planning, Design Influence and Construction for Sustainment

Once the organization is confident that funds will be available to complete the project, generally detailed design of a project begins. Based on the statement of work (SOW) and preferred design approach, the design matures into final construction documents. Usually, these activities are contracted out to Architect-Engineer firms that have the appropriate expertise (unless the Facilities Engineering organization has in-house design staff available). The materials, technologies, and types of systems chosen during this function will have a direct and life-long impact on the costs to operate, maintain, repair, and dispose of the facility and/or infrastructure.



The design process generally follows one of several options for a basic design process:

- The Design Process: The entire design process from conception through completion / delivery;
- Design by In-House Resources: Govt. Engineering staff creates the design and accompanying specifications;
- Design by A-E Contracts: Professional A-E firm creates the design and specifications for negotiated price;
- Project Delivery Using Design-Build: One firm, headed by an A-E or construction firm, completes design and constructs the facility and/or infrastructure;
- Project Delivery Using Design-Bid-Build: Separate A-E firm, who cannot bid on resulting project, creates the design and specs. Separate construction firm bids on and builds project from A-E design;
- Project Delivery Using Task Order Contracts: General contracts for potential projects through negotiated separate work orders.

The Design Process consists of 6 steps. They are:

- The Pre-design Conference;
- Sustainable Design;
- Project Design to Conceptual Stage;
- Continuation of Design;
- Specifications;
- Final Design Review.

Task order contracts:

- Are generally used for maintenance and repairs of government real property;
- Are indefinite delivery/indefinite quantity contracts;
- Include a collection of detailed task specifications.

Sustainable design seeks to reverse the trends in the design communities that focus on first costs and treat each discipline's contribution to the whole building as separate and independent efforts. Sustainability considerations should be included from the start of the planning process all the

way through the facilities and infrastructure life cycle. This means looking for planning, design, and construction solutions that enhance the project's long-term environmental and energy performance in addition to its life cycle cost.

3. Operations, Sustainment & Disposal for Facilities

Facilities and infrastructure sustainment, restoration, and modernization includes the activities necessary to keep or return facilities and infrastructure to good working condition and/or improve facilities and infrastructure beyond original conditions or capacities. Facilities and infrastructure sustainment provides resources for maintenance and repair activities necessary to keep a typical inventory of facilities and infrastructure in good working order over a typical 50-year service life.

It includes regularly scheduled adjustments and inspections, preventive maintenance tasks, and emergency response and service calls for minor repairs. It also includes major repairs or replacement of facility and/or infrastructure components (usually accomplished by contract) that are expected to occur periodically throughout the facility and infrastructure life cycle. This work includes regular roof replacement, refinishing wall surfaces, repairing and replacing electrical, heating, and cooling systems, replacing tile and carpets, and similar type of work. It does not include repairing or replacing non-attached equipment or furniture, or building components that typically last more than 50 years (such as foundations and structural members).
Sustainment does not include restoration, modernization, environmental compliance, specialized historical preservation or costs related to acts of God, which are funded elsewhere. Other tasks associated with facilities and infrastructure operations (such as custodial services, grass cutting, landscaping, waste disposal, and the provision of central utilities) are also not included.

4. Facilities Sustainment Model (FSM)

The DoD uses the term "facilities sustainment model", or FSM to describe the annual maintenance and scheduled repairs for the inventory. Using FSM, the department can compute the annual sustainment requirements for 100% of the department's facilities and infrastructure inventory, using standard benchmarks.

Under the Facilities Sustainment Model, the amount of money that the services need to sustain their facilities and infrastructure is equal to the sum of all of their facilities and infrastructure multiplied by the appropriate Unit Cost Factor, the appropriate Area Cost Factor, and an inflation factor.

All work classified as sustainment is funded using the Facilities Sustainment model. All other

work (e.g., environmental compliance, activities to bring facilities and infrastructure up to current mission requirements, etc.) requires separate funding and justification.

The basic calculations are Sustainment = (RPI Asset Quantity x unit costs1) +…where unit cost is DoD sustainment cost factors (commercial benchmarks, Means, VDOT, Whitestone, etc) and the location and inflation adjustments, RPI is Real Property and Installation, and FAC is the Facilities Assessment Category. RPI Asset Quantity – taken from OSD's Facilities Assessment Database (FAD), which is comprised on the Military Department's RPI as of 30 September each year. The commercial benchmarks are based on standard commercial criterion (unit costs) and are unique to individual facility types. The benchmarks were first published in the DoD Facilities Cost Factors Handbook, Version 2.0 (April 2000), and are updated annually. For further information, visit http://www.acq.osd.mil/ie/fim/Sustainment/Sustainment/Sustainment.shtml.

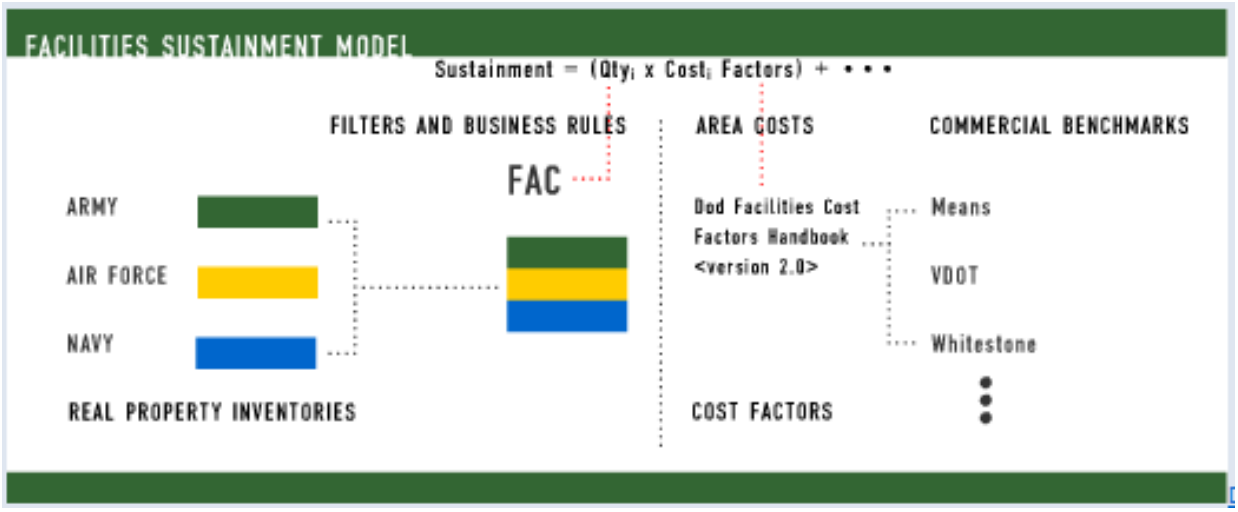


Figure 11.8.4.1. F1. Facilities Sustainment Model Graphical Depiction

Facilities Sustainment, Restoration, and Modernization, or SRM, is the methodology in the DoD replacing the previous Real Property Maintenance (RPM) methodology for asset management and resource allocation. SRM is the result of the DoD improving its methods for computing "deferred maintenance" for facilities and infrastructure and assessing the effects of such deferrals in response to the Chief Financial Officers Act and the need for better management information.

SRM theories are based on the general assumption that facility and infrastructure performance degrades as facilities age. The rate of decay depends, in part, on the level of sustainment provided. Other contributors include the materials used in a facility's construction, weather, and creeping obsolescence caused by changes in standards and missions.

With full sustainment (defined as the completion of all activities required to keep a specific facility and infrastructure in top operating condition), facilities and infrastructure achieve their full potential and deliver acceptable performance over their expected service lives. Thus, SRM theories assume that full sustainment, although not always fully budgeted, is the most cost-

effective approach to managing facilities and infrastructure because it gains the most performance over the longest time for the least investment.

The facilities and infrastructure performance curve under full sustainment typically is displayed as an average for an inventory of facilities and infrastructure, which presents a smooth performance degradation line over time (refer to the example shown in Figure 11.8.4.F2.).

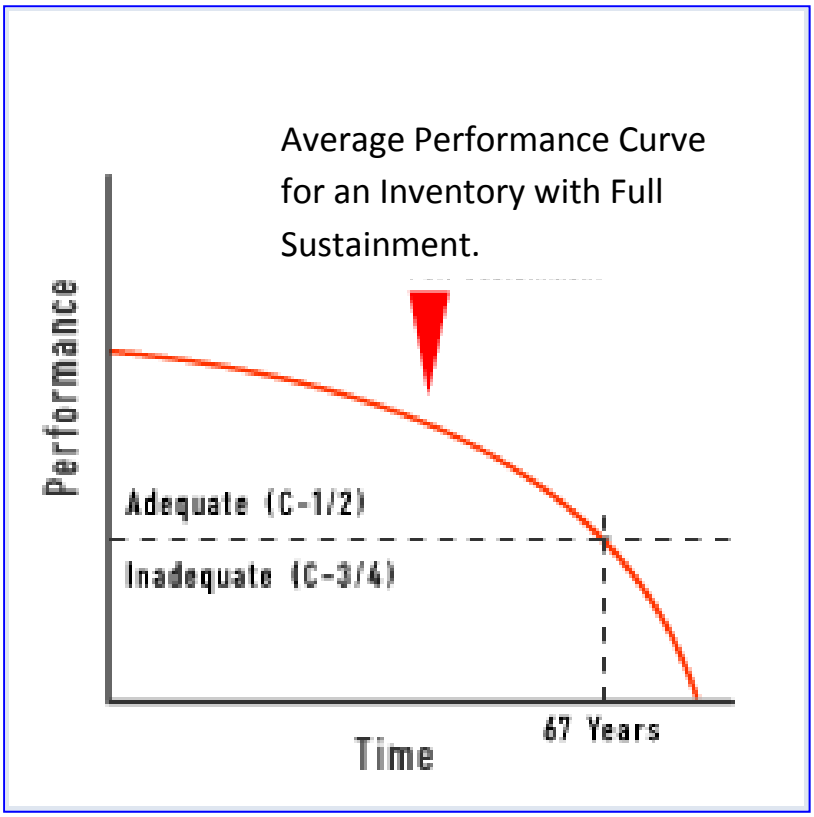


Figure 11.8.4.F2. Facilities Performance Curve

A well-sustained facility and infrastructure inventory gradually declines in performance—due primarily to aging of materials and obsolescence—and at some point (estimated to be 67 years in the case of DoD's inventory) becomes inadequate. It is important to note that the estimated 67-year average service life of DoD facilities and infrastructure will decline if investments fall below the levels required to achieve full sustainment.

Even with full sustainment, facilities and infrastructure eventually either physically wear out or become obsolete. An obsolete facility and infrastructure is one that is irrelevant to present mission requirements, regardless of its condition. According to the SRM construct, once facilities reach the end of their expected service lives, they must be recapitalized (i.e., they must be replaced or extensively renovated or modernized) if they are to continue providing adequate performance.

Alternatively, recapitalization investments can be made periodically throughout a facility's and infrastructure service life, which has the effect of extending service life and delaying the need for replacement. See Figure 11.8.4.F3 and 11.8.4.F4.

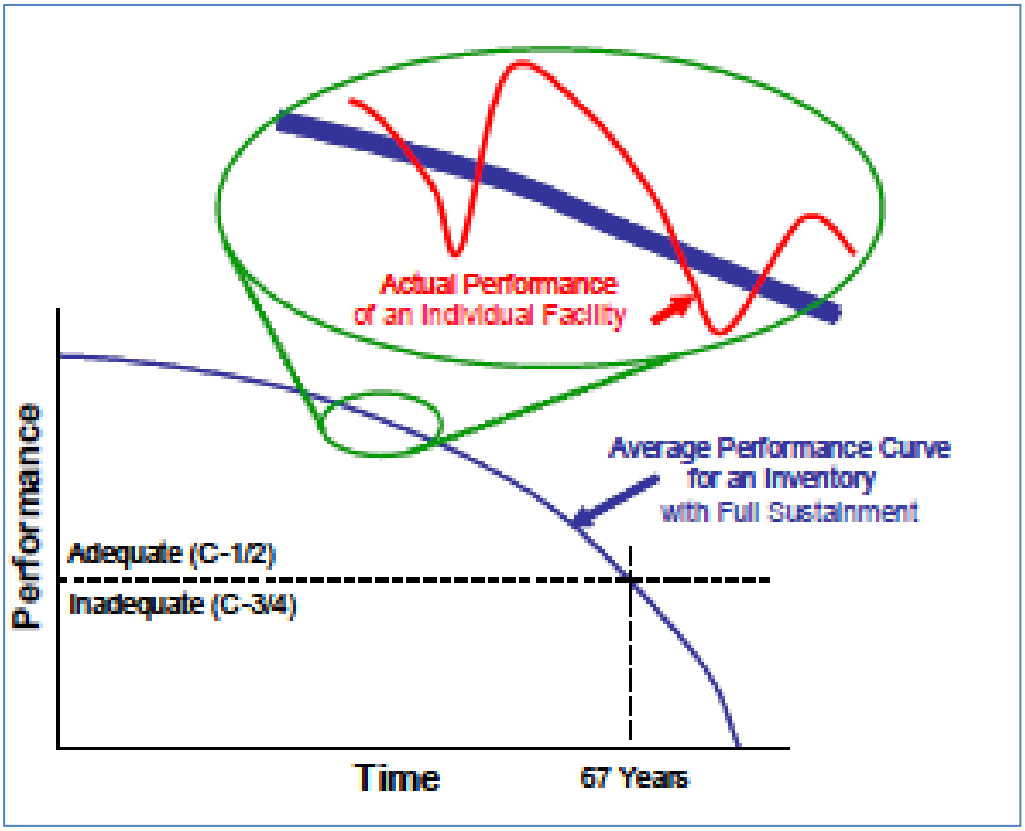


Figure 11.8.4.F3. Facilities Actual Performance Over Time

To meet the requirements of the Defense Authorization Act, the DoD submits the Installation Readiness Report (IRR) on an annual basis to the Office of the Secretary of Defense (OSD) and Congress. The report serves the following functions:

- It uses a DoD facility and infrastructure classification system to report operational readiness;
- It facilitates an integrated, readiness-based investment strategy;
- It allows resources to be focused for maximum readiness impact;
- It is designed to help commanders and other decision makers objectively monitor the quality and quantity of facilities and infrastructure.

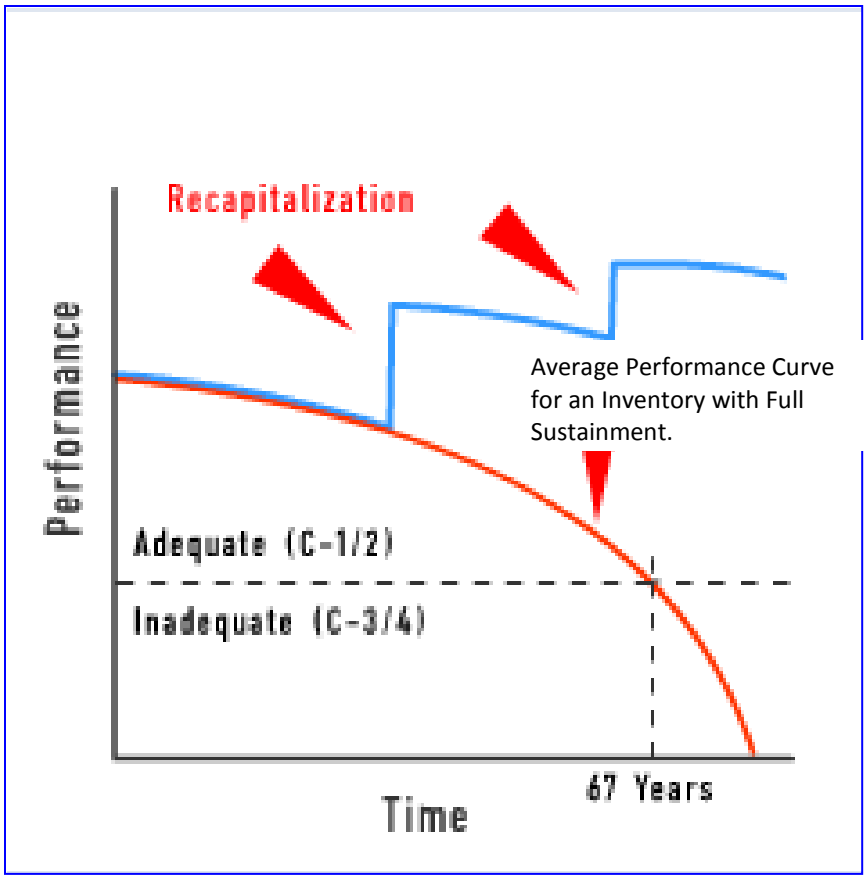


Figure 11.8.4.F4. Facilities Performance Curve with Capitalization Investments

5. Transfer and Disposal Procedures for Real Property

DoD usual procedures for transferring real property:

- Transfer excess to other defense activity use;
- Transfer excess to other federal agency use;
- Transfer surplus for public benefit;
- Negotiated sale of surplus to states or local governments;
- Public sale of surplus.

Other methods used for planning for disposal include the following:

- Base Realignment and Closure (BRAC);
- Special legislation;
- Department of Justice (DOJ);
- The McKinney Act;
- Military Construction Authorizations (MCA);
- Public Private Ventures Under Special Legislation.

The following environmental requirements must be met before the disposition of property is executed:

- Appropriate NEPA documentation should be completed. Determine if the action qualifies as a Categorical Exclusion. If it doesn't, an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) must be prepared. Most major disposal actions will require an EIS;
- De-militarization of the property;
- Asbestos must be identified and/or friable asbestos must be removed;
- If lead-based paint was used for residential structures, it must be identified and the appropriate Housing and Urban Development (HUD) forms must be completed;
- A responsible person must certify that the property does or does not contain Polychlorinated Biphenyl (PCB) transformers or other equipment regulated by the Environmental Protection Agency under 40 CFR Part 761;
- A historic, archaeological and cultural resources survey should be conducted;
- The Comprehensive Environmental Response, Compensation and Liability Act requires the federal holding agency to include a statement indicating whether or not any hazardous substance activity took place on the property during the time the property was owned by the United States (as defined by regulations issued by the Environmental Protection Agency under 40 CFR part 373);
- Based on the Finding of Suitability to Transfer (FOST) and Environmental Baseline Survey (EBS), the property will be environmentally ready to convey after the culmination of other environmental steps;
- If a conveyance of land without environmental remediation is required, a Finding of Suitability for Early Transfer must be completed;
- If the disposition of land includes natural resources, consultation with regulatory agencies is required;
- Land Use Controls (LUCS) must be disclosed before disposal.

When disposal is necessary, it is normally discovered during annual utilization reviews. The conditions under which property is disposed usually include the following:

- The property is functionally or economically obsolete;
- The property has been replaced by a military construction project;
- The abandonment of in-place facilities on non-excess land has occurred;
- It is a specialty building.

After disposition is complete, the property record and installation maps must be updated to ensure the DoD meets its statutory requirements to keep a valid inventory of its real property.

Disposal without land generally involves a standalone demolition of property using maintenance funds or else a demolition to make room for new construction. While real estate may be involved with the property record upkeep, this is a maintenance function.

Depending on the dollar value, the disposal may be accomplished by the base, the MACOM, real estate headquarters or the secretariat level. In certain instances the disposal must be reported to the General Services Administration.

6. Environmental Considerations for Facilities and Infrastructure

Environmental considerations start when the specific facilities need is first identified.

The DoD's environmental strategy is to sustain and enhance mission readiness and protect the health of military members, civilians, the public, and the environment through effective and efficient environmental management.

The Environmental support of facilities consists of:

- Planning to analyze the environmental and economic issues to create and operate facilities and infrastructure that can be sustained over time;
- Compliance so operations meet federal, state, local and host nation environmental requirements;
- Pollution prevention reducing or eliminating the creation of pollutants;
- Conservation: We must protect and enhance cultural resources, and the natural habitats and life sustaining quality of the land and waterways under our protection;
- Restoration: We must repair the damage caused by past substance releases and waste disposal practices.

