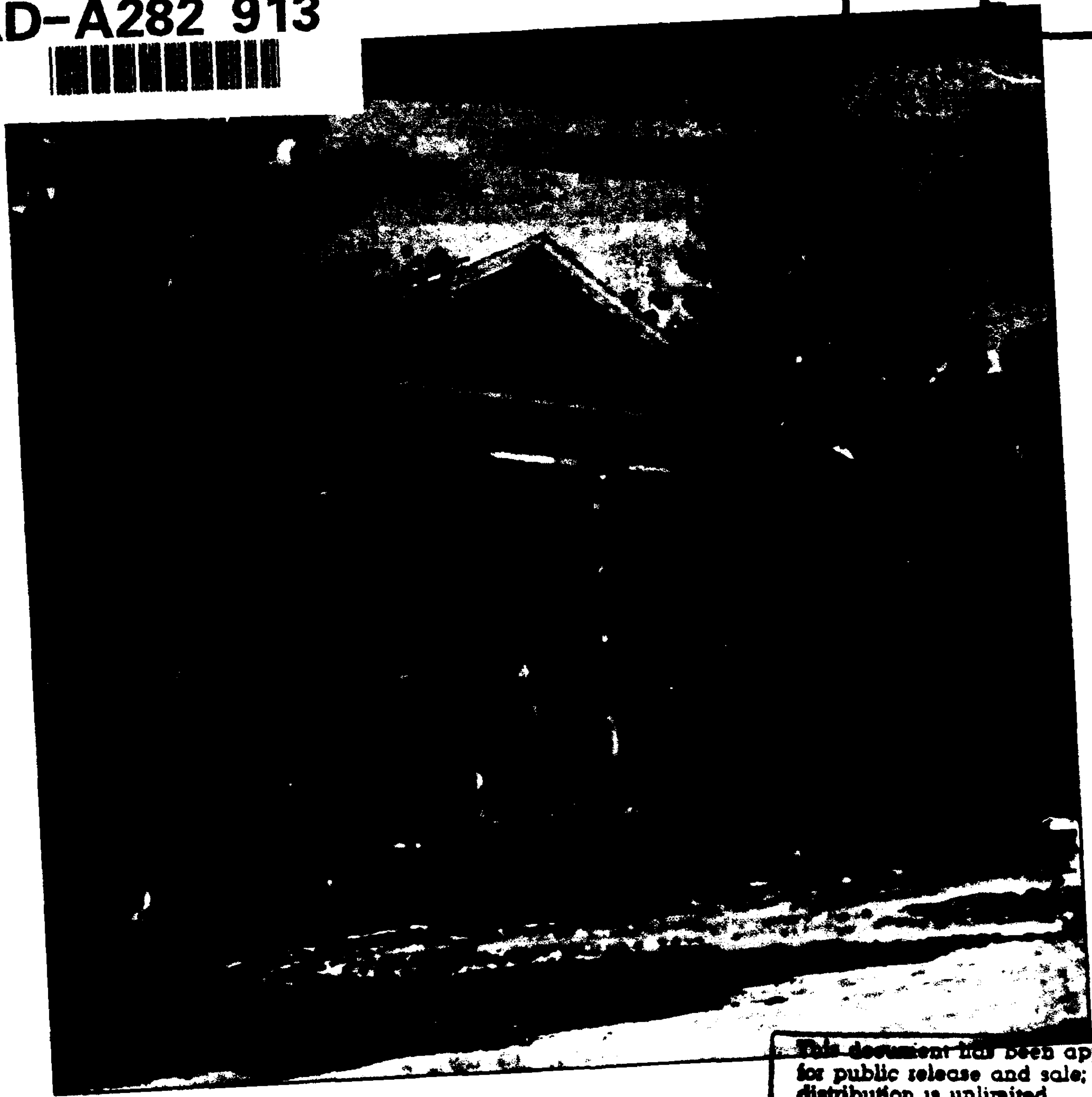
INTEGRATED LOGISTICS SUPPORT GUIDE



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This guide is designed to provide middle and top level logistics and acquisition managers with a working familiarity of Integrated Logistics Support (ILS). It addresses how to manage the ILS process throughout the life cycle from preconcept exploration through post-production support. It provides an organized approach and architecture for integrating support considerations into the requirements definition and design processes; integrating the support elements into a cohesive package; designing and acquiring support elements; and providing integrated support resources to achieve readiness and support objectives. The guide shows the inter-relationships of the major activities in the acquisition process of systems engineering, test, cost, risk, production, contracts, etc. It is designed to bridge the gap between general acquisiton and logistics policy contained in DoD Directive 5000.1 and DoD Instruction 5000.2 and specific detailed procedures such as those in MIL-STD-1388-1A.