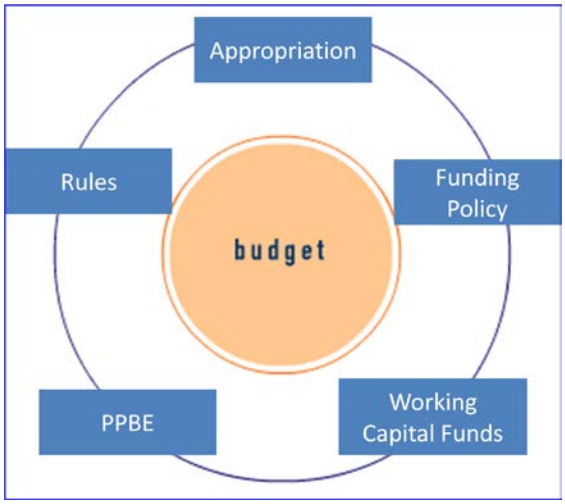
7. The Role of OSHA

Occupational Safety and Health Administration (OSHA) is the administrative body created by the Occupational Safety and Health Act of 1970. Its charge is to:

- Encourage employers and employees to reduce workplace hazards and to implement new or improve existing safety and health programs;
- Provide for research in occupational safety and health to develop innovative ways of dealing with occupational safety and health problems;
- Establish separate but dependent responsibilities and rights for employers and employees for the achievement of better safety and health conditions;
- Maintain a reporting and record keeping system to monitor job-related injuries and illnesses;
- Establish training programs to increase the number and competence of occupational safety and health personnel;
- Develop mandatory job safety and health standards and enforce them effectively;
- Provide for the development, analysis, evaluation, and approval of occupational safety and health programs at the state level for those states that want to establish their own state programs.

OSHA's standards now fill several volumes in the Code of Federal Regulations under Title 29 (Labor). They form the base for OSHA's safety inspections and for citations to employers for violations. To establish a violation, OSHA must show the following:

- A hazard exists;
- The employer has actual knowledge of the hazard or it is recognized as a hazard in the employer's industry;
- The hazard is likely to cause death or serious physical harm;
- It was foreseeable;
- Workers are exposed to it;
- Corrective measures that employer should have taken to prevent the hazard can be specified.



h. Budgeting for Facilities

To properly perform the mission, we must have the appropriate funding amount for the correct purpose. This can only happen if we have identified the funding for facilities well in advance of the actual requirement.

1. Planning, Programming, Budgeting, and Execution (PPBE) Process

In order to receive the funds when we need them, we must identify our needs years in advance of the actual requirement. Additionally, the Department of Defense, like any other organization, has funding limits to which it must adhere. It must prioritize its requirements and use our National Security Strategy as a guide.

PPBE consists of three distinct but interrelated phases: Planning, Programming, and Budgeting with an Execution Review.

The primary purpose of the Planning phase is to review the threats to national security and articulate the DoD strategy and capabilities required to counter these threats in the Joint Programming Guidance (JPG).

The primary purpose of the Programming phase is to develop Component resource packages (programs) prioritized in accordance with the JPG.

The primary purpose of the Budgeting phase with an Execution Review is to produce a defensible and efficiently executable DoD budget request to be incorporated into the President's Budget submission to Congress.

Rules Governing Commitments, Obligations, & Procedures include:

- The Congressional budget enactment process consists of the following three phases:
  - Budget Resolution

  - Authorization
  - Appropriation;
- The annual funding policy applies to O&M and MILPERS appropriations; the incremental funding policy applies to RDT&E appropriations; the full funding policy applies to procurement and MILCON appropriations;
- The annual funding policy requires budgeting only for the estimated cost of goods and services needed in a fiscal year;
- The incremental funding policy requires that an RDT&E budget request based on the costs expected to be incurred during a fiscal year;
- The full funding policy is the practice of funding the total cost of major procurement efforts and construction projects in the fiscal year in which they are initiated.

2. Working Capital Fund

Some Facilities Engineering organizations and organizations for which Facilities Engineers provide services use another type of funding called Working Capital Funds. The use and management of these funds is completely different from the other funds used by Facilities Engineers.

Working capital funds are revolving funds financing the operations of some government business units. Working capital funded business units are not profit oriented.

The primary purposes for Defense Working Capital funds are to:

  - Finance supply inventories as designated by the Secretary of Defense; and
  - Provide working capital for industrial-type activities and commercial-type activities that provide common services within DoD.

3. Other Appropriations

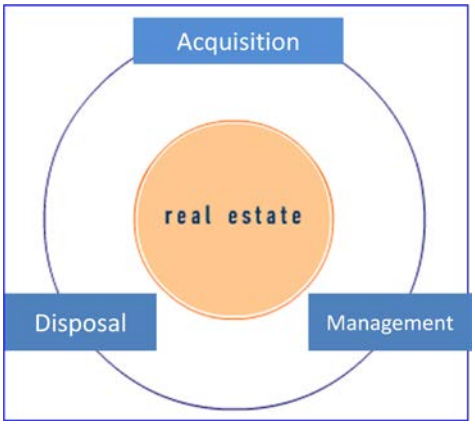
RDT&E appropriations may finance both expenses and investments. They also finance efforts related to research, development, testing, and operational evaluation of weapon and information systems, and are normally available for obligation for two years.

Procurement appropriations are used to finance non-construction-related investment items. Procurement appropriations are normally available for obligation purposes for three years (five years for Shipbuilding and Conversion, Navy).

- O&M appropriations are used to finance expenses not related to military personnel or RDT&E, as well as minor construction projects costing less than $750,000. O&M appropriations are normally available for obligation for one fiscal year);
- MILPERS appropriations finance expenses related to military personnel, and are normally available for obligation for one year;
- MILCON appropriations are used to fund most construction projects for military use that are considered investments, except family housing. MilCON appropriations are usually available for obligation for five years.

Budgeting for facilities and infrastructure sustainment occurs throughout the life cycle of a weapon system to support facilities and infrastructure needed at each life cycle phase.

i. Real Estate



Real Estate is the foundation underneath the installation and the facilities and infrastructure supporting the operational mission. The sequence of the real estate life cycle includes the acquisition of property, the management of the property, and the disposal of the property.

Real estate needs are defined as part of the planning process for a weapon system's acquisition, production, operation and sustainment.

The components of the real estate life cycle sequence include the following:

- Acquisition
- Management
- Disposal

During the acquisition phase, land is acquired for the United States of America using several methods. The method by which the real estate is acquired is based on the category of real estate being purchased.

Depending on the type and value of interest purchased, there are number of codes and statutes that outline the determination of authority used for the military to purchase real estate.

The department that is entrusted with the jurisdiction or control of real property owned by the United States of America has a number of responsibilities, including management of the title, authorization to grant use of the real property, and monitoring unauthorized uses of the property.

The out-grant program involves the government as landowner, managing its real property holdings and authorizing the use of that property by military departments, federal agencies, state and local government agencies, and/or private organizations or individuals. Types of out-grants include leases, easements, and licenses/permits, and are appropriate on non-excess property.

There are a number of authorities related to the application of public private ventures in real estate management. Early involvement of the real estate professional in any outsourcing or privatization action is essential to assessing the impact of the action on the property.

j. Site Activation

Each Service has its tailored approach to site activation based upon specific mission requirements. Site Activation encompasses all of the product support elements and impacts that

must be derived by the logistician when building the product support plan and is a critical component of the DoD Component's equivalent of the Material Fielding Plan.

Materiel Fielding Plan (MFP). The PM, in coordination with the supportability integrated process team members and program leadership will prepare the MFP for each new materiel system having...example of an excerpt of instructions for U.S. Army program management is: "… All MFPs will be coordinated according to DA Pam 700–142, table E–1. and will identify measures to include: specific facility and infrastructure requirements, to include new or modified facility requirements to support doctrinal operation, system operation in a garrison environment, and New Equipment Training; a summary of the system's National Environmental Policy Act documentation that highlights critical environmental planning considerations for gaining installations…."

k. Test Facilities

The Major Range and Test Facility Base [MRTFB] is a set of test installations, facilities, infrastructure, and ranges which are regarded as "national assets." These assets are sized, operated, and maintained primarily for DoD test and evaluation missions. However, the MRTFB facilities and ranges are also available to commercial and other users on a reimbursable basis. Oversight of the MRTFB is performed by the Office of the Director for Test, Systems Engineering, and Evaluation, Resources and Ranges. Refer to DoDD 3200.11.

Test facilities may also be unique to a program and may be the program's responsibility to conduct and establish the infrastructure. Program managers should establish early the existence of test facilities and infrastructure that will meet program requirements.

The Department of Defense Test Resource Management Center (TRMC) is a DoD field activity responsible for the planning and assessment of the adequacy of the Major Range and Test Facility Base to provide adequate testing in support of development, acquisition, fielding, and sustainment of defense systems. The TRMC also maintains an awareness of other test and evaluation facilities, infrastructure and resources, within and outside the DoD, and their impact on DoD requirements. Their website is at http://www.defense.gov/OrgChart/office.aspx?id=95.

l. Additional areas of interest for facilities and infrastructure not specifically covered in detail but should be reviewed include:

- Facilities and Infrastructure Construction;
- Facilities and Infrastructure Project Estimates and Scheduling;
- Contracting for Facilities and Infrastructure;
- Facilities and Infrastructure Construction;
- Contingency Engineering;
- Installation Service & Support Agreements (ISSA) with the applicable installation management command.

G. Communities of Practice and Interest

The Defense Acquisition University maintains a wealth of information on their website under various communities of interest locations:

- PM e-Tool Kit Performance Learning Tools found at https://pmtoolkit.dau.mil/
- AT&L Knowledge Management System (AKMS) (Policy and Procedures, Tools, Knowledge Gateways, Ask-A-Professor, ACQuire Search)
- Web enabled Defense Acquisition Guidebook (DoDD 5000.01; new DoDI 5000.02, new Guidebook)
- Integrated Framework Chart (IFC)(Updated to new DoDI 5000.02)
- Web enabled new JCIDS Instruction and Guidebook
- Best Practices Clearing House (With addition of Multimedia Assets – video, audio)
- ACQuipedia
- Acquisition Community Connection (CoPs and Special Interest Areas)
- PM Certification Course materials and PM Continuous Learning Modules
- Probability of Program Success (PoPS) Model and Service Implementations
- Defense Acquisition Program Support (DAPS) Assessment Guide (Milestone Preparation)
- DoD IG Audit Guides for Acquisition and Contracting
- Service and Agency PMO support sites
- Contract Management Processes Guide
- Leadership Support Center (Requires ACC log-in)

The Defense Logistics Agency (DLA) provides a website called “Assist Online” which is a search engine for Data Item Deliverables, found at https://assist.daps.dla.mil/online/start/

Federal Real Property Council (FRPC). Major provisions of the order include: establish the position of a Senior Real Property Officer (SRPO) at all major landholding agencies, direct the Senior Real Property Officers to develop and implement agency asset management plans, create interagency Federal Real Property Council (FRPC), and authorize the development of a single and descriptive database of federal real properties.

The joint basing program represents the Department of Defense (DoD) efforts to optimize the delivery of installation support across the services.

Defense Environmental Network & Information eXchange (DENIX). DENIX is a resource that provides DoD personnel in the Environmental Security and Safety & Occupational Health arenas (a principal staff element of the OUSD Acquisition, Technology, & Logistics (AT&L) mission) with timely access to environmental legislative, compliance, restoration, cleanup, and DoD guidance information. It is intended to serve as a central electronic "meeting place" where information can be exchanged among environmental professionals worldwide.

H. Lessons Learned / Best Practices

*The Defense Acquisition University's Best Practices Clearinghouse. T*his clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

- A single authoritative source for information about practices, lessons learned and risks to avoid;
- Validated practices with consistent, verifiable information;
- An active knowledge base to help with practice questions;
- Intelligent front-end to quickly get to answers;
- Useful information and tools to help find, select and implement practices appropriate to specific programs;
- Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

Commander in Chief's Annual Award for Installation Excellence. Proponent is the U.S. Marine Corps, *MARINE CORPS ORDER 5200.26B.*

Defense Installation Spatial Data Infrastructure (DISDI) Portal offers high-level geospatial data on DoD's installations, providing strategic maps of installations and information on how to access more detailed data.

Facility Program Requirements Suite (FPRS) allows analysts and other approved users access to the Facilities Assessment Database, the Facilities Sustainment/Modernization/Operation Models, the Future Year Defense Program, and the Annual Base Structure Report.

COMPARE is the cost estimating software supporting competitions conducted under the provisions of Office of Management and Budget (OMB) Circular A-76, Performance of Commercial Activities. COMPARE is mandatory for all federal agencies performing A-76 competitions under the OMB Circular A-76 competitive sourcing process. OMB Circular found at https://acc.dau.mil/CommunityBrowser.aspx?id=360589 .

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

I. Training Resources

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

Below is a selection of relevant DAU Course offerings:

- ACQ 101 Fundamentals of Systems Acquisition Management
- CON 243 Architect-Engineer Contracting
- FE 201 Intermediate Facilities Engineering
- FE 301 Advanced Facilities Engineering
- IND 100 Contract Property Administration and Disposition Fundamentals
- IND 103 Contract Property Systems Analysis Fundamentals
- IND 200 Intermediate Contract Property Administration and Disposition

J. Key References

DoD level

- UFC will be periodically reviewed, updated, and made available for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Support Agency (AFCESA) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. The form is also accessible from the Internet sites listed below. UFC are effective upon issuance and are distributed only in electronic media from the following sources:
    - Unified Facilities Criteria (UFC) Index http://65.204.17.188//report/doc_ufc.html;
    - USACE TECHINFO Internet site http://www.hnd.usace.army.mil/techinfo/index.htm.;
    - NAVFAC Engineering Innovation and Criteria Office Internet site http://dod.wbdg.org/.
    - Construction Criteria Base (CCB) system maintained by the National Institute of Building Sciences at Internet site http://www.ccb.org/;
    - MIL-STD-3007F, Unified Facilities Criteria and Unified Facilities Guide Specifications;
    - DoD Facilities Cost Factor Handbook (part of the UFC series).
- The DAU Acquisition Community Connection provides an entire web-page devoted to highlighting key acquisition logistics guidebooks, the website can be found at https://acc.dau.mil/CommunityBrowser.aspx?id=141967
- MIL-HDBK-502, “DoD Handbook on Acquisition Logistics”, p. 7-14
- Defense Acquisition University, “Acquisition Logistics Guide” (1997), 7.2.8
- Unified Facilities Criteria (UFC) 3-701-09, “DoD Pricing Guide”, 15 Sept 2009

- DoD Facilities Sustainment Model. DoD's tool to establish annual funding benchmarks to keep an inventory of facilities in good condition, based upon commercial benchmarks for maintenance and repair. The office of the Deputy Under Secretary of Defense for Installations and Environment (ODUSD(I&E)) initiated the development of the Facilities Modernization Model (FMM) with OSD PA&E, the Services, and defense agencies in 2004. This model will refine the recap target from the current DoD average value (1/67th of the inventory plant replacement value), to a value calculated using economic assessments and estimated service lives for each facility type, weighted by their plant replacement value in the inventory. The purpose of the DoD Facilities Modernization Model is to predict the average annual dollar amount required for DoD to modernize its inventory of facilities on a continual, ongoing basis. This website is found at http://www.acq.osd.mil/ie/fim/programanalysis_budget/tool_metrics/FPRS/FSMDescription.shtml.
- DOD 4140.25-M, Vol II, Chapter 8, Management of Storage and Distribution Facilities for Bulk Petroleum
- 2009 Guidance For Real Property Inventory Reporting, July 14 2009. Executive Order (EO) 13327 "Federal Real Property Asset Management" was created to promote efficient and economical use of the Federal Government's real property assets. The EO established the interagency Federal Real Property Council, the role of the Senior Real Property Officer, and the mandated creation of a centralized real property database.
- DoD 2007 Defense Installations Strategic Plan outlines the mission to provide installation assets and services necessary to support our military forces in a cost effective, safe, sustainable, and environmentally sound manner.
- Federal Acquisition Regulations have significant impacts on the award of federal construction contracts. Program managers should discuss facilities requirements associated with the FAR with their contracting officers.
- Research for project information can be found in a number of sources, including:
    - The information in DD Form 1391, Military Construction Project Data Sheet, used to state requirements and justifications in support of funding requests for military construction projects,
    - Work Request of existing facilities projects,
    - Backup information project files
    - Installation development plan
    - Similar past projects
    - As-built drawings on the subject facilities
    - Sweet's Catalogue volumes or CD ROM database, a comprehensive series of commercial catalogs of building materials and equipment used in building technology
    - The Environmental Impact Statement (EIS) or Environmental Assessment (EA)
- Section 373 of the Defense Authorization Act for fiscal year 1999 requires that the Secretary of Defense establish a comprehensive readiness reporting system. The act specifies "the system shall include the capability to measure, on a quarterly basis, the capability of defense installations and facilities and other elements of Department of Defense infrastructure, both in the United States and abroad, to provide appropriate support to forces in the conduct of their wartime missions."

- 10 USC Chapter 159 – Real Property; Related Personal Property; and Lease of Non-Excess Property.
- 10 USC 2667(f) (Base Closure or Realignment). The Defense Base Realignment and Closure Act of 1990 and the Federal Property and Administrative Services Act of 1949 provide the basic framework for the transfer and disposal of military installations closed during the base realignment and closure (BRAC) process.
- The environmental requirements at an overseas facility or activity will depend on the requirements and standards set by the host country and Status of Forces Agreements (SOFAs). The DoD Overseas Environmental Baseline Guidance Document (OEBGD) provides guidance, procedures and criteria for environmental compliance outside the U.S. In addition, DoD has designated Executive Agents that have negotiated Final Governing Standards (FGS) that take into account both laws of the host nation and the Overseas Environmental Baseline Guidance Document.
- Most real estate actions are not done under the Federal Acquisition Regulations (FAR). Key references may be found with local realty offices.
- STANAG-6012 ED1(1), Financial Principles and Procedures Relating to Use of Training Areas and Training Facilities.
- Fielding Community of Practice Logistics Assessment (LA) Handbook Checklist D-9, for site activation information, also see: https://acc.dau.mil/CommunityBrowser.aspx?id=255063&lang=en-US.
- DoD Facilities Recapitalization Front-End Assessment, 2002.
- Facility Investment & Management Directorate, http://www.acq.osd.mil/ie/fim/index.shtml, maintains links for all areas related to facilities and infrastructure, many broken out by DoD Component.
- Helpful links:
    - Installation Standards
        - Whole Building Design Guide
        - Unified Facilities Criteria
        - Anti-Terrorism Standards for Buildings
        - Unified Facilities Guide Specifications
        - Mil-Std-3007 (replaces DoD 4270.1-M)
        - Links to Technical Info – Facilities Design
        - DoD Directives and Instructions
    - Installations and Sites
        - Facility/Installation Definitions
        - Installations and Related Links

U.S. Air Force

- Air Force PAMPHLET 63-128, “Guide to Acquisition and Sustainment Life Cycle Management”, 3.9/pg. 45.
- Air Force Handbook 32-1084, “Facility Requirements”, 1 Sept 1996.
- Air Force Materiel Command’s “Acquisition Sustainment (AS) Tool Kit, AS KNEEPAD Checklist”, Appendix A pg. 96-97, 101.
- AF developed "US Air Force Acquisition & Sustainment Processes Matrix, DTD 1 March 08" contains many additional references.

- AFI 10-503, provides procedures for all basing requests on Air Force real property and also applies to Air Force units requesting basing actions on non-Air Force real property
- AFI 10-501, Program Action Directives (PAD) and Programming Plans will coordinate with site and base logisticians on required assets (support equipment, technical orders, spares/training, etc.).
- AFI 32-9005, Real Property Accountability and Reporting.
- Ensure all allied support (base level) is completed (such as infrastructure, communications, electrical power, and physical security requirements) in accordance with the associated Memorandums of Agreement (MOA)s AFI 16-403, Updating the USAF Program Installations, Units, and Priorities and Movement of Air Force Units.

U.S. Army

- AR 700-127, "Integrated Logistics Support", Table 3-1 pg. 15.
- Army Regulation 700–142, "Type Classification, Materiel Release, Fielding, and Transfer", 26 March 2008.
- "Rapid Action Revision (RAR)", Issue Date: 16 October 2008.

U.S. Navy

- The NAVAIR 6.0 Logistics and Industrial Operations website maintains an on-line library of references, located at http://www.navair.navy.mil/logistics/library.cfm.
- The Naval Facilities Engineering Command (NAVFAC) is the Systems Command that delivers and maintains quality, sustainable facilities, acquires and manages capabilities for the Navy's expeditionary combat forces, provides contingency engineering response, and enables energy security and environmental stewardship, more information is found at https://portal.navfac.navy.mil/portal/page/portal/navfac/NAVFAC_ABOUT_PP.
- Department of the Navy Guide for Conducting Independent Logistics Assessments NAVSO P--692 September 2006, Section 13, Facilities.
- NAVAIR 17-35FR-06, Facility Requirements For Navy and Marine Corps Calibration Laboratories. Note: The facility requirements for calibration laboratories both ashore and afloat are distinctive from other maintenance or general use facilities that a thorough knowledge of these requirements will enhance the planning, design, and budgeting effort.
- NAVAIRINST 13640.1(series) NAVAIR Metrology and Calibration (METCAL) Program

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12.0. Computer Resources

12.0.1. Objective

Identify, plan, resource, and acquire facilities, hardware, software, documentation, manpower and personnel necessary for planning and management of mission critical computer hardware and software systems.

12.0.2. Description

Computer Resources encompasses the facilities, hardware, software, documentation, manpower, and personnel needed to operate and support mission critical computer hardware/software systems. As the primary end item, support equipment, and training devices increase in complexity, more and more software is being used. The expense associated with the design and maintenance of software programs is so high that one cannot afford not to manage this process effectively. It is standard practice to establish a computer resource working group to accomplish the necessary planning and management of computer resources.

Computer programs and software are often part of the technical data that defines the current and future configuration baseline of the system necessary to develop safe and effective procedures for operation and maintenance of the system. Software technical data comes in many forms to include, but not limited to, specifications, flow/logic diagrams, Computer Software Configuration Item (CSCI) definitions, test descriptions, operating environments, user/maintainer manuals, and computer code.

Computer resources is the information technology resources and infrastructure required to operate and support mission critical systems to include manpower, personnel, hardware, software, and documentation such as licenses and services.

Product Support Manager Activities

12.1 Information Technology

Per Subsection III of Title 40, the term `information technology', with respect to an executive agency means any equipment or interconnected system or subsystem of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the executive agency. For purposes of the preceding sentence, equipment is used by an executive agency if the equipment is used by the executive agency directly or is used by a contractor under a contract with the executive agency which (i) requires the use of such equipment, or (ii) requires the use, to a significant extent, of such equipment in the performance of a service or the furnishing of a product. The term `information technology' includes computers, ancillary equipment, software, firmware and similar procedures, services (including support services), and related resources. Notwithstanding the above, the term `information technology' does not include any equipment that is acquired by a Federal contractor incidental to a Federal contract.

Information Technology manpower includes computer scientists, information technology management specialists, computer engineers, telecommunications managers, etc., who directly support the acquisition of information technology. The employee identifies requirements; writes and/or reviews specifications; identifies costs; obtains resources (manpower, funding, and training); supports portfolio management, information assurance, and IT-architecture-related activities; and tests, evaluates, plans, obtains, and manages life cycle development and support (operations, maintenance, and replacement).

The DoD is developing a comprehensive new process to acquire and deliver IT capabilities. This process will leverage ongoing Department efforts to streamline Defense Business Systems (DBS) acquisition and incorporate best practices garnered from engagement with industry and lessons learned from ongoing DoD efforts. The new process is intended to take full advantage of the speed of IT innovation from commercial industry to foster an environment for mission focused and time-critical deliveries that support the full spectrum of IT applications within the DoD. Significant and fundamental change across the Department's processes is envisioned to not only improve the IT acquisition cycle time but also to realize the advantages inherent within the operations and maintenance of IT products and services. Requirements, resourcing, and acquisition management will be synchronized and streamlined with risk-scaled oversight through frequent in-process reviews and milestone decision points. IT will be acquired as "time-boxed" projects delivering capability in an iterative fashion using mature technologies, while managed in capability-aligned portfolios to identify and eliminate redundancy. The new IT acquisition process will apply across the DoD information enterprise, delivering effective IT

to our front line War fighters and enabling more efficient business operations. More information is found at the DAU community of practice site at https://dap.dau.mil/career/irm/Pages/Default.aspx and https://acc.dau.mil/it.

12.1.1 Integrated Data Environment (IDE)

The Integrated Digital Environment (IDE) initiative is the DoD approach to breaking away from non-interoperable and costly program-unique information environments. The initiative has moved a long way since its inception and currently focuses on an enterprise-level IDE for the Acquisition and Sustainment community. The DoD IDE initiative is aimed at creating a seamless, collaborative, digital-based business environment for the Acquisition and Sustainment (A&S) community. More information can be found at the DoD IDE website at http://www.acq.osd.mil/pm/old/tpm/ppmo.htm.

An Integrated Digital Environment (IDE) implies an environment of connected knowledge workers, in which the preferred approach to performing work involves instantaneously accessing the required resources to accomplish the necessary tasks and then outputting the results into an instantaneously accessible form. Information sharing is rewarded, and redundant data development, transmission or storage is frowned upon. The goal of developing an IDE is intended to improve current and future overall operational performance.

12.1.1.1 Integrated Data Environment Goals

DoD policy requires the maximum use of digital operations throughout the system life cycle. The program IDE is part of the larger DoD IDE. It should keep pace with evolving automation technologies and provide ready access to anyone with a need-to-know, as determined by the program manager.

Program managers should establish a data management system within the IDE that allows every activity involved with the program to cost-effectively create, store, access, manipulate, and exchange digital data. This includes, at minimum, the data management needs of the system engineering process, modeling and simulation activities, test and evaluation strategy, support strategy, and other periodic reporting requirements. More information can be found at the DAU community of practice website at https://acc.dau.mil/CommunityBrowser.aspx?id=24420.

12.1.1.2 Global Combat Support System (GCSS)

The Global Combat Support System (GCSS) Combatant Commanders/ Joint Task Force (CC/JTF) was developed by the Defense Information Systems Agency (DISA) to respond to the operational concept of Focused Logistics articulated in Joint Vision 2010, and reinforced in Joint Vision 2020. Focused logistics is the fusion of logistics information and transportation technologies for rapid crisis response; deployment and sustainment; the ability to track and shift units, equipment and supplies and the delivery of tailored logistical packages directly to the Warfighter. Website found at http://www.disa.mil/Services/Command-and-Control/GCSS-J.

12.1.1.2.1 Global Combat Support System Air Force (GCSS-AF)

The mission of GCSS-AF is to provide timely, accurate, and trusted Agile Combat Support (ACS) information to Joint and Air Force commanders, their staffs, and ACS personnel at all ranks and echelons, with the appropriate level of security needed for the Expeditionary

Aerospace Force to execute the Air Force mission throughout the spectrum of military operations. In addition, GCSS-AF is the means by which ACS Automated Information Systems (AIS) will be modernized and integrated to improve business processes. Website is at https://www.gcss-af.com/cfs/outreach/index.cfm.

12.1.1.2.2 Global Combat Support System Army (GCSS-A)

GCSS-A will be one single system that contains the functionality associated with the business areas of supply, maintenance, property, and tactical finance. GCSS-Army is an integrated system where users with access and permissions can login and perform their business area missions regardless of their position in the modular structure or location throughout the world. GCSS-Army is an integrated solution, meaning that all data exists in a single database and is accessible to all authorized users. Integration promotes accuracy, timeliness, and enables significant economies of scale in such areas as system support, training, and management. GCSS-Army will replace the existing suite of legacy STAMIS which includes the Standard Army Retail Supply System, Standard Army Maintenance System Enhanced, Property Book Unit Supply Enhanced, Unit Level Logistics System - Aviation Enhanced, a host of unique applications, and the materiel management structure associated with these systems. Website is found at https://gcss.army.mil/.

12.1.1.2.3 Global Combat Support System Marine Corps (GCSS-MC)

GCSS-MC provides capabilities that support the physical implementation requirements and support discreet performance measures necessary to accomplish enterprise logistics transformation objectives. The Program Manager is chartered to deliver integrated functionality and a logistics SDE implemented through the maximum use of COTS and GOTs software, enterprise application integration/middleware software, and web portal software. The Program Manager acquires capabilities that satisfy the Marine Corps Logistics Transformation Plan and the Marine Corps Logistics Campaign Plan. The GCSS-MC program, when fully implemented, will sustain an enterprise strategy designed to enable business processes and modernize information technology required to improve combat effectiveness for 21st century expeditionary operations. Website found at http://www.marines.mil/unit/marcorsyscom/Pages/Level-02/IndPMs/GCSS-MC/MCSC-Level02-IndPMs-GCSS-MC.aspx.

12.1.1.3 Government-Industry Data Exchange Program (GIDEP)

GIDEP is a cooperative activity between government and industry participants seeking to reduce or eliminate expenditures of resources by sharing technical information. Since 1959, over $2.1B in prevention of unplanned expenditures has been reported.

The key concepts of GIDEP are sharing information and connectivity between government and industry associates. GIDEP is the centralized source of critical types of information essential to many projects and programs. Information in an ALERT can help your organization avoid thousands of dollars in lost productivity, increase customer confidence and sometimes even avoid catastrophic loss of life or systems. In other cases loss of source for parts and components restricts manufacturing capacity and for systems having 10 to 40 year life expectancy, loss of logistics support for sustainability. Organizations participating in GIDEP agree to supply appropriate types of information such as parts related engineering and management reports. Website found at http://www.gidep.org/about/gidep_policy_guidance.pdf.

12.1.1.4 Department of Defense Architecture Framework (DoDAF)

The DoD Architecture Framework (DoDAF) was established as a guide for the development of architectures. The DoDAF provides the guidance and rules for developing, representing, and understanding architectures based on a common denominator across DoD, Joint, and multinational boundaries. It provides insight for external stakeholders into how the DoD develops architectures. The DoDAF is intended to ensure that architecture descriptions can be compared and related across programs, mission areas, and, ultimately, the enterprise, thus, establishing the foundation for analyses that supports decision-making processes throughout the DoD. Website found at http://cio-nii.defense.gov/docs/DoDAF_volume_I.pdf

The DoDAF is a three-volume set that inclusively covers the concept of the architecture framework, development of architecture descriptions, and management of architecture data:
• Volume I introduces the DoDAF framework and addresses the development, use, governance, and maintenance of architecture data;
• Volume II outlines the essential aspects of architecture development and applies the net-centric concepts to the DoDAF products;
• Volume III introduces the architecture data management strategy and describes the pre-release CADM v1.5, which includes the data elements and business rules for the relationships that enable consistent data representation across architectures.

An Online DoDAF Journal, hosted on the DoD Architecture Registry System (DARS) website (https://dars1.army.mil/IER/index.jsp) replaces the DoDAF v1.0 Desk Book and is designed to capture development best practices, architecture analytical techniques, and showcase exemplar architectures.

12.1.2 Communications and Connectivity

CIO Teri Takai told Congress that greater use of mobile devices and social networks requires changes in the Defense Department's network strategy. The Department of Defense (DoD) is investing in networks that can provide always-on connectivity to support the military's growing use of mobile devices and greater dependency on the Internet for information sharing. The recently published Information Enterprise Strategic Plan focuses on an interoperable infrastructure with A more robust, reliable, rapidly scalable and interoperable infrastructure provides connectivity and computing capabilities that allow all DoD users and mission partners to access, share, and act on the information needed to accomplish their missions. This strategic plan can be found at http://cio-nii.defense.gov/docs/DodIESP-r16.pdf.

12.2 Software

Nearly all DoD systems rely on software for their operation. Software touches virtually every facet of military systems, from the more common Information Technology (IT) systems to the less obvious "embedded" software-intensive systems. Because the vast majority of system functionality is now being implemented via software (vice hardware), the Assistant Secretary of the Navy for Research, Development and Acquisition (ASN(RD&A)) Software Acquisition Management Focus Team believes that all current systems should be considered “software intensive” unless the Program Manager can explain why they are not. Therefore, there is no need

to define what a software-intensive system is. Software is embedded in the aircraft, weapons, ground stations, and support equipment that the DoD delivers to the fleet and supports hroughout their life cycle. It adds tools and weapons capabilities that would likely not be possible otherwise. With the advent of software-driven Portable Electronic Maintenance Aides (PEMAs), diagnostics and prognostics, and maintenance data collection systems, software is also an increasingly critical part of the maintenance environment.

Over the past quarter of a century, many audits and studies have been conducted by various authorities and agencies, including the Government Accountability Office and the Defense Science Board, in an attempt to explain and resolve the problems that the DoD, and by extension the Federal Government, has been encountering in acquiring software and software intensive systems that perform as expected within budget and schedule constraints.
Their findings have been remarkably consistent. Basically, they all concluded that there is insufficient knowledge and skill to effectively manage the life-cycle of those systems where software plays a significant role. In part, these findings led to "Section 804" legislation that mandates that each military department and defense agency develops programs to improve the software acquisition processes of that organization. In concurrence, a joint AT&L and NII memo directed that "... Improvement in the Department's capability to acquire all types of software-intensive systems is a Department-wide objective." The SAM SIA was established as the means to provide relevant and timely information, suggested best practices, lessons learned, and other resources necessary to the successful definition, development, deployment, operation, and maintenance of software components and software intensive systems.

To adequately plan for software support, the acquisition logistician must be a value-added and integral part of the software acquisition processes. DAU maintains a community of practice website for software acquisition management found at https://acc.dau.mil/sam.

12.3 Hardware

Computer hardware, due to the rapid pace of technology change, is often acquired through a Commercial-Off-the Shelf (COTS) system. Per the Defense Acquisition Guidebook, maximum use of mature technology (including non-developmental and/or standards based COTS computer hardware) provides the greatest opportunity to adhere to program cost, schedule, and performance requirements by leveraging industry's research & development and is consistent with an incremental acquisition approach. However, this is not a one-time activity. Unanticipated changes and the natural evolution of commercial items may drive reconsideration of engineering decisions throughout the life cycle. In addition, the program must consider the logistics implications of supporting commercial items in a military environment. Finally, because COTS items have a relatively short manufacturing life, a proactive diminishing manufacturing sources and material shortages / obsolescence approach should also be

considered. Consequently, care must be taken to assess the long term sustainability of COTS options and to avoid or minimize single source options. More information can be found in the DAG in multiple sections, https://acc.dau.mil/CommunityBrowser.aspx?id=346680.

12.4 Licenses

Per the USAF Weapon Systems Software Management Guidebook, commercial software is set forth in DFARS 252.227-7014(a) as software developed or regularly used for non-governmental purposes and either 1) sold, leased, or licensed to the public; 2) offered for sale, lease, or license to the public; 3) doesn't meet the two prior conditions but will be available for commercial sale, lease, or license in time to satisfy the delivery requirements of this contract; or 4) meets any of the prior three conditions and would require only minor modification to meet the requirements of the contract.

Commercial computer software should be acquired under the licenses customarily provided to the public unless such licenses are inconsistent with federal procurement law or do not otherwise satisfy user needs. For example, a commercial computer software license may be modified to refer to federal law instead of a particular state law or modified to request source code in order to support a program requirement to integrate the software into an existing system. Noncommercial software is any software that does not meet the description of commercial software.

For noncommercial software the DFARS includes a standard set of license rights that delineate what the Government can expect, but if these are either 1) not cited, 2) not exercised, or 3) not appropriate for the needs of the Government, then the ability of the Government to take full advantage of the products being acquired will be compromised. It is important to understand that, according to law, the contractor typically owns whatever they develop, such as computer software, computer software documentation, or technical data unless a special works clause is provided in the contract. The Government only receives license rights to use these items. It is therefore crucial that the Government negotiates license rights that are needed for any specific acquisition. The DFARS standard license language provides rights only if the DFARS clauses are placed into the contract. Even then it is possible that the rights might not meet the needs of a particular acquisition.

Appropriate Contract Data Requirements Lists (CDRLs) or other contract deliverables should be prepared for any software that the Government program intends to use, modify or distribute to other contractors.

12.5 Computer Resources Life Cycle Management

Computer Resources Life Cycle Management describes the development, acquisition, test, and support plans over the life cycle of computer resources integral to, or used in, direct support of systems.

Computer Resources Life Cycle Management encompasses the facilities, hardware, software, documentation, manpower, and personnel needed to operate and support mission critical computer hardware/software systems. As the primary end item, support equipment, and training devices increase in complexity, more and more software is being used. The expense associated with the design and maintenance of software programs is so high that one cannot afford not to

manage this process effectively. It is standard practice to establish some form of computer resource working group to accomplish the necessary planning and management of computer resources support. Computer programs and software are often part of the technical data that defines the current and future configuration baseline of the system necessary to develop safe and effective procedures for operation and maintenance of the system. Software technical data comes in many forms to include, but not limited to, specifications, flow/logic diagrams, Computer Software Configuration Item (CSCI) definitions, test descriptions, operating environments, user/maintainer manuals, and computer code. Additional information is found at https://acc.dau.mil/CommunityBrowser.aspx?id=246989.

12.5.1 Requirements

12.5.1.1 Needs Analysis

Needs analysis, also referred to as requirements analysis, involves defining customer needs and objectives in the context of planned customer use, environments, and identified system characteristics to determine requirements for system functions.

Requirements Analysis encompasses the definition and refinement of system, subsystem, and lower-level functional and performance requirements and interfaces to facilitate the Architecture Design process. Requirements Analysis needs to provide measurable and verifiable requirements. Requirements should avoid specifying technological implementations. The requirements being developed by the materiel developer should balance requirements to include performance, functional and technical constraints, and both life-cycle costs and development cycle time. More information can be found at https://acc.dau.mil/CommunityBrowser.aspx?id=332973#4.2.3.2.2.

12.5.1.2 Net-Ready Key Performance (KPP)

Per the DAG 7.3.4, The Net-Ready Key Performance Parameter (NR-KPP) has been developed to assess net-ready attributes required for both the technical exchange of information and the end-to-end operational effectiveness of that exchange. The NR-KPP replaces the Interoperability KPP, and incorporates net-centric concepts for achieving Information Technology (IT) (including National Security Systems (NSS)) interoperability and supportability. The NR-KPP assists Program Managers (PMs), the test community, and Milestone Decision Authorities in assessing and evaluating IT (including NSS) interoperability.

The NR-KPP assesses information needs, information timeliness, Information Assurance (IA), and net-ready attributes required for both the technical exchange of information and the end-to-end operational effectiveness of that exchange. The NR-KPP consists of verifiable performance measures and associated metrics required to evaluate the timely, accurate, and complete exchange and use of information to satisfy information needs for a given capability.

PMs/PSMs will use the NR-KPP documented in Capability Development Documents and Capability Production Documents to analyze, identify, and describe IT (including NSS) interoperability needs in the Information Support Plan and in the test strategies in the Test and Evaluation Master Plan. The following elements comprise the NR-KPP:

- Supporting integrated architecture products, including the Joint Common Systems Function List required to assess information exchange and operationally effective use for a given capability;
- Compliance with DoD Net-centric Data and Services strategies , including data and services exposure criteria;
- Compliance with applicable Global information Grid (GIG) Technical Direction to include DoD IT Standards Registry -mandated GIG net centric IT Standards reflected in the Technical Standards View-1 and, Functional and Technical Implementation of GIG Enterprise Service Profiles necessary to meet the net centric operational requirements specified in the integrated architecture system views;
- Verification of compliance with DoD IA requirements;
- Compliance with Supportability elements to include Spectrum Analysis, Selective Availability Anti-Spoofing Module, and the Joint Tactical Radio System.