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The guide is divided into five modules:

1. Introduction to ILS
2. Developing the ILS Program
3. Programming, Budgeting and Contracting
4. Providing the Support
5. International, Non Major and Joint Programs

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A special thanks to Mr. Stan Crognale, faculty member in the Funds management Department, for drafting the Continuous Acquisition and Life-Cycle Support (CALS - formerly Computer-Aided Acquisition and Logistics Support) chapter.

CONTRIBUTING TO THE LOGISTICS FACULTY BODY OF KNOWLEDGE THAT HELPED BRING THIS EDITION TO PRINT:

FORMER DSMC LOGISTICS FACULTY MEMBERS:
CDR THOMAS BALLEW, USN (RET), FORMER FACULTY DEPARTMENT CHAIR
CDR MICHAEL ALLEN, USN (RET)
CDR RICHARD WRIGHT, USN (RET)
LT COL LINDA WYATT, USAF (RET)
LT COL GARRY DEVINGER, USAF (RET)
LTC LARRY IVEY, USA (RET)
LTC GARY BAKER, USA (RET)
MAJ JACK SOSEBY, USA (RET)

CURRENT DSMC LOGISTICS FACULTY MEMBERS:
MR. PAUL MCILVAINE, FORMER FACULTY DEPARTMENT CHAIRMAN
MR. JOHN RIFFEE
MR. JOEL MANARY
CDR DALE IMMEL, USN
COL SHAROLYN HAYES, USA
LT COL RICHARD EZZELL, USAF

DSMC LOGISTICS DEPARTMENT SUPPORT STAFF:
MS LEE COBLE
MS URSULA LILLIMAN

PREFACE

This second edition of the *Integrated Logistics Support (ILS) Guide* supersedes the first edition published by the Defense Systems Management College (DSMC) in 1986. Although it retains much of the material contained in the 1986 version, this edition has been revised and updated to reflect the latest Department of Defense (DoD) acquisition policies and procedures as described in the DoD 5000 Series directives and instructions. The guide also contains a new section on the Continuous Acquisition and Life-Cycle Support (CALS) initiative to generate, exchange, manage and use digital data to support defense systems.

We have designed this guide to be a general road map for newcomers to the acquisition logistics management career field and to serve as an overall study aid for acquisition managers who work with acquisition logistics managers. It is one in a family of educational guides written from a DoD perspective. Companion DSMC documents include:

Introduction to Defense Acquisition Management
Systems Engineering Management Guide
Mission Critical Computer Resources Management Guide
Test and Evaluation Management Guide
Defense Manufacturing Management Guide

Each of these and several related materials can be obtained from DSMC for DoD personnel and offices or from the U.S. Government Printing Office (GPO) for others.

Suggested additions, deletions, and other changes are encouraged from readers of this guide. Send them to:

Department of Defense
Defense Sys Mgmt College
ATTN Logistics Department
9820 Belvoir Road
Suite G38
Fort Belvoir VA 22060-5565

Mark Fantasia
Lt Col, USAF
Chairman
Logistics Support Department

George S. Merchant
Program Management Education Division
Project Coordinator

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I

Introduction to ILS

All acquisition programs require an ILS effort that begins before program initiation and continues for the life of the system. This module introduces the ILS process and its objectives, ILS planning requirements, development of readiness and supportability objectives and design parameters. The module also introduces Continuous Acquisition Life-Cycle Support (CALS).

1

ILS FUNDAMENTALS

1.1 INTRODUCTION

1.1.1 Purpose

To provide an introductory overview of ILS, including its historical background, conceptual basis, guidelines for application and elements.

1.1.2 Definition

ILS is defined in DoDI 5000.2, Part 7A, "Integrated Logistics Support," as a "disciplined, unified and iterative approach to the management and technical activities necessary to:

(1) Develop support requirements that are related consistently to readiness objectives, to design and to each other;

(2) Integrate support considerations effectively into the system and equipment design;

(3) Identify the most cost-effective approach to supporting the system when it is fielded; and

(4) Ensure that the required support structure elements are developed and acquired."

These can be expressed more simply as:

- Define the support;
- Design for support;
- Refine the support; and
- Provide the support.

1.2 BACKGROUND

Changing threats and limited budgets have caused an increased emphasis on readiness. The Defense Acquisition Improvement Program, initiated in 1981, requires the following readiness improvement measures:

- Establishment of readiness objectives for each system development program;
- Enhanced visibility of logistics and support resources by mandating identification of resources by system in each Service's Program Objectives Memorandum (POM);
- Design incorporation of reliability and maintainability (R&M) objectives; and
- Development of contractor incentives for reliability and support enhancement.

ILS policy initially emphasized the integrated development of a total logistics support structure instead of developing individual, isolated ILS elements. While this remains important, the current emphasis is on the introduction of readiness implications in the "front end" of system development as a prime objective of the acquisition process.

- DEVELOP READINESS OBJECTIVES TO SUPPORT MISSION NEED
- INTEGRATE READINESS ENGINEERING ACTIVITIES WITH DESIGN EFFORT
- DOCUMENT SUPPORTABILITY DESIGN OBJECTIVES EXPLICITLY IN STATEMENTS OF WORK AND SPECIFICATIONS
- RELATE READINESS ACTIVITIES TO THE BUDGET
- DEVELOP AND UPDATE COMPREHENSIVE PLANNING OF INTEGRATED LOGISTICS SUPPORT (ILS) ACTIVITIES
- STRUCTURE THE LOGISTICS SUPPORT ANALYSIS (LSA) PROGRAM TO REQUIREMENTS AND OBJECTIVES
- ENSURE EARLY "FRONT END" DEVELOPMENT OF READINESS OBJECTIVES

Figure 1-1. Readiness and Supportability Guidelines

The program manager (PM) is assigned the responsibility for establishing and managing an adequately funded ILS program. The early identification of readiness objectives and their translation into explicit supportability design parameters are necessary to achieve system readiness objectives at an affordable Life-Cycle Cost (LCC).

Advances in computer technology have facilitated the improvement of methods for developing logistics support. Logistics aspects of CALS are described in Chapter 4.

1.3 GUIDELINES

Major guidelines for the development of readiness objectives are listed in Figure 1-1 and discussed in the following paragraphs.

1.3.1 Mission Need

Continuing analyses of threats associated with specific mission areas (Figure 1-2) may result in the identification of a need for

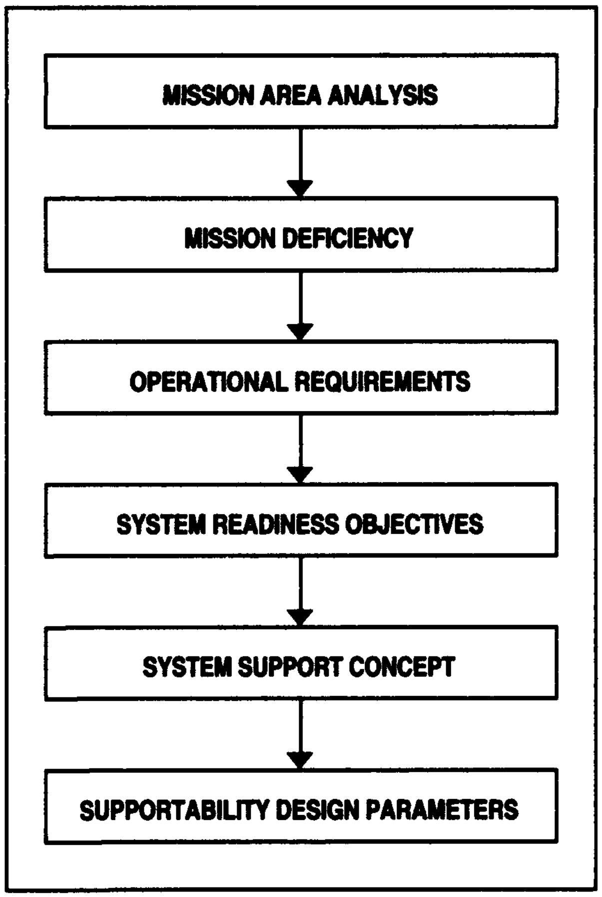


Figure 1-2. Relationship of ILS Objectives to Mission Need

new or modified system to meet the threat. Readiness objectives must be established to support the system's operational requirements. The readiness objectives determine or influence the manner in which the system will be supported in its operational role. This leads to the establishment of supportability parameters for use in the system design process. (See Chapter 3.)