12.5.1.3 Information Support Plan (ISP)

The ISP is a requirement for all Acquisition Category (ACAT) programs that connect in any way to the communications and information infrastructure including both Information Technology (IT) and National Security System (NSS) programs. The *ISP* is used by program authorities to document IT, NSS and computer resources needs, objectives, and interface requirements in sufficient detail to enable testing and verification of requirements. The *ISP* also contains interface descriptions, infrastructure and support requirements, standards profiles, measures of performance, and interoperability shortfalls. The ISP is summarized in the Acquisition Strategy and reviewed at Milestones B and C. (DoDI 5000.02 and CJCSI 6212.01D)

12.5.1.4 Life Cycle Signature Support Plan (LCSSP)

LSSP Requirement: DoDD 5250.01 requires that an LSSP be established for signature dependent programs. A program is signature dependent if its sensor, platform, or information system relies on signatures or signature data for design, development, testing, training or operations of sensors, models, or algorithms for the purpose of: combat identification; blue force tracking; targeting, or; detecting & identifying activities, events, persons, materials or equipment.

The LSSP defines specific signature requirements for a program, and becomes more detailed as the system progresses toward IOC. For each required signature, as much detail as possible should be provided in the LSSP. PMs submit an LSSP through their Program Executive Officer (PEO) and respective service requirements coordination hierarchy to the SSP prior to MS A, MS B, and MS C. The timing of LSSP delivery should be coincident with the Technology Development Strategy for MS A, and with the CDD and CPD Phase 1 (O-6/Planner-level) reviews for Milestones B and C respectively. LSSPs will facilitate the Intelligence Certification process relative to signatures. PM and PEO approvals on the LSSP cover indicate that to the best of their knowledge, the LSSP contains a complete list of all signatures required for the Milestone indicated, to support sensor, model and algorithm design, development, testing, training or operations.

If you have any questions on the LSSP, signature requirements or DoDD 5250.01, contact the Signature Support Program. Also see https://acc.dau.mil/CommunityBrowser.aspx?id=289687.

12.5.2 Acquisition

12.5.2.1 Commercial Off the Shelf (COTS)

Per DoN SECNAVINST 5230.15, 10 Apr 2009, COTS software is defined as applications and tools that are ready-made by commercial vendors and are available for sale, lease, or license to the general public, as well as to the Federal Government. COTS software includes desktop and server tools, applications, operating systems, and back office software that is employed in support of DoN Systems.

The use of COTS software brings additional challenges. Development, delivery and upgrades of COTS products are market-driven. Control of the future direction of the component is surrendered. Modifying COTS software is strongly discouraged, as the resulting component is no longer a COTS product. Although security and assurance are important considerations for all software activities, they are critical for COTS products, which may have been developed outside the normal trusted supplier base that is subject to industrial security requirements.

Per the Defense Acquisition Guidebook, para. 4.4.2., use of COTS items offers significant opportunities for reduced development time, faster insertion of new technology, and lower life-cycle costs, owing to a more robust industrial base. Maximum use of commercially mature technology provides the greatest opportunity to meet program cost, schedule, and performance requirements and is consistent with an evolutionary acquisition strategy. However, regardless of the extent to which a system is made up of commercial items, the program manager still engineers, develops, integrates, tests, evaluates, delivers, sustains, and manages the overall system. The program manager should pay particular attention to the intended product use environment and understand the extent to which this environment differs from (or is similar to) the commercial use environment. Subtle differences in product use can significantly impact system effectiveness, safety, reliability, and durability.

The marketplace drives COTS product definition, application, and evolution. COTS products presume a flexible architecture (in most cases an open architecture) and most often depend on product releases that are designed to be used "as is" to meet general business needs, not a specific organization's needs. Consequently, if a program purchases a "modified COTS product" (which, by definition, is not a COTS product) or modifies a COTS product on its own, then the program may lose the ability to use the vendor's subsequent product upgrades or to find a suitable replacement for the product from other commercial sources. Moreover, COTS products require continuous monitoring of the commercial marketplace through market research activities and continuing alignment of business and technical processes, and impose additional cost, schedule, and performance risks that the acquisition community should pay attention to and plan for.

12.5.2.2 Government Off the Shelf (GOTS)

Government off-the-shelf (GOTS) is a term for software and hardware Government products that are ready-to-use. They were created and are owned by the Government. Typically GOTS are developed by the technical staff of the government agency for which it is created. It is sometimes developed by an external entity, but with funding and specification from the agency. Because agencies can directly control all aspects of GOTS products, these are generally preferred

for government purposes. GOTS software solutions can normally be shared among Federal agencies without additional cost. GOTS hardware solutions are typically provided at cost (i.e. R&D costs not recouped). A report by the Defense Science Board Task Force on Integrating Commercial Systems into the DoD, Effectively and Efficiently can be found at http://www.acq.osd.mil/dsb/reports/ADA494760.pdf.

12.5.2.3 Non-Developmental Items (NDI)

Non-Developmental Software (NDS) is any software that is not legacy software for the program, or is not developed as part of the effort being accomplished by the developer team. NDS includes COTS software, government furnished software, open source software, and software being reused from another program. NDS can provide significant benefits including faster delivery of capabilities, reduced costs, and faster technology upgrades. NDS can also introduce numerous risks to the program that can have contractual and long-term sustainment implications. Robust systems engineering is essential for developing a system using NDS.

When contemplating the use of NDS software, consider the following:

- Ensure decisions to use NDS are based on and are traceable to validated system architecture and design requirements;
- Include appropriate NDS activities in the program Integrated Master Plan/Integrated Master Schedule;
- Evaluate all proposed NDS to the extent possible at the start of the development;
- Establish configuration control procedures to address NDS integration, upgrades, and changes throughout the system life cycle;
- Assess suitability and manage technical risk inherent in NDS during the system development phase;
- Address security/assurance concerns with COTS software;
- Track COTS software purchases and maintenance licenses;
- Carefully evaluate for realism those Offerors' proposals that include significant amounts of software re-use.

12.5.2.4 Development

Development within the Computer Resources IPS Element includes that of both hardware and software. Each of these development processes should follow the DoD acquisition processes appropriate for that specific product (i.e., hardware or software deliverable) or process (i.e., software as a service).

Per the Defense Acquisition Guidebook, para. 3.6.1., an automated information system (AIS) is a system of computer hardware, computer software, data and/or telecommunications that performs functions such as collecting, processing, storing, transmitting and displaying information; however, systems that are an integral part of a weapon or weapon system are excluded from this definition. AIS programs that meet the specified dollar thresholds in DoD Instruction 5000.02, Enclosure 3, Table 1, qualify as Major Automated Information System (MAIS) programs. MAIS programs that are subject to review by OSD, at the Information Technology Acquisition Board (ITAB), are designated Acquisition Category (ACAT) IAM. Other MAIS programs, delegated to the head of the DoD Component or the appropriate DoD Component Acquisition Executive, are designated ACAT IAC. In some cases, an ACAT IA program also meets the definition of a

Major Defense Acquisition Program (MDAP). In these cases, the USD(AT&L) is the Milestone Decision Authority unless delegated to a DoD Component, and the statutory requirements that apply to both MAIS programs and MDAPs apply.

12.5.2.5 System Security and Information Assurance

Information assurance refers to Information operations that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and non-repudiation. This includes providing for the restoration of information systems by incorporating protection, detection, and reaction capabilities. More information can be found at the DAU Community of Practice site at https://acc.dau.mil/CommunityBrowser.aspx?id=24671 or in the Defense Acquisition Guidebook, Section 7.5, found at https://acc.dau.mil/CommunityBrowser.aspx?id=334056.

12.5.2.5.1 Certification and Accreditation

Certification and accreditation is a process that ensures that systems and major applications adhere to formal and established security requirements. Certification and accreditation is required by the Federal Information Security Management Act (FISMA) of 2002. For the Air Force, the PM for Air Force information systems must ensure the system is certified and accredited in accordance with DoDI 8510.01, DoD Information Assurance Certification and Accreditation Process (DIACAP), AFPD 33-2, Information Assurance (IA) Program and AFI 33-210, Air Force Certification and Accreditation (C&A) Program (AFCAP). PSMs should check with their respective DoD Components for applicable guidelines and regulations. PSMs should also ensure that C&A is budgeted and funded early in the program.

12.5.3 Operations

12.5.3.1 Verification and Validation

Verification and validation is the process of evaluating a system or software component during, or at the end of, the development process to determine whether it satisfies specified requirements. Independent verification and validation is an independent review of software performed by an organization that is technically, managerially, and financially independent of the development organization. More information is found at https://acc.dau.mil/CommunityBrowser.aspx?id=38502.

12.5.3.2 Fielding

Post-Production Software Support (PPSS) Contracts are established to ensure systems engineering and sustainment principles, processes and practices are applied to software maintenance, and to obtain software support after fielding.

Software support begins early in the life cycle with the identification of software support requirements within the Life Cycle Sustainment Plan (LCSP). Rights in technical data and software data rights are significant components of the Data Management Strategy as required by DoDI 5000.02. The Systems Engineering process addresses the development of software as a configured item equal to hardware in all programs, therefore addressed in program reviews, systems requirements reviews, testing, sustainment planning, and maintained as part of Operations and Maintenance (O&M) phase activities.

As discussed in the NAVAIR Software Logistics Primer Version 1.0 DTD August 2008, software support considerations are uniquely different that those of hardware support. Hardware support activities are typically dominated by preventive and corrective maintenance, which involves replacement or repair of a failed part. The failed part is replaced with an identical, functioning part. When software fails, the software engineer does not replace the offending code with an identical piece of code, but rather must modify the code to provide the needed functionality. Software modification is undertaken to defect corrections, address policy or doctrine, ensure safety, enable interoperability, reflect hardware changes, accommodate technology insertion, and incorporate functional changes.

Typically, Software Support costs include the labor, material, and overhead costs incurred after deployment in supporting the update, maintenance and modification, integration, and configuration management of software. These costs include operational, maintenance, support and diagnostic software programs for the primary system, support equipment, and training equipment. The respective costs of operating and maintaining Software Support Environment (the associated computer/peripheral equipment and associated software dedicated to performing software maintenance) and the cost to conduct all testing of the software should also be included. Other costs may include licensing fees for commercial software and accreditation of processes and facilities.

The identification and establishment of Software Support Activity (SSA) is the first step in the preparation of a Post-Production Software Support Contract. The Software Support Activity assumes the role of providing post-deployment life cycle support for modifications or upgrades made to a system's software following the system's initial fielding. System modifications and upgrades include multi-system changes, block changes, preplanned product improvements, repair of deficiencies reported by the user, and other types of system change packages. The SSA organization typically compiles these needed updates into formal software releases to avoid disrupting the fielded system. Software development activities performed by a SSA in providing life cycle support are the same as those carried out during the development effort that led to the first fielding. They are tailored, as appropriate, to reflect the effort required to implement each change package, update pertinent documentation, verify the changes, and distribute the changes to users.

Non-organic software support may be achieved through either traditional contacting methods or through a Performance-Based Logistics (PBL) program. If commercial software support is required, the steps in obtaining software support contracts parallel those of the original procurement, to include preparation of requirements, development of a procurement package, to include a statement of work/objectives, Contract Data Requirements, deliverables, contract pricing and evaluation and award criteria. Under the Performance-Based Logistics (PBL) construct, Performance-Based Agreements may be structured to provide software support. In either case, a clear statement of outcomes to be achieved and the metrics needed to evaluate success are required.

12.5.4 Software Sustainment

Software maintenance consists of correcting faults, improving performance or other attributes, and adapting to a changing organization and technical environment. To be complete, there is usually a fourth category of maintenance activities focused on anticipated problems, or preventive maintenance.

Software sustainment addresses other issues not always an integral part of maintenance such as documentation, operations, deployment, security, configuration management, training (users and sustainment personnel), help desk, COTS product management, and technology refresh. Successful software sustainment consists of more than modifying and updating source code. It also depends on the experience of the sustainment organization, the skills of the sustainment team, the adaptability of the customer, and the operational domain of the team. Thus, software maintenance as well as operations should be considered part of software sustainment. The Software Engineering Institute has developed a report under DoD contract on "Sustaining Software Intensive Systems", found at http://www.sei.cmu.edu/reports/06tn007.pdf.

Each of the Services maintains policy for sustainment of computer resources hardware, software and services. Additional attention should be made if the program contains a mission-critical system. A mission-critical system is one whose operational effectiveness and operational suitability are essential to successful mission completion or to aggregate residual combat capability. If this system fails, the mission likely will not be completed. Such a system can be an auxiliary or supporting system, as well as a primary mission system. The Product Support Manager must be aware of any mission critical designations within the Computer Resources area since programs require an IA Strategy if they are designated Mission Critical or Mission Essential. The Product Support Manager should refer to the DAG and the owning DoD Component for mission criticality management, system development and reporting requirements.

12.5.4.1 Maintenance

Per the USAF Weapon Systems Software Management Guidebook, as an example, program leadership should ensure there is an integrated data management system with obsolescence precautions that:

- Considers the use of non-developmental tools and interfaces with Government data management systems;
- Considers Modular Open System Architecture (MOSA);
- Allows single manager and developer immediate access;
- Preserves trade study and other requirement decision rationale documentation.

Every PSM must have a good support plan when dealing with networked (SIPR or NIPR), un-networked systems and the handling of computer Hard Drives that become SECRET.

12.5.4.2 Upgrades

Per the DAG 4.4.16, the program manager/PSM should structure a software development process to recognize that emerging capabilities and missions will require modification to software over the life cycle of the system. To deliver truly state-of-the-software, this process should allow for periodic software enhancements.

The DoD should use performance specifications (i.e., DoD performance specifications, commercial item descriptions, and performance-based non-Government standards) when purchasing new systems, major modifications, upgrades to current systems, and commercial and non-developmental items for programs in all acquisition categories. The Department should emphasize conversion to performance specifications for re-procurements of existing systems at the subsystems level; and for components, spares, and services, where supported by a business case analysis; for programs in all acquisition categories.

12.5.4.3 Modifications

Software modifications management strategy and implementation plan should be contained in the Software Development Plan (SDP). The Software Development Plan describes a developer's plans for conducting a software development effort. The term "software development" in this context is meant to include new development, modification, reuse, reengineering, maintenance, and all other activities resulting in software products. The SDP provides the acquirer insight into, and a tool for monitoring, the processes to be followed for software development, the methods to be used, approach to be followed for each activity, organization, and resources. The SDP should be developed in the contractor‘s preferred format, and should document all processes applicable to the system to be acquired, at a level of detail sufficient to allow the use of the SDP as the full guidance for the developers. It should contain or reference specific standards, methods, tools, actions, reuse strategy, and responsibility associated with the development and qualification of all requirements, including safety and security.

Software confirmations from LCMC Software Engineering Directorates, regression testing, and vulnerability testing must all be done to ensure Defense Information Assurance Capabilities Assessment Program (DIACAP) compliance is maintained

12.5.4.4 Service Level Agreements (SLAs) or Software as a Service (SaaS)

The Department of Defense Enterprise Software Initiative (DoD ESI) has developed the SaaS Toolkit to provide independent and unbiased educational materials for the DoD information technology acquisition and management community. The toolkit is available at www.esi.mil and provides access to decision-analysis tools and contract-related forms to streamline the process of understanding, evaluating and acquiring SaaS offerings throughout the DoD. The below information, available on the U.S. Navy CIO website, captures some of the key educational content from the toolkit and explains the key differences between perpetual licensing and the SaaS model.

SaaS is a method of software deployment and an alternative to perpetual software licensing. With SaaS, applications are owned, delivered and managed remotely by one or more providers over the Internet or an intranet, and licensed to customers as an on-demand service. An application can be run directly from a SaaS provider's web servers or downloaded to an end-user's device; and it can be disabled after use or after the on-demand contract expires

12.5.4.5 Disaster Recovery

Disaster recovery plans take many forms but all should be focused on the diligent planning and preparation to minimize downtime and data loss in the event of an interruption in service or a failure of one or more items within the information network.

Disaster recovery plans should address three main functional areas:

1) Recovery: being able to recover data necessary to perform operations;
2) Restoring / Sustaining Operations: critical computer processes will need to be supported, especially during periods of electrical interruption; and
3) Transferring Data Back to Operations Equipment: eventually operations will need to be transferred back from the backup infrastructure to the permanent restored infrastructure.

Disaster recovery plans should address the technical areas of hardware, the network, and software (tools, applications, third party software and the main operating system) that is separate from the network itself. Each Service, Agency and most subordinate organizations within the DoD develop and maintain their own disaster recovery programs which are linked back to a higher organization's recovery plan. Program Managers/PSMs should check with their respective organizational CIO offices for the most appropriate DRP planning tools and processes.

12.5.5 End-of-Life

As commercial and consumer system lifecycles shrink, the components used in those broad markets are facing ever shorter life spans. Today, end products in those areas are almost universally designed to be disposable. The DoD remains as one segment of the electronics market that repairs and upgrades its electronics subsystems rather than just throwing out the obsolete product.

There's a well-established infrastructure of companies and government organizations addressing the obsolescence problem with a variety of ways to deal with the problem of a chip or board that has gone end-of-life. For example, there are numerous after-market chip suppliers who stock inventories of obsolete devices. Among them is a mix of small firms specializing in after-market business, and large distributors who include after-market products in their portfolio.

Product lines are discontinued when the economic factors for their continuance are unfavorable. As the market shifts to a new technology, demand is reduced for earlier models and configurations and the cost for supporting the technology escalates. Suppliers must either raise the price (to maintain profit margins and offset reduction in demand) or terminate the product line. Accepting price increases or diminished availability as the supplier eliminates the remaining inventory are poor choices for the customer. In the end, customers pay significantly increased sustainment costs and are eventually forced to upgrade or replace systems with newer technologies. This is referred to as Diminishing Manufacturing Sources (DMS). Find more information on DMSMS in section 3.4 "DMSMS" of this Guidebook.

12.5.5.1 Storage

The Department of Defense is transforming to become a net-centric force. This transformation is based upon the recognition that information is a critical strategic component that enables decision makers at all levels to make better decisions faster and to act sooner. Ensuring timely and trusted information is available where it is needed, when it is needed, and to those who need it is at the heart of net-centricity. The DoD has a strategy document for the Vision for a Net-

Centric, Service-Oriented DoD Enterprise found at http://cio-nii.defense.gov/docs/DodIESP-r16.pdf.

According to the DoD Information Enterprise Strategic Plan, one major challenge facing the Department today is transforming from its legacy of system-specific infrastructures to a shared infrastructure that can deliver capabilities at varying levels to consumers and providers of the Department's data and services. This goal seeks to transform the DoD GIG infrastructure into a more dynamic and adaptable shared environment that is sufficient to support global net-centric operations. As DoD moves further along the net-centric operations path, the Department must transform its infrastructure concept to support new service-oriented approaches, such as cloud computing and virtualization, for sharing, storing, processing and transporting information. Several beneficial outcomes of this approach will be a smaller physical footprint, and reduced need for skilled touch-labor, logistics and electrical power. These outcomes have mission effectiveness benefits for the Warfighter and support achieving national environmental objectives through green IT approaches. The Defense Acquisition University sponsored a workshop on cloud computing and has posted numerous links to current articles, 30 March 2011 Hot Topic Forum on "Cloud Computing", found at https://acc.dau.mil/CommunityBrowser.aspx?id=437106.