1.3.2 Integration with Design Effort

The establishment of supportability parameters is an engineering design activity. It must be integrated with all other design development performed as part of the system engineering process, using compatible design techniques. (See Chapter 5.)

1.3.3 Specification of Supportability Objectives

System designers are guided by and held accountable to requirements system specifications and Statements of Work (SOW). Logistics Support Analysis (LSA) provides a means for determining supportability objectives but does not by itself direct design activity. Supportability-related design parameters, such as operational R&M, must be specified in design-related terms that can be interpreted unambiguously, designed to and demonstrated. (See Chapters 3 and 11.)

1.3.4 Relation to the Budget

Readiness objectives have two basic relationships to Defense budgets. First, effective implementation will be possible only when logistics support resource requirements and supportability-related tasks receive adequate funding. Second, objectives are links to the determination of LCC and particularly Operation and Support (O&S) costs, which generally account for about 60 percent of the total system LCC. These relationships must be evaluated continuously for the impact of system design decisions. (See Chapters 6 and 10.)

1.3.5 Comprehensive ILS Planning

Early development — during Concept Exploration and Definition (CED) — and continued updating of ILS planning are critical to the attainment of readiness objectives throughout the system's life cycle. A comprehensive and current ILS Plan provides essential direction to the multidisciplinary ILS activities required to satisfy evolving requirements. The ILS program and LSA activities must remain responsive to these requirements. (See Chapter 2.)

1.3.6 Structuring the Logistics Support Analysis Program

The general attributes of a well-structured ILS program, offering needed emphasis on readiness objectives, can be identified from LSA tasks outlined in MIL-STD-1388-1A, "Logistics Support Analysis." The total analysis effort must be structured to achieve readiness objectives by tailoring tasks to obtain cost-effective implementation. (See Chapters 2, 7 and 8.)

Experience has demonstrated that emphasis on readiness must start at the front end of the program, when requirements are defined and system performance characteristics and objectives are established. Readiness and supportability are inextricably bound to these early activities. Prior to program initiation, cost drivers and supportability problems of existing systems operating in the mission area provide the basis for continuing logistics Research and Development (R&D) and the focus for improved performance in the new system. (See Chapter 3.)

1.4 ILS ELEMENTS

The ten ILS elements (Figure 1-3) are specified in DoDI 5000.2, Part 7A. Eight of the ten, (all but Maintenance Planning and Design Interface), focus on the logistics support resources that contribute to system operation and the attainment of readiness objectives in the system's operational role. Maintenance Planning and Design Interface are directly related to the system engineering management process. During early development phases, the Design Interface develops the supportability influence starting at the system level and proceeding down the system indenture levels (Figure 1-4). This dovetails with detailed Maintenance Planning and eventually results in a bottom-up identification of total logistics resource requirements.

- Maintenance Planning: The process conducted to evolve and establish maintenance concepts and requirements for the lifetime of the system.

- Manpower and Personnel: The identification and acquisition of military and civilian personnel with the skills and grades required to operate and support the system over its lifetime at peacetime and wartime rates.

- Supply Support: All management actions, procedures and techniques used to determine requirements to acquire, catalog, receive, store, transfer, issue and dispose of secondary items. This includes provisioning for initial support as well as replenishment supply support.

- Support Equipment: All equipment, mobile or fixed, required to support the operation and maintenance of the system. Equipment includes associated multiuse end items, ground-handling and maintenance equipment, tools, metrology and calibration equipment, test equipment and automatic test equipment. It includes the acquisition of logistics support for support and test equipment.

- Technical Data: Scientific or technical information recorded in any form or medium, such as manuals and drawings. (Computer programs and related software are not technical data; documentation of computer programs and related software are. Also excluded are financial data or other information related to contract administration.)

- Training and Training Support: The processes, procedures, techniques, training devices and equipment used to train civilian, active duty and reserve military personnel to operate and support the system. It includes individual and crew training (both initial and continuation); new equipment training; initial, formal, and on-the-job training; and logistics support planning for training equipment and training device acquisitions and installations.

- Computer Resources Support: The facilities, hardware, software, documentation, manpower and people needed to operate and support embedded computer systems.

- Facilities: The permanent, semi-permanent, or temporary real property assets required to support the system, including studies to define facilities or facility improvements, locations, space needs, utilities, environmental requirements, real estate requirement and equipment.

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

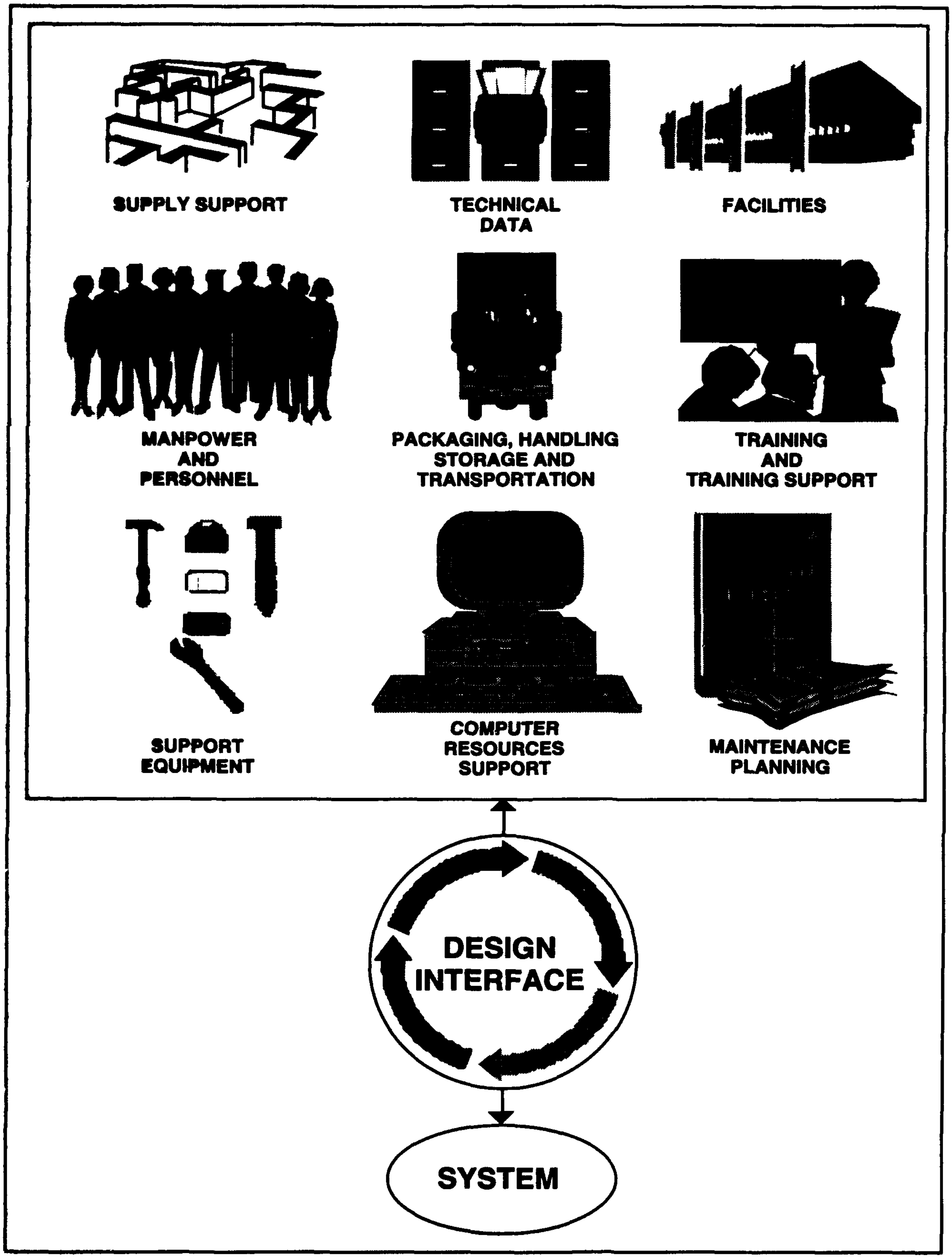


Figure 1-3. The ILS Elements

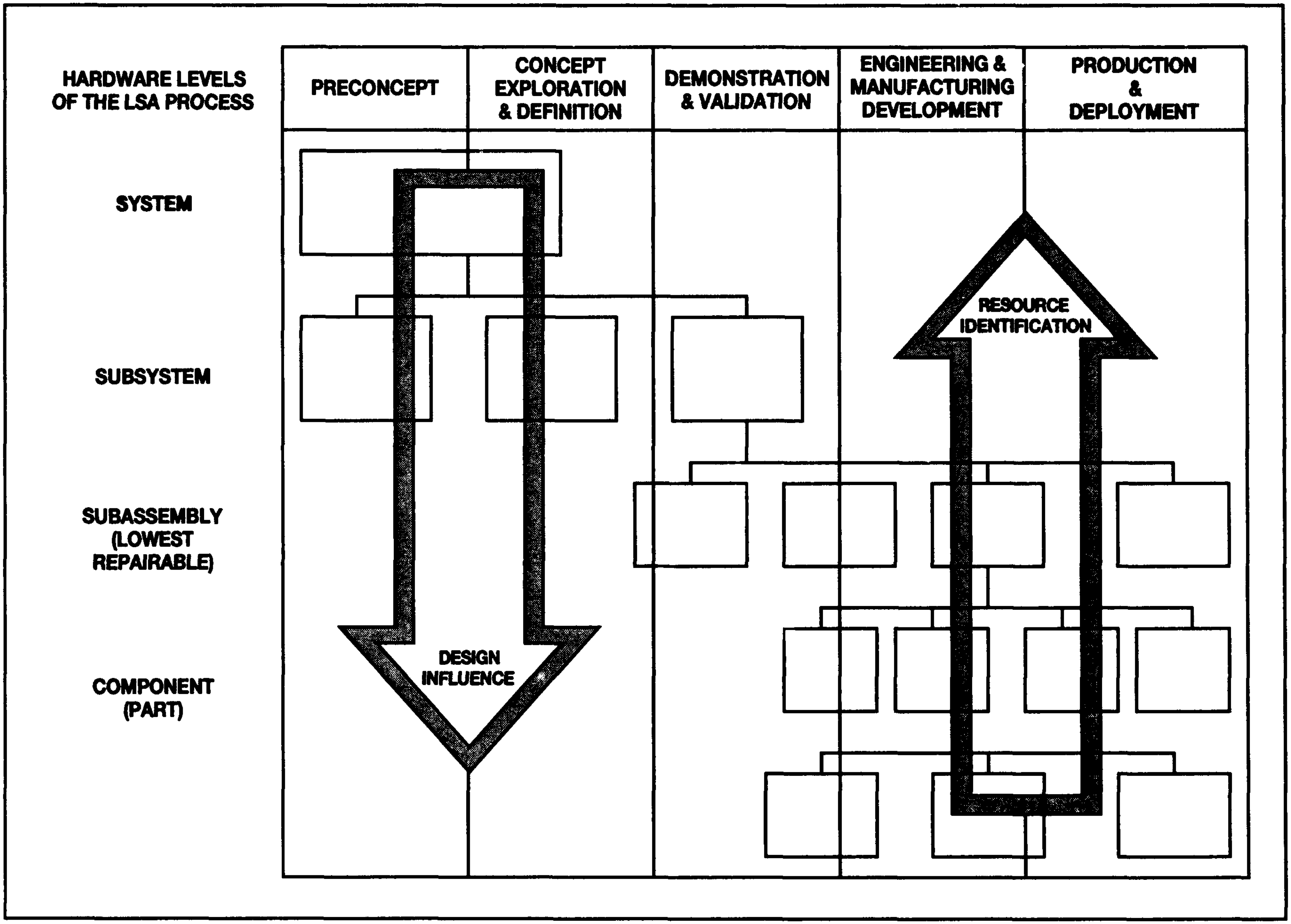


Figure 1-4. LSA Activity Emphasis During the Acquisition Cycle

cesses, procedures, design considerations and methods to ensure that all system, equipment, and support items are preserved, packaged, handled, and transported properly, taking into consideration environmental issues, equipment preservation requirements for short and long term storage and transportability.

- Design Interface: The relationship of logistics-related design parameters to readiness and support resource requirements. These logistics-related design parameters are expressed in operational terms rather than as inherent values, and specifically relate to system readiness objectives and support costs of the system.

1.5 TOTAL QUALITY MANAGEMENT (TQM)

The TQM is a strategy for continuously improving performance at every level. The TQM combines fundamental management techniques, existing improvement efforts and specialized technical tools focused on continuous improvement of all products and services. Two TQM techniques are discussed in later chapters: concurrent engineering in 5.3.4 and production variability reduction in 12.3.2. Examples of strategies for implementing TQM within the DoD are shown in Figure 1-5.

TQM STRATEGIES

- **Know your customers; set measures of success**
- **Concentrate on prevention not correction**
- **Reduce chronic waste**
- **Pursue continuous improvement**
- **Reduce production variances**

Figure 1-5. Examples of TQM Strategies

1.6 DEFENSE ACQUISITION IN THE 90s

The following four documents have established a major restructuring of the Defense acquisition process:

- Final Report to the President by the Blue Ribbon Panel on Defense Management, June 1986.