12.5.5.2 Archiving

Data archiving is the process of moving data that is no longer actively used to a separate data storage device for long-term retention. Data archives consist of older data that is still important and necessary for future reference, as well as data that must be retained for regulatory compliance. Data archives are indexed and have search capabilities so that files and parts of files can be easily located and retrieved.
Data archives are often confused with data backups, which are copies of data. Data backups are used to restore data in case it is corrupted or destroyed. In contrast, data archives protect older information that is not needed for everyday operations but may occasionally need to be accessed.

Archival/Retention activities are intended to ensure that data is archived toward organizational regulations and requirements, to meet near-term and far-term needs – and to include Records Management requirements. For some contracts, data may be required to be online or available for periods of time ranging from one year to up to 12 years, for example. Organizations frequently have requirements for retention imposed upon them externally, as from The National Archives and Records Administration (NARA). DoD 5015.02-STD provides an extensive list of references to United States Code, Executive Orders, Policy, and Guidelines for Data and Records storage.

12.5.5.3 Disposal

Information systems capture, process, and store information using a wide variety of media. This information is not only located on the intended storage media but also on devices used to create, process, or transmit this information. These media may require special disposition in order to mitigate the risk of unauthorized disclosure of information and to ensure its confidentiality. Efficient and effective management of information that is created, processed, and stored by an information technology (IT) system throughout its life, from inception through disposition, is a primary concern of an information system owner and the custodian of the data.

With the use of increasingly sophisticated encryption, an attacker wishing to gain access to an organization's sensitive information is forced to look outside the system itself for that information. One avenue of attack is the recovery of supposedly deleted data from media. These residual data may allow unauthorized individuals to reconstruct data and thereby gain access to sensitive information. Sanitization can be used to thwart this attack by ensuring that deleted data cannot be easily recovered.
When storage media are transferred, become obsolete, or are no longer usable or required by an information system, it is important to ensure that residual magnetic, optical, electrical, or other representation of data that has been deleted is not easily recoverable. Sanitization refers to the general process of removing data from storage media, such that there is reasonable assurance that the data may not be easily retrieved and reconstructed.

A good guidebook written by the National Institute of Standards and Technology can be found at http://csrc.nist.gov/publications/nistpubs/800-88/NISTSP800-88_rev1.pdf. PSMs should also check with their respective Components for additional information.

Computer Resources in the Life Cycle

A. Purpose

Most weapon systems today have a significant investment in embedded and external software with its related hardware. The challenges to The Product Support Manager occur because software and computer hardware support does not necessarily follow the traditional life cycle product support processes and tenets. Additionally, the field of software is advancing rapidly with new development, production and supportability technologies appearing every year, offering new capabilities, creating new requirements, but driving obsolescence problems even before a system can be fielded.

a. Why Computer Resources is Important

The role of information technology and computer hardware and software is becoming ever more integral to the operation and support of all weapon systems. In fact, most weapon systems can no longer function properly without their integrated information technology system operating correctly.

The activities occurring within the scope of this area should be integrated with other product support element areas in keeping with KPP and KSA optimization goals and constraints.

b. Summary of Activities by Acquisition Phase

The table below describes the major computer resources activities and deliverables of the Defense Acquisition System by phase emphasizing Life Cycle Support activities. These deliverables are significant because The Product Support Manager must provide Life Cycle Product Support information. Since each weapon system acquisition program is different, the actual activities and information required may change from program to program. The Product Support Manager should review their respective program requirements for each document and be

prepared to provide the required information. The table summarizes the key activities and types of information required for each phase.

Note that the Logistics Analysis (LA), also known as an independent logistics analysis, is part of **each** Milestone Decision Package and is a requirement for type classification.

The Product Support Manager should review the Defense Acquisition Guidebook with emphasis on Chapter 5, but a careful reading of the entire document is highly recommended.

Below is the table for Computer Resources IPS Element highlighting those activities and major products which generally occur by acquisition phase to include Operations and Support. Please note that the first table, Product Support Management, included in the left column a listing of all deliverables to support requirements for Milestone/Decision Reviews, *See enclosure 4, DoDI 5000.02 and also the DAU website at* https://ilc.dau.mil/back_pg1.html#. The tables for the IPS Elements of Design Interface through Computer Resources reflect major activities and products by phase. The listing of individual deliverables to support Milestone/Decision Reviews in the left hand column is not subsequently reprinted.

Acquisition Phase	**Computer Resources Major Activities**
User Need / Technology Opportunities & Resources	Understanding user needs in terms of performance is an essential initial step in developing a meaningful computer resources strategy because changes to the CONOPS or the sustainment approach may impact the effectiveness, suitability, or cost of the system. Market analysis is performed to assess the availability of qualified suppliers to meet specific sustainment requirements. The Product Support Manager must be able to understand and forecast computer resource requirements to actual product support sustainment activities and outcomes. The Product Support Manager is directed to the most current version of the CJCS Instruction 3170.01. Determine applicability of net readiness which applies to Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance systems and to any weapon or system that share data. In general, every system is required to have a Net-Ready Key Performance Parameter (KPP) (NR-KPP) and be certified for net readiness. Key Products: • Requirements • Metrics • Computer Resources and information management strategy
Materiel Solution Analysis	The Analysis of Alternatives (AoA), Initial Capabilities Document (ICD) and initial Life Cycle Sustainment Plan (LCSP) are the primary deliverables of the material solution analysis phase. The AoA requires, at minimum, full consideration of possible trade-offs among cost, schedule, and performance objectives for each alternative considered. Trade-off studies validate and forecast computer resources product

	support sustainment. Specific analysis focuses on the approach for achieving the required enabling computer resources technologies to implement the product support strategy and achieve the sustainment metrics. Risks to achieving the necessary support structure for the time frame of the program by IOC should be identified and a mitigation strategy outlined. The specific enabling support technologies should be identified along with the corresponding plan to technically mature each support element. The Product Support Manager is referred to the Defense Acquisition University's Community of Practices at https://dag.dau.mil/Pages/Default.aspx or https://dap.dau.mil/aphome/das/pages/mdid.aspx for a complete list of Milestone Decision Review required documents. Key Products: • Computer resources concept • Long lead items identification and planning • Inputs to required acquisition documents
Technology Development	The primary document incorporating computer resource sustainment plans and outcomes is the LCSP. After Milestone A the LCSP evolves from a strategic outline to a management plan describing the sustainment efforts in the system design and acquisition processes to achieve the required performance and sustainment outcomes necessary to ensure required Warfighter capabilities. A detailed outline for the LCSP can be found in the Defense Acquisition Guidebook, Chapter 5.1.2.2. and the DAU community of practice at https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3303/USA005157-11_SignedLCSPMemo_14Sep2011.pdf. Computer resources are important early in the acquisition phase to test product support strategies and evaluate risk. Computer-generated product support scenarios, as well as synthetic stimulation of the system, support T&E by creating and enhancing realistic live test environments. PSM's should follow best practices for acquisition of computer resources software capabilities and services as defined in the DAG para.4.4.16. • Viewing the software "content," particularly complex algorithms and functional flows, as enabling technologies requiring maturation and risk reduction before Milestone B, • Developing architectural-based software systems that support open system concepts, • Exploiting commercial, off-the-shelf (COTS) computer systems products, • Allowing incremental improvements based on modular, reusable, extensible software, • Identifying and exploiting, where practicable, government and commercial software reuse opportunities before developing new software, • Selecting the programming language in context of the systems and software

	engineering factors that influence system performance, overall life-cycle costs, risks, and the potential for interoperability, • Using DoD standard data and following data administrative policies in DoD Directive 8320.02, • Selecting contractors with domain experience in developing comparable software systems, successful past performance, and demonstrated commitment to disciplined software development process. • Assessing information operations risks (see DoD Directive 3600.01) using techniques such as Program Support Reviews, • Preparing for life-cycle software support or maintenance by planning early in the system life cycle for the transition of fielded software to the support/maintenance activity, developing or acquiring the necessary documentation, host systems, test beds, and computer-aided software engineering tools consistent with planned support concepts, • Tracking COTS software purchases and maintenance licenses, and • Performing system safety engineering tasks on safety-critical systems to reduce the safety risk in all aspects of a program, including the software system safety (SSS) activities involving the design, code, test, Independent Verification and Validation (IV&V), operation & maintenance, and change control functions of the software engineering development process. Key Products: • Computer Resources Plan • Computer resources for test and evaluation • Inputs to required acquisition documents
Engineering & Manufacturing Development	Computer resources requirements identified earlier in the acquisition process should be validated and those that were not defined are assessed for impact. Any final engineering changes as a result of computer resources analysis must be implemented no later than this phase to achieve maximum benefit. Significant changes may be required to the computer resources support package to achieve the objective sustainment metrics including major support provider changes. Key Products: • Computer resources detailed plans • Validation of requirements from test and evaluation • Acquisition activities for computer resources capabilities and services
Production & Deployment	Computer resources activities continue with emphasis on reviewing outcomes of operational test and evaluation, updating trade-off studies, taking part in planning activities that may be on-going already for product improvement, and developing long term plans for design improvements as part of sustaining engineering for both the system and its support infrastructure as documented in the LCSP. Fielding occurs during this phase and proof of early planning is now being validated as the system deploys to the operational site.

	The program manager should structure a software development process to recognize that emerging capabilities and missions will require modification to software over the life cycle of the system. To deliver truly state-of-the-software, this process should allow for periodic software enhancements. Key Products: • Updating computer resources plans to allow for periodic enhancements • Deployment of computer resources capabilities and services to support weapon system fielding and IOC
Operations & Support	Computer resources activities continue throughout the system's operations and support phase and updates / improvements to computer resources capabilities are through multiple avenues which include: 1) new requirements due to fielding of weapon system updates, 2) technology refresh activities, 3) modifications and changes to the system, 4) analysis of failure data and reliability growth programs, plus others. The Product Support Manager 's responsibility is to continue reviewing system performance while looking for opportunities to improve both the system itself and the support infrastructure to optimize cost versus availability. Key Products: • Delivery of computer resources capabilities and services • Maintenance of computer resources infrastructure • Updates and improvements of computer resources capabilities

Table 12.2.T1. Summary of Activities and Deliverables by Acquisition Phase

B. Data Item Description (DID) Deliverables

(Information and a search engine for DIDs is available at the "Assist Online" database at https://assist.daps.dla.mil)

DI-EMCS-80200B, "EMI Test Report"
DI-EMCS-80 201, "EMI Test Procedures"
DI-EMCS-81540A, "E3 Integration and Analysis Report"
DI-EMCS-81541A, "E3 Verification Procedures"
DI-EMCS-81542A, "E3 Verification Report"
DI-IPSC-80590B, "Computer Program End Item Documentation"
DI-IPSC-81428A, "Software Installation Plan (SIP)"
DI-IPSC-81429, "Software Transition Plan (STrP)"
DI-IPSC-81442A, "Software Version Description (SVD)"
DI-IPSC-81443A, "Software User Manual (SUM)"
DI-IPSC-81444A, "Software Center Operator Manual (SCOM)"
DI-IPSC-81446A, "Computer Operation Manual" (COM)

DI-IPSC-81488, "Computer Software Product"DI-EMCS-80199B, "EMI [Electromagnetic Interference] Control Procedures"
DI-MISC-81174, "Frequency Allocation Data"

C. OSD Proponency, Policy, Regulations and U.S. Statutes

a. Proponency

Within the DoD, the Office of the Chief Information Officer ensures that acquired information technology and resources are managed using Government policies and procedures. The primary goals of the DoD CIO are:

- Lead the Department in achieving a persistent and dominant information advantage for ourselves and our mission partners;
- Lead the Department in changing those policies, processes, and culture necessary to provide the speed, accuracy, and agility to ensure mission success in a rapidly changing and uncertain world;
- Ensure a robust and secure information environment;
- Provide modern command and control capabilities through persistent collaboration at all levels and among all mission partners;
- Acquire new information capabilities rapidly (9-12 months) and at low cost by delivering them as enterprise services.

Within the Office of the Undersecretary for Acquisition, Logistics & Technology, the offices which are proponent for systems engineering, Defense Research and Engineering (DDR&E) and logistics, Logistics & Materiel Readiness (L&MR), have responsibilities during weapon system acquisition for the development, acquisition and delivery of computer resources capabilities.

The Office of the Director for Defense Research and Engineering Systems Engineering Directorate is actively involved in international efforts related to defense acquisition, systems engineering, and related efforts and specifically focused on computer resources related topics. Below are two international committees. More information can be found at http://www.acq.osd.mil/se/outreach/intl_partners.html.

b. Policy and Regulation

Note: please see the References at the end of this section for a more complete list of relevant materials.

- The Product Support Manager is invited to review the Defense Acquisition Guidebook, Chapter 7, "Acquiring Information Technology and National Security Systems". This chapter contains 10 sections that present the PM with a comprehensive review of topics, concepts, and activities associated with the acquisition of Information Technology and National Security Systems.

Section 7.1, "Introduction," explains net-centric information sharing in the context of the discussions and requirements outlined in the various other sections of this chapter.

Section 7.2, "DoD Information Enterprise (DoD IE)," explains several important concepts that provide a foundation for acquiring net-centric Information Technology (including National Security Systems). The overarching concept is that of the DoD Enterprise Architecture (EA) as the enterprise information technology architecture used to describe and document current and desired relationships among warfighting operations, business and management processes, and information technology.

Section 7.3, "Interoperability and Supportability of Information Technology and National Security Systems," explains interoperability and supportability, outlines the use of the Net-Ready Key Performance Parameter in these processes, and describes the process of building an Information Support Plan.

Section 7.4, "Net-centric Information Sharing Data Strategy," provides guidance on implementing the Net-centric Data Strategy and outlines important data tasks as they relate to the acquisition process.

Section 7.5, "Information Assurance," explains the requirements for Information Assurance and provides links to resources to assist in developing an Information Assurance strategy.

Section 7.6, "Electromagnetic Spectrum," offers help understanding the process of Spectrum Supportability.

Section 7.7, "Section 508 of the Rehabilitation of 1973," summarizes the requirements of the Workforce Investment Act of 1998," Section 508 of the Rehabilitation Act (as amended in 1998), regarding the purchase, development, maintenance, and use electronic and IT that is accessible to people with disabilities.

Section 7.8, "Clinger-Cohen Act," helps PMs and Sponsors/Domain Owners understand how to implement Subtitle III of title 40 United States Code (formerly known as division E of the Clinger-Cohen Act (CCA) and hereinafter referred to as "Title 40/CCA") and associated regulatory requirements.

Section 7.9, "Post Deployment Reviews," discusses how the Department of Defense (DoD) uses the Post Implementation Review to inform Sponsors of the degree to which their IT/NSS/computer resources investments closed the needed capability gaps.

Section 7.10, "Commercial, Off-The-Shelf (COTS) Solutions," provides insight into DoD guidance regarding acquisition of commercial-off-the-shelf (COTS) software products.

- *NATO AC/327, Life Cycle Management. I*n 2003, the NATO Conference of National Armaments Directors (CNAD) consolidated four CNAD Partnership Groups (AC/250 (Quality), AC/301 (Standardization of Materiel and Engineering Practices), AC/313 (Acquisition Practices), and AC/325 (Life Cycle Management)) into AC/327, Life Cycle

Management. The Director, Systems Engineering, Office of the Director, Defense Research and Engineering, is the past chairman of AC/327. The Deputy Director, Systems and Software Engineering, OUSD (AT&L), is the Chairman of Sub-Group A, Policy and Enterprise Processes. The Chairmanship of Sub-Group B, Project Management and Agreement Processes, resides with the U.S. Army.

- *AC/327, Life Cycle Management*, provides for an integrated, system life cycle approach, and structured process for life cycle management of NATO armament systems, services, and equipment. This is achieved through the managerial integration of all processes necessary to deliver these capabilities. The AC/327 Group is responsible for all acquisition life cycle policies, methods, procedures, and agreements, regarding systems engineering (hardware and software), quality, reliability and maintainability, configuration management, data management, risk management, and test and evaluation; and spanning across the full breadth of NATO systems, services, and equipment (i.e., not limited to armament systems under CNAD).

- *US/UK/AUS Trilateral Software Intensive Systems Acquisition Improvement Group (SISAIG)* The United States/United Kingdom/Australia (US/UK/AUS) Trilateral Software Intensive Systems Acquisition Improvement Group (SISAIG) is focused on working together to improve the acquisition of software intensive systems (SIS). As described in the Framework for Activities [PDF, 474KB], the SISAIG provides a focus for working common issues within a joint forum to enrich and amplify the US/UK/AUS national software acquisition improvement efforts.

D. Who Develops, Delivers and Manages Computer Resources

The program manager has overall responsibility for software and computer hardware acquisition, development, and delivery to the user. The Product Support Manager's responsibilities include an enterprise wide Computer Resources Life Cycle Product Support strategy and resulting implementation that integrates with the all the Product Support Elements and other program areas as necessary to optimize availability, reliability and life cycle cost.

Management during Operations and Sustainment will be dependent on the program objectives, the type of Computer Resources deliverables, and specific management responsibilities within the DoD Components and Agencies.

E. When Is Computer Resources Delivered and Managed in the Life Cycle

Computer Resources requirements start their development during the JCIDS pre-acquisition activities and are important elements of deliverables for all Milestone Decisions. During Operations and Sustainment, The Product Support Manager is encouraged to conduct frequent reviews to determine gaps and risk areas, especially for new capability fieldings, obsolescence, new user requirements, configuration management, reliability, and overall user satisfaction. The

impact of computer resources on program KPP and KSA's can be significant since most operational and logistics processes are electronically driven.

F. How Computer Resources Is Developed, Established and Managed

Each DoD Component has developed policy and regulations to govern the acquisition and management of Computer Resources (software and computer hardware). Each program PSM should refer to their respective organization for further guidance.

a. Software Management Guidelines (per U.S. Air Force guidelines)

Below is a discussion from the USAF Weapon Systems Software Management Guidebook.

Planning for Program Start/Source Selection should address the following activities:

a. Developing a Computer Systems and Software (CS&S) acquisition strategy consistent with the system acquisition strategy, including program objectives and constraints; available and projected assets, resources, and technologies such as Non-Developmental Items (NDI); acquisition methods; potential contract types and terms; end user considerations; risk identification; life cycle support approach; technology insertion; and architecture & interoperability.
b. Defining and establishing the membership and responsibilities for the Air Force organization that will be responsible for software (includes interaction with system developers, testers, supporters, and users; as well as the means of management and control of the CS&S development effort).
c. Identifying and obtaining sufficient trained and experienced personnel to plan and oversee the computer system and software development.
d. Identifying, capturing, documenting, and maturing end user/warfighter needs and requirements specific to CS&S.
e. Identifying any policies, standards, or other guidance applicable to the program.
f. Identifying all software to be developed, reused (used-as-is), modified, integrated, tested, or delivered (includes operational software; tools for software development, integration, test, and data reduction; firmware; databases; software for mission planning, training, automated test, and other support equipment/functions).
g. Examine the range of potential architectural approaches and assess the risks and opportunities associated with each to arrive at initial system/software architecture.
h. Developing an early and independent program office estimate of the expected software size, effort (staff hours), cost, and schedule (prior to release of Request for Proposal (RFP) or receipt of offeror's proposals).
i. Ensuring the planned CS&S development is consistent with the program budget and schedule allocated to software.
j. Developing CS&S inputs to the RFP.

More information on detailed planning for the other acquisition life cycle phases can be found in the USAF Guidebook.

In order to meet the requirements of Section 804, NDAA FY2003, and improve the efficiency and effectiveness of Air Force acquisition processes and software management, SAF/AQ/US Memorandum 04A-003, "Revitalizing the Software Aspects of Systems Engineering", 20 September 2004, originally identified ten software focus areas that programs must address.