- Defense Management Report to the President, July 1989.

- DoDD 5000.1, "Defense Acquisition," 1991.

- DoDI 5000.2, "Defense Acquisition Management Policies and Procedures," 1991.

The Defense Management Report (by the Secretary of Defense) essentially completed implementation of the acquisition streamlining recommendations of the Blue Ribbon Panel. DoDD 5000.1 and DoDI 5000.2 provide directions, policies and procedures that implement the Defense Management Report.

1.6.1 Acquisition Management Streamlining

The layers of management between the Secretary of Defense and the managers of major acquisition programs have been reduced to the three shown in Figure 1-6.

- The Defense Acquisition Executive (DAE) occupies the position of Under Secretary of Defense for Acquisition and exercises full responsibility for supervising the performance of the DoD acquisition system.

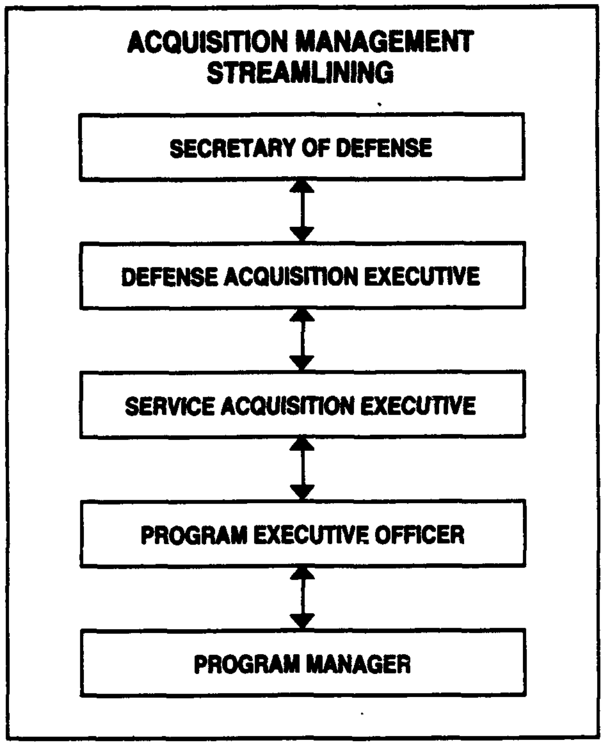


Figure 1-6. Acquisition Streamlining

• A Service Acquisition Executive (SAE), an Assistant Secretary within each military department, exercises full-time responsibility for all service acquisition functions.

• Within each military department, the SAE manages all major acquisition programs through Program Executive Officers (PEOs) who are dedicated full-time to management of assigned programs.

1.6.2 Acquisition Phases

The DAE is the milestone decision authority for designated major Defense programs. These are referred to as Acquisition Category (ACAT) ID programs. Milestone decision authority for all other programs (ACAT IS, II, III, IV) is assigned to the military departments.

• CED Phase: Explore various alternatives to satisfy the requirements of the mission need statement (MNS). Define the most promising system concept(s).

• Demonstration and Validation (DV) Phase: Define the critical design characteristics and capabilities. Demonstrate that the required technologies can be incorporated into system design. Establish a baseline support concept.

• Engineering and Manufacturing Development (EMD) Phase: Translate the design approach into a stable, producible and cost-effective system design. Demonstrate through developmental and operational testing that the system meets specification requirements, satisfies the mission need and meets minimum acceptable peacetime and wartime readiness requirements.

• Production and Deployment (P&D) Phase: Establish a stable, efficient production and support base. Achieve an operational capability that satisfies the mission need. The milestone IV review, Major Modification, is conducted during this phase to determine the need for major modification.

• O&S Phase: Attain and maintain required performance characteristics and capabilities. Identify shortcomings and deficiencies to be corrected.

1.6.3 Fabrication, Production, and Testing

Early tests of prototypes are conducted during DV to demonstrate the concept, to identify risks and to select an approach and system developer for the EMD phase.