The ten focus areas and their associated tasks mandate that software engineering practitioners and managers must:

a. Estimate software development and integration at a high level (80-90%) of confidence.
b. Ensure program baselines support the disciplined application of mature systems/software engineering processes, are compatible with the overall program's Expectation Management Agreement (EMA), and are supported by the program's budget.
c. Manage computer systems and software specific risks as an integral part of the program risk management process.
d. Identify the software-related strengths, weaknesses, experience, process capability, development capacity, and past performance for all developer team members with significant software development responsibilities.
e. Ensure the developer team establishes and applies effective software development processes.
f. Ensure the program office establishes and applies effective acquisition processes, is adequately staffed, and supports application of effective processes by the developer team.
g. Collect and analyze Earned Value Management (EVM) data at the software level.
h. Employ a core set of basic software metrics.
i. Plan and develop life cycle software support capabilities and support operations.
j. Support the transfer of lessons learned to future programs by providing feedback to center level Acquisition Center of Excellence (ACE) and other affected organizations.

b. Computer Resources Life Cycle Management Plan (CRLCMP) (Not required by policy but still recommended for use)

The DoD considers the CRLCMP to be a good method for organizing and documenting such planning. It has traditionally been a key product of the Computer Resources Working Group. The CRLCMP is no longer required by policy, but such a plan can still be developed to establish and document the buy-in of all stakeholders, including the end customer (e.g., Air Combat Command, Air Mobility Command), operational testers, and system sustainers. An outline of this document is below.

WHO - The Product Support Manager, APML , Assistant Program Manager for Systems Engineering, IPT's.

WHAT – The CRLCMP is the primary product of the Computer Resources Working Group (CRWG). The approved document defines and proclaims the entire spectrum of computer resources for the system for the intended life cycle. The CRLCMP includes:

- Software support concept;
- Selection of software source of support;

- Describes the software support concept to enable contractors to provide meaningful trade-offs in supportability analysis efforts, depot support requirement, and in Support Equipment Recommendation Data (SERD) efforts.

The primary planning document for computer resources throughout system life cycle:

- System program plan for computer resource and software requirements, development acquisition and life cycle support including any changes in the system, or its support environment;
- Source of justification in obtaining the resources required to establish the Post-Deployment Software Support (PDSS) capability and to help derive the support requirements by all participating agencies;
- Key Acquisition Strategy source for all software/software support planning for the program office;
- Defines life cycle system strategy for the software support concept, selection of source of software support, hardware design impacts, and other software support decisions and solutions.

WHEN – Milestone B, updated before Milestone C and throughout the system life cycle.

WHERE – NAVAIR, IPT FST, SSA, Fleet, Prime Contractor.

HOW – While there are no longer formal requirements for the CRLCMP, a similar document is needed to address life cycle software support issues for all computer systems and software elements. A format for a Computer Resources Plan is provided in Desk book (see references and links) that can be used and tailored to meet the needs for any software-intensive system.

PSM ROLE –

- Ensure through the IPT process all CRS requirements are identified in the CRLCMP or plan as applicable
- Ensure the Life Cycle Sustainment Plan (LCSP) identifies all supportability requirements including planning, funding and resources necessary maintain and sustain support throughout life of system
- Ensure planning includes hardware, software, user instructions and tech support
- Integrate requirements as required into the software environment planning for the system and user plan
- Sustain the support system requirements

c. DoD Research and Development Facilities

Each of the Services maintains research and development facilities to further support mission critical computer hardware & software operations and support. Examples of these facilities are below:

The U.S. Army Research, Development & Engineering Command's Aviation & Missile Research, Development & Engineering Center has a Software Engineering Directorate (SED) that supports the acquisition, research, development, and sustainment of weapon systems, primarily in the aviation and missile operational areas. This center also develops Munitions Fire Control Systems software for all Services. The SED maintains expertise in the Army's prevailing policies and practices on software reuse, software metrics, post deployment software support, process improvement, computer resource margins analysis, and risk management. The SED's risk based approach to performing Verification and Validation (V &V) is designed to focus on identified problem areas to ensure effective software engineering support with minimum cost. Their website is at http://www.redstone.army.mil/amrdec/RD&E/SED.html.

The U.S. Navy's Naval Air Engineering Station at Lakehurst maintains multiple labs and test facilities to provide full spectrum support for aircraft launch, recovery and support equipment systems for U.S. and Allied Naval Aviation Forces at sea and Marine Corps Expeditionary Aviation Forces ashore. These capabilities include a Software Test Laboratory (STL), Electromagnetic Interference (EMI) Laboratory, an Electric Modeling Laboratory, and the Consolidated Automated Support System (CASS) Product Verification/Evaluation Facility provides the means to perform single site testing on the CASS hardware and associated Test Program Sets (TPS). Their website is at http://www.navair.navy.mil/lakehurst/nlweb/other-labs.asp.

The Air Force's Research Laboratory (AFRL) has multiple initiatives focused on software and information assurance. Below are two examples. More information can be found at http://www.au.af.mil/info-ops/usaf.htm.

- Software Protection Initiative (SPI), AF Research Lab (AFRL). The Software Protection Initiative (SPI) protects critical DoD intellectual property against nation-state class threats by taking an alternative approach to security based on 3 Tenets: 1) Focus on What's Critical, 2) Move it Out-of-Band, and 3) Detect, React, Adapt. SPI researches, designs, develops, tests, and deploys protections to prevent piracy, tampering, and reverse engineering of critical software code and data. SPI builds cost effective, adaptable, strong defenses from today's commercial components. The Air Force Research Laboratory's Anti-Tamper Software Protection Initiative (ATSPI) Technology Office manages SPI for the DDR&E via the High Performance Computing and Modernization Program.

- Information Institute, AF Research Lab (AFRL). The Institute is a virtual, collaborative research environment concentrating on Information Science and Technology. The Information Institute currently consists of universities allied with the US Air Force Research Laboratory Information Directorate at the Rome Research Site and Wright Research Site. Within these categories, supportability is often divided into software, hardware, and supporting functions and elements.

G. Communities of Interest and Practice

a. Communities of Interest

b. Software Technical Standards
c. Software Supportability-Related Technical Standards
d. Information Assurance / System Security – Additional Information

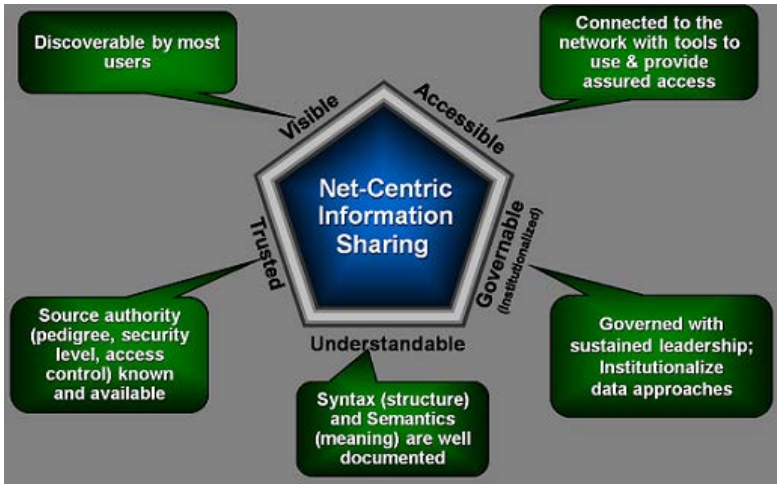
a. Communities of Interest (COIs)

Communities of Interest are an approach for developing the agreements necessary for meaningful information exchange, and doing so collaboratively across the community of people who share a common interest. The COI concept is described in the DoD Net-Centric Data Strategy and directed by DoD Directive 8320.2, "Data Sharing in a Net-Centric Department of Defense".

A COI consists of collaborative groups of users who must have a shared vocabulary to exchange information in pursuit of their shared goals, interests, missions, or business processes. This group includes end users, program managers, application developers, subject matter experts, Combatant Command, Service and Agency representatives, and IT Portfolio representatives.

What do COIs do once formed?

- Identify data assets such as files, databases, and information services
- Make data assets visible, accessible, and understandable (tagged and discoverable)
- Define shared vocabularies and taxonomies
- Register semantic and structural metadata to the DoD Metadata Registry



The COI Newsletter is a quarterly publication provided by the DoD CIO Enterprise Services and Integration (ES&I) Directorate to provide awareness about the activities of COIs and to discuss issues relating to the implementation of the DoD Data Strategy. Issues of the COI Newsletter are listed below:

- Volume 2 Issue 1 - April 2009 (PDF)
- Volume 1 Issue 4 - December 2008 (PDF)
- Volume 1 Issue 3 - September 2008 (PDF)
- Volume 1 Issue 2 - June 2008 (PDF)
- Volume 1 Issue 1 - March 2008 (PDF)

COIs must make data Visible, Accessible, Governable, Understandable and Trusted. The characteristics of a COI include:

- Visible - Users and applications can discover the existence of data assets through catalogs, registries, and other search services. All data assets (intelligence, non-

intelligence, raw, and processed) are advertised or "made visible" by providing metadata, which describes the asset;

- Accessible - Users and applications post data to a "shared space." Posting data implies that (1) descriptive information about the asset (metadata) has been provided to a catalog that is visible to the Enterprise and (2) the data is stored such that users and applications in the Enterprise can access it. Data assets are made available to any user or application except when limited by policy, regulation, or security;
- Governable (Institutionalized) - Data approaches are incorporated into Department processes and practices. The benefits of Enterprise and community data are recognized throughout the Department;
- Understandable - Users and applications can comprehend the data, both structurally and semantically, and readily determine how the data may be used for their specific needs;
- Trusted - Users and applications can determine and assess the authority of the source because the pedigree, security level, and access control level of each data asset is known and available.

On the OSD CIO website, there are numerous web links to communities of interest, below are several with high interest,

- COI Toolkit (DoD PKI Limited Access) Community of Interest Toolkit hosted on DKO.
- COI Directory (DoD PKI Limited Access) Displays information about COIs, Domains, Mission Areas and COI-related resources.
    - Software Acquisition Management COI
- Association For Enterprise Integration (AFEI) The Association for Enterprise Integration (AFEI) provides industry-wide input to government on enterprise-wide net-centric operations and transformation to assist industry in understanding and assessing the implications and impacts of these changes, and to provide a conduit between government and industry. This collaboration is achieved under a charter jointly approved by ASD(NII)/DoD CIO and AFEI.
- Net-Centric Enterprise Services (NCES) Developer Community (DoD PKI Limited Access) Portal for the NCES program that provides COIs with the opportunity to become NCES early-adopters and pilot versions of the Core Enterprise Services.
- DoD Metadata Registry and Clearinghouse (DoD PKI Limited Access) Provides software developers access to data technologies to support DoD mission applications. Software developers can access registered XML data and metadata components, COE database segments, and reference data tables and related meta-data information such as Country Code and US State Code.
- DKO Portal (DoD PKI Limited Access) Collaboration portal and workspaces provided by DISA to support net-centric initiatives.
- Net-Centric Data and Services Strategy Home (*DoD PKI Limited Access)* Command & Control (C2) Portfolio and Warfighter Mission Area site hosted on DKO.
- Universal Core (UCore) *(Limited Access*) UCore is a federal initiative that supports the National Information Sharing Strategy and all associated Departmental / Agency strategies. UCore enables information sharing by defining an implementable specification (XML Schema) containing agreed upon representations for the most commonly shared and universally understood concepts of Who, What, When, Where and How.

The SAE G-11 RMSL Software Committee (G-11SW) belongs to the SAE G-11 Reliability, Maintainability, Supportability and Logistics (RSML) Division. This committee develops and promotes emerging RMSL principles, processes, technologies, and standards to further improve their application to the software component of systems. The SAE G-11 Software Committee should be a leader in developing and promoting software RMSL principles, processes, technologies, and standards for use by international industries and governments.

The G-11SW group was organized in March 1994. G-11SW now consists of approximately 40 participants and 20 full members. The membership is from the United States, United Kingdom, Spain, France, Canada, Germany, Belgium, and Israel.

New Projects:
G-11SW-04-1 Software Safety Program Standard & Implementation Guide (Software Reliability Subcommittee)
G-11SW-04-2 Practical Approach to the Conduct of Software FMEA (Software Reliability Subcommittee)
G-11SW-04-3 Practical Roadmap for Software Reliability (Software Reliability Subcommittee)
G-11SW-04-4 Guidance on Software Material Release (Software Supportability Subcommittee)
G-11SW-04-5 NATO Liaison for Adoption of Software SAE Standards (Software Liaison Subcommittee)

b. Software Technical Standards

Below are technical standards addressing software supportability to include ISO/IEC 12207.

SAE AIR 5121 *Software Supportability - An Overview* (November 2003)
Overview: This Aerospace Information Report (AIR) provides an overview of the issues relating to the support & supportability of software in computer-based systems.
Application: General applicability to all sectors of industry and commerce and to all types of equipment that contain software.
Organization: Society of Automotive Engineers (SAE)
Current status: Active

SAE JA1004 *Software Supportability Program Standard* (November 2003)
Overview: This standard defines recommended practices for the achievement of suitable supportability and through-life support arrangements for software within an overall systems engineering framework. The Software Supportability Plan (goals to achieve) and the Software Supportability Case (demonstration of achievement) are presented as the basis for program management. This standard is applicable to all projects incorporating software, and aims to meet the needs of end-users and of organizations that acquire, develop or provide post-delivery support for software.
Application: The recommended process is applicable to all projects incorporating software. The target audience for this document includes software acquisition organizations, logisticians, developers, supporters, and customers.

Organization: Society of Automotive Engineers (SAE)
Current status: Active - under reaffirmation

SAE JA1005 *Software Supportability Program Implementation Guide* (November 2003)
Overview: This document identifies recommended practices for the implementation of a supportability program for software within an overall systems engineering framework. Guidelines for implementation of a Software Supportability Plan and associated Software Supportability Case are presented. Recommended practices are described for establishing a software supportability program through selection of life cycle activity tasks tailored for the application. Recommended models and process methods to achieve the life cycle activity tasks are briefly reviewed and/or referenced.
Application: The recommended practices are applicable to all projects incorporating software. The target audience for this document includes software acquisition organizations, logisticians, developers, supporters, and customers.
Organization: Society of Automotive Engineers (SAE)
Current status: Active

SAE JA1006 *Software Support Concept* (June 1999 - Reaffirmed November 2003)
Overview: This document provides a framework for the establishment of a software support concept related to the support and supportability of both custom-developed and Off The Shelf (OTS) software. This document provides information needed to understand the support aspects that should be covered by a software supportability program.
Application: The recommended concept is applicable to all projects incorporating software. The target audience for this document includes software acquisition organizations, logisticians, developers, supporters, and customers.
Organization: Society of Automotive Engineers (SAE)
Current status: Active

MIL-HDBK-347 *Mission-Critical Computer Resources Software Support* (May 1990)
Overview: This document provides DoD guidance to improve the operational viability of its weapons systems while keeping support costs under control, standardizing related concepts and management procedures. The document covers pre- and post-deployment software support operations. In addition to a standard definition and detailed description of software support and the post-deployment software support process, this handbook provides guidance in the areas of post-deployment software support and transition planning, support resource analysis, resource requirements planning and support concept alternatives.
Application: The recommended guidelines are applicable to all US DoD projects requiring development of software.
Organization: US Department of Defense (DoD)
Current status: Active

MIL-HDBK-1467 *Acquisition of Software Environments and Support Software* (Dec1997)
Overview: This document provides an overview about the US DoD recommendations for the acquisition of software environments and support software, mainly for the development phase, but in principle also for the support phase. Though very oriented towards the US DoD

acquisition, it is an interesting document insofar it provides insight about the aspects to be considered for the acquisition of these elements, which may impact long-term support.
Application: The recommended guidelines are applicable to all US DoD projects requiring development of software.
Organization: US Department of Defense (DoD)
Current status: Active

*CRLCMP - Computer Resources Life-Cycle Management Plan (*1998)
Overview: A set of document templates per AR 700-127, the Computer Resources Life Cycle Management Plan (CRLCMP) contains the acquisition, development, transition, and support requirements for the computer resources of an Army system. The CRLCMP identifies the organizations/individuals responsible for the performance of related tasks over the system's life cycle. The CRLCMP can also be used as an annex to the Acquisition Plan and to the Life Cycle Sustainment Plan (LCSP).
Application: The recommended process is applicable to U.S. Army systems containing software.
Organization: U.S. Army CECOM Software Engineering Center
Current status: Active

IEEE 1044 - IEEE *Standard Classification for Software Anomalies (*1993)
Overview: A uniform approach to the classification of anomalies found in software and its documentation is provided. The processing of anomalies discovered during any software life cycle phase are described, and comprehensive lists of software anomaly classifications and related data items that are helpful to identify and track anomalies are provided. This standard is not intended to define procedural or format requirements for using the classification scheme. It identifies some classification measures but does not attempt to define all the data supporting the analysis of an anomaly.
Application: In principle all software systems.
Organization: Institute of Electrical and Electronics Engineers (IEEE)
Current status: Active - Reaffirmed 2002

IEEE 1063- IEEE *Standard for Software User Documentation* (2001)
Overview: Minimum requirements for the structure, information content, and format of user documentation, including both printed and electronic documents used in the work environment by users of systems containing software, are provided in this standard.
Application: In principle all software systems.
Organization: Institute of Electrical and Electronics Engineers (IEEE)
Current status: Active

IEEE 1219 - *IEEE Standard for Software Maintenance* (1998)
Overview: The process for managing and executing software maintenance activities.
Application: In principle all software systems.
Current status: Active

J-STD-016-1995 *Standard for Information Technology/Software Life Cycle Processes/Software Development/Acquirer-Supplier Agreement* (1995)
Overview: This standard defines a set of software development activities and resulting software products. It provides a framework for software development planning and engineering. It is also intended to merge commercial and Government software development requirements within the framework of the software life cycle process requirements of the Electronic Industries Association (EIA), Institute of Electrical and Electronics Engineers (IEEE) and International Organization for Standardization (ISO). The term "software development" is used as an inclusive term encompassing new development, modification, reuse, reengineering, maintenance, and all other processes or activities resulting in software products.
Application: In principle all purchased software systems.
Organization: Institute of Electrical and Electronics Engineers (IEEE)
Current status: Issued for Trial use

ISO 14764 - *Information technology -- Software maintenance (*1999)
Application: In principle all software systems.
Organization: International Organization for Standardization (ISO)
Current status: Active

ISO 12207 - *Information technology -- Software life cycle processes (*1995, 1996, 1997)
Overview: Establishes a system for software life cycle processes with well-defined terminology. Contains processes, activities and tasks that are to be applied during the acquisition of a system that contains software, a stand-alone software product and software services. It also addresses software maintenance.
Application: In principle all software systems.
Organization: International Organization for Standardization (ISO)
Current status: Active

ISO/IEC TR 15271 - *Guide for ISO/IEC 12207 (Software Life Cycle Processes)* (1998)
Overview: The purpose of this technical report is to provide guidance to the application of ISO/IEC 12207. This Technical Report elaborates on factors which should be considered when applying ISO/IEC 12207 and does this in the context of the various ways in which this standard can be applied. This guidance is not intended to provide the rationale for the requirements of the ISO/IEC 12207 standard. The three fundamental life cycle models are discussed and examples of tailoring are provided.
Application: In principle all software systems.
Organization: International Organization for Standardization (ISO)
Current status: Active

c. Software Supportability-Related Technical Standards

Technical software standards are typically developed and sponsored by professional associations that are dedicated to improving the technical management of a particular field. This professional association role has become even more important since the elimination of DoD standards in favor of using best commercial practices. Software standards are governed to a significant extent

by ISO, IEEE, and SAE. For each of the standards, there is typically a community of interest, an active development user group, and recurring conferences or workshops to educate the rest of the community what the latest updates and new material is all about. Sometime this information is free but often there is a nominal fee to join a user group or to attend a conference.

Below are examples of some of the more important standards being developed and maintained by these professional associations. For more information, search on the name of the technical standard and the results should take you directly to the relevant information.

IEEE Standard 1063-2001, “IEEE Standard for Software User Documentation”. Minimum requirements for the structure, information content, and format of user documentation, including both printed and electronic documents used in the work environment by users of systems containing software.

IEEE Standard 1228-1994, “IEEE Standard for Software Safety Plans”. The minimum acceptable requirements for the content of a software safety plan are established. This standard applies to the software safety plan used for the development, procurement, maintenance, and retirement of safety-critical software. This standard requires that the plan be prepared within the context of the system safety program. Only the safety aspects of the software are included. This standard does not contain special provisions required for software used in distributed systems or in parallel processors.

ISO/IEC 16086 IEEE Std 16085-2006, “Systems and Software”. The process for managing and executing software maintenance activities is described.

d. Information Assurance / System Security – Additional Information

DoD Instruction 8500.2, 6 February 2003, “Information Assurance (IA) Implementation”. This instruction implements policy, assigns responsibilities, and prescribes procedures for applying integrated, layered protection of the DoD information systems and networks under reference (a) (DoD Directive 8500.1, "Information Assurance," October 24, 2002). This instruction references the below three references and also includes a very extensive listing of references in its Enclose 1 on the topic of information assurance.

- DoD 5025.1-M, "DoD Directives System Procedures," current edition
- National Security Telecommunications and Information Systems Security Instruction (NSTISSI) No. 4009, "National Information Systems Security Glossary," Sept 2000
- DoD Directive 8000.1, "Management of DoD Information Resources and Information Technology," February 27, 2002

Public Key Infrastructure (PKI). ASD Memo of Aug 12, 2000, Department of Defense (DoD) Public Key Infrastructure (PKI), describes the Defense-in-Depth strategy element of the use of a common, integrated interoperable DoD PKI to enable security services at multiple levels of assurance.

The DoD Enterprise Software Initiative (ESI) contains important guidance regarding information and software assurance and is further described below in the "Service Level Agreements" section. It is based on multiple policy memos:

- Department of Defense (DOD) Chief Information Officer (CIO) Guidance and Policy Memorandum No. 12-8430 –July 26, 2000 –Acquiring Commercial Software
- Defense Federal Acquisition Regulation Supplement (DFARS) Subpart 208.74, Enterprise Software Agreements
- DODI 5000.2 (E.4.2.7) Operation of the Defense Acquisition System
- DPAP/DCIO memo of December 22, 2005, DOD Support for the Smart BUY initiative
- DoD CIO Memo of July 3, 2007 -Encryption of Sensitive Unclassified Data at Rest on Mobile Computing Devices and Removable Storage Media
- DNI CIO Memo of June 26, 2008 –Intelligence

IEEE Std 730-2002, "IEEE Standards for Software Quality Assurance Plans". The standard specifies the format and content of software quality assurance plans. It meets the IEEE/EIA 12207.1 requirements for such plans.

Additional good links are at:

- http://dod5000.dau.mil/, DoD 5000 Resource Center
- http://web1.deskbook.osd.mil/default.asp, Acquisition Technology & Logistics (AT&L) Knowledge Sharing System
- http://logistics.navair.navy.mil/alsp, Air 6.0 Logistics
- http://web1.deskbook.osd.mil/default.asp, Defense Acquisition Desk book (DON Section), enclosure (7), appendix XI, format for computer resources planning
- https://cosip.npt.nuwc.navy.mil, Expert System with a database of Computer Hardware and Software products, with an emphasis on the information required by U.S. DoD application, in particular that of the U.S. Navy
- www.sei.cmu.edu/pub/documents/87.reports/ps/tr02.87.ps, This AFMC Computer resources document provides additional information useful to the APML

H. Lessons Learned / Best Practices

*SmartBUY. P*er the DAG 7.10.6.2, SmartBUY is a federal government strategic sourcing initiative intended to support effective enterprise level software management and achieve government-wide cost avoidance through aggregate buying of commercial software. Besides providing reduced prices and more favorable terms/conditions, the SmartBUY program assists agencies to achieve greater standardization, improved configuration management, and more robust Information Technology security. The General Services Administration (GSA) manages the SmartBUY Program, and leads the interagency team in negotiating government-wide enterprise licenses for software. The GSA SmartBUY Program focuses on commercial-off-the-shelf software that is generally acquired using license agreements with terms and prices that vary based on volume. The GSA SmartBUY Program was formally announced on June 2, 2003 in an Office of Management and Budget Memorandum to the federal agencies. The DoD ESI Team has worked closely with the SmartBUY project since its inception, and negotiates and manages many of the SmartBUY agreements as a partner to GSA.

*The Defense Acquisition University's Best Practices Clearinghouse. T*his clearinghouse is found at https://acc.dau.mil/bpch. Section 804 of the National Defense Authorization Act of 2003 directed OSD to establish a clearinghouse for best practices in software development and acquisition. In response to that direction, OUSD(AT&L) and OASD(NII) have established the DoD Best Practices Clearinghouse project. The Clearinghouse will initially improve DoD's acquisition of software-intensive systems by helping programs select and implement proven acquisition, development and systems engineering practices appropriate to their individual programmatic needs. It will support Component improvement initiatives by enabling acquisition organizations to create and institutionalize effective system acquisition processes and maintain well-trained, experienced personnel.

The Clearinghouse provides:

A single authoritative source for information about practices, lessons learned and risks;
Validated practices with consistent, verifiable information;
An active knowledge base to help with practice questions;
Intelligent front-end to quickly get to answers;
Useful information and tools to help find, select and implement practices appropriate to specific programs;
Living knowledge through: a constantly updated, expanded, and refined database; access mechanisms that learn and evolve with the type of questions asked and the utilization patterns of the database; and, an associated community of practice (the Acquisition Community Connection) that includes expert support.

The Government Accountability Office, GAO, maintains a best practices and benchmarking website found at http://www.gao.gov/bestpractices/. Links are generally to past GAO reports which cover specific topics of research and investigation. Most GAO reports cite industry practices and outcomes and evaluate DoD processes and practices.

Researching the Defense Acquisition Guidebook on the DAU Website. On the Defense Acquisition University (DAU) Defense Acquisition Guidebook (DAG) website, located at https://dag.dau.mil/Pages/Default.aspx, there is an interactive graphic depicting the DoD Acquisition Lifecycle Framework View with specific acquisition phases and milestone decision reviews highlighted. By moving the cursor onto the graphic, the viewer can click onto the Milestone Review "letter", i.e., A or B or C, and a listing will show itself of each major defense program and major information system program deliverables. Each deliverable is then further hyperlinked to show information regarding its content.

NAVAIR Software Logistics Primer (For Training Purposes Only), April 2010. This short primer is intended to be a knowledge and awareness builder with emphasis placed on what the logistician needs to [Know], what to [Do], and where to [Go] for more information. This is a living document, which will be improved upon over time as NAVAIR builds its body of knowledge in this critical support area. It includes fundamental principles and references necessary for software acquisition logistics planning and some pointers to sources of information that will enhance the logistician's ability to plan and execute software support.

I. Training Resources

A complete list of DAU training resources can be found at http://icatalog.dau.mil/. Courses are classified as Training Courses (Regular (certification and assignment specific) training courses), Continuous Learning, and Targeted Training (Alternate means to meet training requirements).

- LOG 101 Acquisition Logistics Fundamentals
- CLE 025 Information Assurance for Acquisition Professionals
- CLE 060 Practical Software and Systems Development
- CLM 025 COTS Acquisition for Program Managers
- CLM 029 NR-KPP (Net-Ready Key Performance Parameter)
- CLM 035 Environmental, Safety and Occupational Health (ESOH)

J. Key References

PSM's should check with their respective DoD Component / Agency for further guidance.

- DoDD 3222.3, "DoD Electromagnetic Environmental Effects (E3) Program"
- DoDD 5000.01, "The Defense Acquisition System," May 12, 2003
- DoDD 5144.1, "Assistant Secretary of Defense for Networks and Information Integration/DoD Chief Information Officer (ASD(NII)/DoD CIO)," May 2, 2005
- DoDD 5250.01 requires that an LSSP shall be established for signature dependent program
- DoDD 8000.1, "Management of DoD Information Resources and Information Technology," February 27, 2002
- DoDD 8320.2, "Data Sharing in a Net-Centric Department of Defense"
- DoDD 8500.1, "Information Assurance," October 24, 2002
- DoDD 8570.01, "Information Assurance Training, Certification, and Workforce Management," August 15, 2004 (Reference (a))
- DoDI 4650.01, "Policy and Procedures for Use of the Electromagnetic Spectrum"
- DoDI 5000.02, "Operation of the Defense Acquisition System," December 8, 2008
- DoDI 8500.2, 6 February 2003, "Information Assurance (IA) Implementation"
- USC Title 10, Sections 2223 and 2224
- USC Title 40, Sections 11101 and 11316, and Chapter 113
- USC Title 44, Chapters 35 and 36 of Title 44
- Office of Management and Budget Circular A-130, "Management of Federal Information Resources," November 28, 2000
- "National Strategy for Information Sharing", October 2007
- "The National Defense Strategy of the United States of America", September 2002
- Section 794d of Title 29, U.S.C. (Section 508 of the Rehabilitation Act of 1973)
- MIL-STD-461, "Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment"
- Directive Type Memorandum (DTM) 10-015, USD(AT&L), "Requirements for Life Cycle Management and Product Support", 6 Oct 2010

- CJCS Instruction 3170.01, "Operation of the Joint Capabilities Integration and Development System"
- CJCSI 6212.01D, "Interoperability and Supportability of Information Technology and National Security Systems", 15 December 2008
- Defense Acquisition Guidebook, sections as identified throughout this handbook.
- Government Performance Results Act of 1993
- Clinger-Cohen Act of 1996, OMB Circular A-130
- Computer Security Act of 1987
- Federal Information Security Management Act
- Commercial software guidance is set forth in DFARS 252.227-7014(a)
- DoD-STD-1679A (22 Oct 1983 but still active)
- DAU Press, "Systems Engineering Fundamentals", 2001
- Manual for the Operation of the Joint Capabilities Integration and Development System, multiple pages with references
- DFARS 211.274-2 for IUID directive
- Defense Federal Acquisition Regulation Supplement (DFARS) Subpart 208.74, Enterprise Software Agreements
- DoD 5025.1-M, "DoD Directives System Procedures," current edition
- Defense Acquisition University Acquisition Logistics Guide (ALG) (1997), 7.2.10
- National Security Telecommunications and Information Systems Security Instruction (NSTISSI) No. 4009, "National Information Systems Security Glossary," Sept 2000
- Department of Defense (DoD) Chief Information Officer (CIO) Guidance and Policy
- Memorandum No. 12-8430, July 26, 2000, "Acquiring Commercial Software"
- DPAP/DCIO memo of December 22, 2005, DoD Support for the Smart BUY initiative
- DoD CIO Memo of July 3, 2007 -Encryption of Sensitive Unclassified Data at Rest on Mobile Computing Devices and Removable Storage Media
- DNI CIO Memo of June 26, 2008 –Intelligence
- IEEE Std 730-2002, "IEEE Standards for Software Quality Assurance Plans"
- IEEE Std 1063-2001, "IEEE Standard for Software User Documentation"
- IEEE Std 1228-1994, "IEEE Standard for Software Safety Plans"
- IEEE/EIA 12207.0, "Standard for Information Technology – Software Life Cycle Processes"
- IEEE/EIA 12207.1-1997, "Standard for Information Technology-Software Life Cycle Processes-Life Cycle Data"
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Appendix A. ACRONYMS

AAR, After Action Review
ABCL, As Built Configuration List
AC, Active Component
ACAT, Acquisition Category
ACC, Acquisition Community Connection
ACQ, Acquisition
ACSA, Acquisition and Cross-Servicing Agreement
ACWP, Actual Cost of Work Performed
ADL, Advanced Distributed Learning
AEC, Army Evaluation Center
AECA, Arms Export Control Act
AFEMS, Air Force Equipment Management System
AFMC, Air Force Materiel Command
AFOTEC, Air Force Operational Test and Evaluation Center
AFRL, Air Force Research Laboratory
AIA, Aerospace Industries Association
AIS, Automated Information System
AIT, Automated Identification Technology
AKMS, AT&L Knowledge Management System
AKSS, Acquisition, Technology & Logistics Knowledge Sharing System
ALH, DoD Acquisition Logistics Handbook
ALRE, Aircraft Launch and Recovery Systems
ALSS, Aviation Life Support Systems
ALU, Army Logistics University
A_M, Materiel Availability
AMARC, Aerospace Maintenance and Regeneration Center
AMARG, Aerospace Maintenance and Regeneration Group
AMC, Army Materiel Command
AMMPS, Advanced Medium Mobile Power Sources
AMSDL, Acquisition Management Systems Data List
ANSI, American National Standards Institute
Ao, Operational Availability
AoA, Analysis of Alternatives
AOR, Areas of Responsibility
AOTR, Assessment of Operational Test Readiness
APB, Acquisition Program Baseline
APICS, The Association for Operations Management
APS, Automated Planning System
APSL, Amy Primary Standards Laboratory
AR, Army Regulation
ARFORGEN, Army Force Generation
ARNG, Army National Guard
ASC, Accredited Standards Committee
ASD, Aerospace and Defence Industries Association of Europe

ASETDS, Aeronautical & Support Equipment Type Designation System
ASPMPL, AS-designed Parts, Materials, and Processes List
ASR, Alternative System Review
ASQ, American Society for Quality
ASTK, Acquisition Sustainment Tool Kit
ASVAB, Armed Services Vocational Aptitude Battery
ATA, Air Transport Association
AT&L, Acquisition Technology and Logistics
ATE, Automatic Test Equipment
ATPS, Acceptance Test Procedures
ATPSI, Anti-Tamper Software Protection Initiative
ATR, Acceptance Test Report
ATS, Automatic Test Systems
AWACS, Airborne Warning and Control System
AWCF, Army Working Capital Fund
BAC, Budget At Completion
BCA, Business Case Analysis
BCS, Baseline Comparison System
BCWP, Budgeted Cost of Work Performed
BCWS, Budgeted Cost of Work Scheduled
BES, Budget Estimate Submission
BIA, Bilateral Infrastructure Agreements
BLRIP, Beyond Low Rate Initial Production
BOM, Bill of Material
BRAC, Base Realignment and Closure
CAD, Computer Aided Design
CAE, Component Acquisition Executive
CAGE, Commercial and Government Entity
CAI, Computer Aided Instruction
CAIG, Cost Analysis Improvement Group
CAIV, Cost As An Independent Variable
CAMP, Calibration and Maintenance Program
CAP, Critical Acquisition Position
CAPE, Cost Assessment and Program Evaluation
CARD, Cost Analysis Requirements Description
CASA, Cost Analysis Strategy Assessment
CASS, Consolidated Automated Support System
CATEX, Categorical Exclusion
CBA, Capabilities-Based Assessment
CBA, Cost Benefit Analysis
CBM+, Condition Based Maintenance Plus
CBT, Computer Based Training
CAPDEV, Combat Developer
CC, Configuration Control
CCA, Component Cost Analysis
CCB, Configuration Control Board

CCDR, Combatant Commander
CCL, Commerce Control List
CCLI, Commerce Control List Item
CCPS, Contract Change Proposals
CDA, Core Depot Assessment
CDC, Contractor Data Collection
CDD, Capability Development Document
CDLS, Configuration Data Lists
CDR, Critical Design Review
CDRL, Contract Data Requirements List
CDRS, Container Design Retrieval Systems
CEAC, U.S. Army Cost and Economic Analysis Center
CECOM, Communications-Electronics Command
CES, Cost Element Structure
CF, Contractor Furnished
CFR, Code of Federal Regulations
CFR, Commercial and Foreign Trade
CFSR, Contract Funds Status Report
CI, Configuration Item
C/I, Component Item
CITE, Centers of Industrial and Technical Excellence
CJCS, Chairman of the Joint Chiefs of Staff
CJCSM, Chairman of the Joint Chiefs of Staff Manual
CLB, Continuous Learning Business
CLC, Continuous Learning Center
CLIN, Contract Line Items Number
CLM, Continuous Learning Module
CLS, Contractor Logistics Support
CLSSA, Cooperative Logistics Supply Support Arrangements
CM, Configuration Management
CMIS, Configuration Management Information System
CMMI, Capability Maturity Model-Integration
CMRS, Calibration, Measurement and Requirements Summary
CNAD, Conference of National Armaments Directors
COCOM, Combatant Commanders
COI, Communities of Interest
COMPARE, cost estimating software supporting competitions
COMPASS, Computerized Optimization Model for Predicting and Analyzing Support and Structures
CONOPS, Concept of Operations
CONUS, Continental United States
CoP, Community of Practice
COR, Contracting Officers Representative
COTS, Commercial Off-the-Shelf
CPD, Capability Production Document
CPI, Continuous Process Improvement

CPI, Cost Performance Index
CPI, Critical Program Information
CPIN, Computer Program Identification Number
CPR, Cost Performance Report
CRAF, Civil Reserve Air Fleet
CRLCMP, Computer Resources Life Cycle Management Plan
CRWG, Computer Resources Working Group
CSA, Configuration Status Accounting
CSA, Combat Support Agency
CSB, Configuration Steering Boards
CSCI, Computer Software Configuration Item
CSCMP, Council of Supply Chain Management Professionals
CSDB, Common Source Data Base
CSDR, Cost and Software Data Reporting
CSE, Common Support Equipment
CSI, Contract Simulator Instruction
CSI, Critical Safety Items
CSR, Competitive Sub-Contracts Report
C/SSR, Cost/Schedule Status Report
CUI, Controlled Unclassified Information
CV, Cost Variance
CVN, Carrier Vessel Nuclear
DAASC, Defense Automatic Addressing System Center
DAB, Defense Acquisition Board
DAES, Defense Acquisition Executive Summary
DAG, Defense Acquisition Guidebook
DAMIR, Defense Acquisition Management Information Retrieval
DA PAM, Department of the Army Pamphlet
DAPS, Defense Acquisition Program Support
DASD(MR), Deputy Assistant Secretary of Defense (Materiel Readiness)
DAU, Defense Acquisition University
DCAPE, Director of Cost Assessment and Program Evaluation
DCARC, Defense Cost and Resource Center
DCMA, Defense Contract Management Agency
DCR, DOTMLPF Change Recommendation
DDR&E, Director, Defense Research & Engineering
DEMIL, Demilitarization
DENIX, Defense Environmental Network & Information eXchange
DET, Displaced Equipment Training
DFARS, Defense Federal Acquisition Regulations
DHRA, DoD Human Resources Activity
DIACAP, DoD Information Assurance Certification and Accreditation process
DID, Data Item Description
DIFM, Due-in-From Maintenance
DI-MGMT, Data Item - Management
DIS, Defense Investigative Service

DISAM, Defense Institute of Security Assistance Management
DISN, Defense Information Switch Network
DKO, Defense Knowledge Online
DLA, Defense Logistics Agency
DLMS, Defense Logistics Management System
DLMSO, Defense Logistics Management Standards Office
DLR, Depot Level Repairables
DM, Data Management
DMAIC, Define, Measure, Analyze, Improve, Control
DMAWG, Depot Maintenance Activation Working Group
DMS, Data Management Strategy now known as the Technical Data Rights Strategy
DMS, Diminishing Manufacturing Sources
DMSMS, Diminishing Manufacturing Sources and Material Shortages
DMT, Depot Maintenance Transformation
DoD, Department of Defense
DoDD, Department of Defense Directive
DoDI, Department of Defense Instruction
DOE, Department Of Energy
DoN, Department of the Navy
DoS, Department of State
DOT&E, Director, Operational Test & Evaluation
DOTMLPF, Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, or Facilities
DPAP, Defense Procurement, Acquisition Policy, and Strategic Sourcing
DPGDS, Deployable Power Generation and Distribution System
DPO, Distribution Process Owner
DPPG, Defense Planning and Programming Guidance
DR, Deficiency Report
DRM, Data Reference Model
DRMO, Defense Reutilization and Marketing Office
DRMS, Defense Reutilization and Marketing Service
DRRS, Defense Readiness Reporting System
DSCA, DoD Security Cooperation Agency
DSD, Deputy Secretary of Defense
DSE, Data Services Environment
DSOR, Depot Source of Repair
DSPO, Defense Standardization Program Office
DT, Developmental Test
DT&E, Developmental Test and Evaluation
DTIC, Defense Technical Information Center
DTR, Defense Transportation Regulations
DTS, Defense Transportation System
DTM, Directive Type Memorandum
DUSD(SCI), Deputy Assistant Secretary of Defense for Supply Chain Integration
DWCF, Defense Working Capital Fund
E3, Electromagnetic, Electronic and Environmental Effects

EA, Environmental Assessment
EAC, Estimate At Completion
EBS, Environmental Baseline Survey
ECP, Engineering Change Proposal
EDA, Excess Defense Articles
EDFP, Engineering Data for Provisioning
EDI, Electronic Data Interchange
EFV, Expeditionary Fighting Vehicle
EIA, Electronic Industries Alliance
EIS, Environmental Impact Statement
EM, Electro-Magnetic
EMA, Expectation Management Agreement
EMD, Engineering and Manufacturing Development
EME, Electro-Magnetic Environment
EMIS, Electromagnetic Interference Survey
EO, Executive Order
EPR, Essential Performance Requirement
eRMS, Electronic Retrograde Management System
ERP, Enterprise Resource Planning
ESD, Electrostatic Discharge
ESOH, Environmental, Safety and Occupational Health
ETIMS, Electronic Tooling Information Management System
EVM, Earned Value Management
EVMIG, Earned Value Management Implementation Guide
EVMS, Earned Value Management System
FAC, Facilities Assessment Category
FAD, Facilities Asset Database
FAR, Federal Acquisition Regulations
FCA, Functional Configuration Audit
FCB, Functional Capabilities Board
FCBF, Fully Burdened Cost of Fuel
FE, Facilities Engineering
FEA, Federal Enterprise Architecture
FEPP, Foreign Excess Personal Property
FISMA, Federal Information Security Management Act
FFP, Firm Fixed Price
FMCS, Foreign Military Construction Services
FMEA, Failure Modes and Effects Analysis
FMECA, Failure Modes Effects and Criticality Analysis
FMF, Foreign Military Financing
FMR, Financial Management Regulation
FMS, Foreign Military Sales
FMSCR, Foreign Military Sales Credit
FOST, Finding of Suitability to Transfer
FOT&E, Follow-on Operational Test and Evaluation
FRACAS, Failure Reporting and Corrective Action System

FRD, Facilities Requirements Data
FRP, Full Rate Production
FRP&D, Full Rate Production and Deployment
FRPC, Federal Real Property Council
FRPDR, Full Rate Production Decision Review
FSM, Facilities Sustainment Model
FSO, Full Spectrum Operations
FTA, Failure / Fault Tree Analysis
FUE, First Unit Equipped
FY, Fiscal Year
FYDP, Future Years Defense Program
GAO, U.S. Government Accountability Office
GCQA, Government Contract Quality Assurance
GDF, Guidance for the Development of the Force
GEIA, Government Electronics Information Technology Association
GFE, Government Furnished Equipment
GFM, Government Furnished Material
GFP, Government Furnished Property
GIG, Global Information Grid
GOCO, Government Owned/Contractor Operated
GOM, Government Owned Material
GOSSPL, Ground Support Equipment Omnibus Supply Support Program for Legacy
GOTS, Government Off The Shelf
GPRA, Government Performance and Results Act
GSA, U.S. General Services Administration
HAZMAT, Hazardous Material
HCS, Human Capital Strategy
HEMTT, Heavy Expanded Mobility Tactical Truck
HHAR, Health Hazard Assessment Report
HIMARS, High Mobility Artillery Rocket System
HMMP, Hazardous Materials Management Program
HNFA, Host Nation Funded Construction Agreements
HQDA, Headquarters, Department of the Army
HSI, Human Systems Integration
HUD, Housing and Urban Development
HW, Hazardous Waste
HWG, Harmonization Working Group
IAC, Information Analysis Center
IAM, Information Assurance Management
IATAC, Information Assurance Technology Analysis Center
IATP, Installation and Acceptance Test Plan
IBR, Integrated Baseline Review
ICD, Initial Capabilities Document
ICE, Initial Cost Estimate
ICP, Inventory Control Point
ICS, Interim Contractor Support

ICWG, Interface Control Working Groups
IDE, Integrated Data Environment
IECU, Improved Environmental Control Units
IEEE, refers to a technical innovation professional association
IEP, Information Exchange Program
IETM, Interactive Electronic Technical Manual
IFC, Integrated Framework Chart
IG, Inspector General
IIPT, Integrating Integrated Product Team
IKE, Integrated Knowledge Environment
LA, Logistics Assessment
IMET, International Military Education and Training
IMM, Integrated Materiel Managers
IMS, Integrated Master Schedule
INCOSE, International Council on Systems Engineering
IOC, Initial Operating Capability
IOT&E, Initial Operational Test and Evaluation
IPB, Illustrated Parts Breakdown
IPE, Information Processing Equipment
IPPD, Integrated Product and Process Development
IPS, Integrated Product Support
IPT, Integrated Product (or Process) Team
IRB, Investment Review Board
IRR, Installation Readiness Report
IRR, Internal Rate of Return
ISA, Independent Schedule Assessment
ISA, Independent Schedule Assessment
ISM, Institute for Supply Management
ISP, Information Support Plan
ISO, International Organization for Standardization
ISR, In-Service Review
IT, Information Technology
IT/AIS, Information Technology / Automated Information Systems
ITOPS, International Test Operations Procedures
ITR, Initial Technical Review
IUID, Item Unique Identification
JADL, Joint Advanced Distributed Learning Co-Laboratory
JCA, Joint Capability Area
JCIDS, Joint Capabilities Integration and Development System
JDAM, Joint Direct Attach Munition
JDDE COI, Joint Deployment & Distribution Enterprise Community of Interest
JDPO, Joint Deployment Process Owner
JDRS, Joint Deficiency Reporting System
JFC, Joint Force Commanders
JFTR, Joint Federal Travel Regulations
JLC, Joint Logistics Commanders

JLE, Joint Logistics Environment
JPG, Joint Programming Guidance
JRMET, Joint Reliability and Maintainability Evaluation Team
JROC, Joint Requirements Oversight Council
JSCA, Joint Supply Chain Architecture
JSISS, Joint Staff System Integration Services
JSTARS, Joint Surveillance and Target Attack Radar System
KLP, Key Leadership Position
KPP, Key Performance Parameter
KSA, Key System Attribute
LA, Logistics Assessment
LCC, Life Cycle Cost
LCCE, Life Cycle Cost Estimate
LCSP, Life Cycle Sustainment Plan
LD, Logistics Demonstration
LFT&E, Live-Fire Test and Evaluation
LHA, Logistics Health Assessment
LMI, Logistics Management Information
LOA, Letter of Agreement
LOGCOM, Marine Corps Logistics Command
LOGDEMO, Logistics Demonstration
LOGPARS, Logistics Planning and Requirements System
LOGSA, U.S. Army Logistics Support Activity
LORA, Level of Repair Analysis
LPD, Landing Platform Dock
LRIP, Low Rate Initial Production
LRT, Logistics Response Time
LRU, Line Replaceable Unit
LSSP, Life Cycle Signature Support Plan
LUC, Land Use Controls
MACOM, Major Command
MAIS, Major Automated Information Systems
MAP, Military Assistance Program
M&P, Manpower and Personnel
M&S, Modeling and Simulation
MARCORSYSCOM, Marine Corps Systems Command
MATDEV, Materiel Developer
MCA, Military Construction Authorization
MCEB, Military Communications-Electronics Board
MCO, Marine Corps Order
MCOTEA, Marine Corps Operational Test and Evaluation Activity
MDA, Milestone Decision Authority
MDAP, Major Defense Acquisition Program
MDC, Maintenance Data Collection
MDD, Materiel Development Decision
MDT, Mean Down Time

MEARS, Multi-User ECP Automated Review System
MEASURE, Metrology Automated System for Uniform Recall and Reporting
MLV, Memory Loader Verifier
MEP, Mobile Electric Power
MER, Manpower Estimate Report
METCAL, Metrology and Calibration
MFP, Materiel Fielding Plan
MID, Management Initiative Decision
MILCON, Military Construction
MILDEP, Military Department
MIL-HDBK, Military Handbook
MILPERS, Military Personnel
MILS, Military Standard
MILSTRIP, Military Standard Requisitioning and Issue Procedures
MIL-STD, Military Standard
MIP, Materiel Improvement Plan
MIS, Management Information System
MISMO, Service Maintenance Inter-service Support Management Office
MIT, Massachusetts Institute of Technology
MLDT, Mean Logistics Delay Time
MOA, Memorandum of Agreement
MOE, Measures of Effectiveness
MOSA, Modularity and Open Systems Architecture
MOU, Memorandum of Understanding
MR, Maintenance Ratio
MRAR, Mishap Risk Assessment Report
MRO, Maintenance Repair and Overhaul
MRP, Maintenance Requirements Planning
MRTFB, Major Range and Test Facility Base
MS, Milestone
MS-A, Milestone A
MS-B, Milestone B
MS-C, Milestone C
MTA, Maintenance Task Analysis
MTBCF, Mean Time Between Critical Failures
MTBF, Mean Time Between Failure
MTG, Military Tactical Generator
MTOE, Modified Table of Organization and Equipment
MTTR, Mean Time to Repair
MTVR, Medium Tactical Vehicle Replacement
NADR, Nonproliferation, Anti-Terrorism, Demining, and Related Programs
NARA, National Archives and Records Administration
NATO, North Atlantic Treaty Organization
NAVAIR, U.S. Navy Naval Air Systems Command
NAVAIRINST, Naval Air Systems Command Instruction
NAVICP, Naval Inventory Control Point

NAVSOP, U.S. Navy Standard Operating Procedure
NCOW, Net-Centric Operations and Warfare
NCW, Network Centric Warfare
NDI, Non-Developmental Items
NDS, Non-Developmental Software
NDT, Non-destructive Testing
NEPA, National Environmental Policy Act of 1969
NET, New Equipment Training
NET TSP, New Equipment Training Test Support Package
NII, Networks and Information Integration
NISP, National Industrial Security Program
NISPOM, National Industrial Security Program Operating Manual
NIST, National Institute of Standards and Technology
NMCM, Non-Mission Capable for Maintenance
NMCS, Non-Mission Capable for Supply
NOR, Notice of Revision
NPV, Net Present Value
NR-KPP, Net-Ready Key Performance Parameter
NSN, National Stock Number
NSS, National Security System
NWCF, Navy Working Capital Fund
O&M, Operations and Maintenance
O&S, Operations and Support
OASD (NII), Office of the Assistant Secretary of Defense (Network and Information Integration)
ODS, Ozone-Depleting Substances
OEBGD, Overseas Environmental Baseline Guidance Document
OIPT, Overarching Integrated Product Team
OJT, On-the-Job
OMB, Office of Management and Budget
OMC, Optical Memory Cards
OPLANS, Operations Plans
OPORDS, Operations Orders
OPTEMPO, Operating/Operations Tempo
OPTEVFOR, Operational Test and Evaluation Force
OPNAVINST, Chief of Naval Operations Instruction
ORD, Operational Requirements Document
ORR, Operational Readiness Rate
ORSA, Operations Research / Systems Analysis
OSD, Office of the Secretary of Defense
OSHA, Occupational Safety and Health Administration
OSI, Operating Space Item
OT, Operational Testing
OTA, Operational Test Agency
OT&E, Operational Test and Evaluation
OTC, Operational Test Command
OTPI/TPI, Operational Test Program Instruction / Test Program Instruction

OTPS, Operational Test Program Set
OTRR, Operational Test Readiness Review
PADHM, Prognostics, Advanced Diagnostics and Health Management
PBA, Performance Based Agreements
PBD, Program Budget Decision
PBL, Performance-Based Life-Cycle Product Support
PCA, Physical Configuration Audit
PDISE, Power Distribution Illumination System Electric
PDM, Programmed Depot Maintenance
PDM, Product Data Management
PDPR, Post Deployment Performance Review
PDR, Preliminary Design Review
PDSS, Post-Deployment Software Support
PEO/SYSCOM, Program Executive Officers'/Systems Command
PESHE, Programmatic Environmental, Safety, and Occupational Health Evaluation
PHM, Prognostics and Health Management
PHS&T, Packaging, Handling, Storage and Transportation
PII, Personally Identifiable Information
PIP, Product Improvement Programs
PKO, Peace Keeping Operations
PM, Program (or Product) Manager
PMB, Performance Measurement Baseline
PME, Professional Military Education
PMEL, Precision Measurement Equipment Laboratory
PMO, Program Management Office
PMOLCS, Program Manager Oversight of Life Cycle Costs
PMPSL, Parts, Materials, and Processes Selection List
PMR, Program Management Review
PMS, Planned Maintenance System
POC, Point Of Contact
POE, Program Office Estimate
POL, Petroleum, Oil and Lubricants
POM, Program Objective Memorandum
POPS, Probability of Program Success
PPBE, Planning, Programming, Budget and Execution
PPBES, Planning, Programming, Budgeting and Execution System
PPBS, Planning, Programming, and Budgeting System
PPL, Provisioning Parts List
PPLI, Provisioning Parts List Index
PPP, Program Protection Plan
PPP, Public-Private Partnering
PPS, Post Production Support
PPSL, Program Parts Selection List
PPSP, Post Production Support Planning
PRMP, Precious Metals Recovery Program
PRP, Parts Reclamation Procedures

PRR, Production Readiness Review
PSA, Product Support Arrangement
PSBM, Product Support Business Model
PSE, Peculiar Support Equipment
PSI, Product Support Integrator
PSM, Product Support Management
PSM, Product Support Manager
PSP, Product Support Package
PSP, Product Support Provider
PSR, Program Support Reviews
PTS, Preservation Team Services
PULHES, Military Physical Profile Serial System
QDR, Quadrennial Defense Review
QDR, Quality Deficiency Reporting
QQPRI, Qualitative and Quantitative Personnel Requirements Information
QRP, Qualified Recycling Program
RAM-C, Reliability, Availability and Maintainability and Cost
RAR, Rapid Action Revision
RBS, Readiness Based Sparing
RC, Reserve Component
RCC, Request Contract Change
RCM, Reliability Centered Maintenance
RDBMS, Relational Data Base Management System
RDT&E, Research, Development, Test, and Evaluation
ReMR, Reuse Management Report
RESET, Resetting the Force
RFD, Request for Deviation or Design change
RFID, Radio Frequency Identification
RFP, Request for Proposal
RFW, Request for Waivers
RHCP, Radiation Hazard Control Procedures
ROI, Return on Investment
ROM, Rough Order of Magnitude
RPILM, Real Property and Installation Lifecycle Management
RPM, Real Property Maintenance
RPSTL, Repair Parts Special Tools Lists
R-TOC, Reduction of Total Ownership Cost
RTP, Research and Technology Protection
S&T, Science and Technology
SaaS, Software as a Service
SAE, Society of Automotive Engineers International
SCM, Supply Chain Management
SCN, Specification Change Notices
SCORM, Sharable Content Object Reference Model
SCRM, Supply Chain Risk Management
SD, Standardization Document

SDLM, Scheduled Depot Level Maintenance
SDP, Software Development Plan
SE, Support Equipment
SECDEF, Secretary of Defense
SECNAV, Secretary of the Navy
SEMP, Systems Engineering Master Plan
SEP, Systems Engineering Plan
SEPG, Software Engineering Process Group
SERD, Support Equipment Recommendation Data
SERMIS, Support Equipment Resources Management Information System
SESAME, Selected Essential-Item Stockage for Availability Method
SETR, Systems Engineering Technical Reviews
SFR, System Functional Review
SIM, Serialized Item Management
SIP, Structural Integrity Programs
SLA, Service Level Agreement
SLAM-ER, Stand-Off Land Attack Missile Extended Range
SLEP, Service Life Extension Programs
SLIN, Subcontract Line Items
SM&R, Source, Maintainability and Recovery Codes
SME, Subject Matter Experts
SML, Sustainment Maturity Levels
SOFA, Status of Forces Agreement
SORAP, Source of Repair Assignment Process
SOW, Statement of Work
SPG, Strategic Planning Guidance
SPI, Schedule Performance Index
SRM, Sustainment, Restoration, and Modernization
SRR, System Requirements Review
SRU, Shop Replaceable Units
SSE, Systems and Software Engineering
SSHA, System Safety Hazard Analysis Report
ST/STE, Special Tooling/Special TEST Equipment
STA, Systems Threat Assessment
STAR, Systems Threat Assessment Report
STD, Standard
STE, Special Test Equipment
STL, Software Test Laboratory
STRAP, System Training Plan
STRI, Simulation, Training and Instrumentation
STTC, Simulation and Training Technology Center
SV, Schedule Variance
SVR, System Verification Review
SYSPARS, Systems Planning and Requirements Software
T&E, Test and Evaluation
T&ME, Test and Measurement Equipment

TAD, Target Audience Description
TADSS, Training and Training Aids Devices Simulators and Simulations
TAMS, Test and Monitoring System
TBD, To Be Determined
TD, Technology Development
TDA, table of Distribution and Allowance
TDP, Technical Data Package
TDS, Technical Data Strategy
TEMP, Test and Evaluation Master Plan
TEPP, Test and Evaluation Program Plan
TFRD, Test Facility Requirements Document
TIR, Transaction Item Reporting
TIS, Test Information Sheet
TLCSM, Total Life Cycle Systems Management
TM, Technical Manual
TMCR, Technical Manual Contract Requirement
TMDE, Test, Measurement and Diagnostic Equipment
TMQA, Technical Manual Quality Assurance
TO, Technical Order
TOC, Theory of Constraints
TOC, Total Ownership Cost
TOE, Table of Organization and Equipment
TOW-ITAS, Tube-launched, Optically-tracked, Wireless-guided Improved Target Acquisition System
TRADOC, Training and Doctrine Command
TPD, Test Program Documentation
TPR, Test Problem Report
TPS, Test Program Set
TPSD, Test Program Set Documentation
TPSMG, Technical Publications Specification Maintenance Group
TQG, Tactical Quiet Generator
TRA, Technology Readiness Assessment
TRANSCOM, Transportation Command
TRD, Test Requirements Document
TRMC, Test Resource Management Center
TRNGDEV, Training Developer
TRR, Technical Readiness Review
TSC, Trade Security Controls
UAV, Unmanned Aerial Vehicle
UFC, Unified Facilities Criteria
UID, Unique Identification
UII, Unique Item Identifier
USAF, United States Air Force
USAR, United States Army Reserve
USARCENT, U.S. Army Central Command
USAREUR, U.S. Army Europe

USATA, U.S. Army TMDE Activity
USC, United States Code
USD(AT&L), Under Secretary of Defense (Acquisition, Technology and Logistics)
USJFCOM, United States Joint Forces Command
USG, United States Government
USMC, United States Marine Corps
USML, U.S. Munitions List
USTRANSCOM, United States Transportation Command
UT, Ultrasonic Testing
XML, Extensible Markup Language
VAMOSC, Visibility and Management of Operating and Support Costs
VAC, Variance at Completion
VAST, Visual Approach Slope Indicator
VE, Value Engineering
VEC, Value Engineering Change
VECP, Value Engineering Change Proposal
W3C, World Wide Web Consortium
WBS, Work Breakdown Structure
WCF, Working Capital Fund
WG, Work Group
WIPT, Working-Level Integrated Product Team
WSAR, Weapon System Acquisition Reform
WSPM, Weapons System Program Manager
WSSM, Weapon System Support Manager
3-M, Maintenance and Material Management