Development testing of one or more engineering development models is performed during EMD to verify achievement of specified performance. Operational testing is performed during this phase to determine

PHASES		O CED	I D/V	II EMD	III P&D	IV O&S
MILESTONES	O CONCEPT STUDIES	I CONCEPT DEMO	II DEVEL-OPMENT	△ LRIP DECISION	III PRODUCTION	IV MAJOR MODIFICATION
KEY MILESTONE DOCUMENTS	MNS	ADM IPS STAR TEMP PLCE ICE COEA ORD	ADM IPS STAR TEMP PLCE ICE COEA ORD MER	ADM IPS STAR TEMP PLCE ICE COEA ORD MER	ADM IPS STAR TEMP PLCE ICE COEA ORD	ADM
ACQUISITION PROGRAM BASELINE		△ CONCEPT	△ DEVELOP-MENT	△ PRODUCTION		
KEY OBJECTIVE		EXPLORE ALTER-NATIVES	DEFINE/ DEMON-STRATE CAPABILITIES	DEVELOP/VERIFY SYSTEM PERFORMANCE AND MANUFACTURING PROCESS	ESTABLISH PRODUCTION/AND SUPPORT BASE	ATTAIN AND MAINTAIN REQUIRED PERFORMANCE
SYSTEM DELIVERIES			PROTOTYPE			
TEST & EVAL DT&E OT&E						

NOTE: INTEGRATED PROGRAM SUMMARY (IPS) INCLUDES ACQUISITION STRATEGY REPORT, RISK AND AFFORDABILITY ASSESSMENTS, ENVIRONMENTAL ANALYSIS, AND COOPERATIVE OPPORTUNITIES DOCUMENT

ACRONYMS:

ADM	ACQUISITION DECISION MEMORANDUM
CED	CONCEPT EXPLORATION & DEFINITION
COEA	COST & OPERATIONAL EFFECTIVENESS EVALUATION
DT&E	DEVELOPMENT TEST & EVALUATION
DV	DEMONSTRATION & VALIDATION
EDM	ENGINEERING DEVELOPMENT MODEL
EMD	ENGINEERING & MANUFACTURING DEVELOPMENT
FRP	FULL-RATE PRODUCTION
ICE	INDEPENDENT COST ESTIMATE
LRIP	LOW-RATE INITIAL PRODUCTION
MER	MANPOWER ESTIMATE REPORT
MNS	MISSION NEED STATEMENT
O&S	OPERATIONS & SUPPORT
ORD	OPERATIONAL REQUIREMENTS DOCUMENT
P&D	PRODUCTION & DEPLOYMENT
PLCE	PROGRAM LIFE-CYCLE COST ESTIMATE
STAR	SYSTEM THREAT ASSESSMENT REPORT
TEMP	TEST & EVALUATION MASTER PLAN

Figure 1-7. Logistics Support Analysis Process Objective by Program Phase

operational effectiveness and suitability under realistic combat conditions using typical operators and maintainers. Operational testing of production or "production representative" items must be used to support the milestone III full-rate production decision. An option for low-rate initial production may be chosen to prove the capabilities of production processes and equipment.

Follow-on operational and production verification is conducted during P&D to confirm performance and quality.

1.6.4 Key Milestone Documents

Key documents that support milestone reviews or document decisions made are identified in Figure 1-7 and defined briefly below. Formal definitions are provided in DoDI 5000.2, Part 15, *Definitions*, and repeated in Appendix A, Glossary, to this guide. Descriptions of the content of these documents are provided in DoD Manual 5000.2-M, Defense Acquisition Management Documentation and Reports.

- Acquisition Decision Memorandum (ADM): Documentation of the milestone decision authority decision;

- Acquisition Strategy Report: Description of the acquisition approach to include streamlining, sources, competition and contract types;

- Affordability Assessment: Breakdown of program costs compared to funds expected to be available;

- Cooperative Opportunities Document: Description of opportunities for cooperative development with an allied country;

- Cost and Operational Effectiveness Analysis (COEA): Analysis of estimated cost and operational effectiveness of alternative systems;

- Environmental Analysis: Analysis of potential impacts of the system on public health and safety;

- Independent Cost Estimate (ICE): Estimate of the costs to acquire goods or services prepared by someone independent of the authority acquiring the goods or services;

- Integrated Program Summary: Document prepared by the PM and submitted to the milestone decision authority to support proceeding into the next phase;

- Manpower Estimate Report (MER): Estimate of manpower required for full operational deployment of major defense programs;

- Mission Need Statement (MNS): Statement of operational capability required to perform an assigned mission;

- Operational Requirements Document (ORD): Statement of performance and operational parameters for the proposed concept or system;

- Program Life-Cycle Cost Estimate (PLCE): PM's LCC cost estimate for the program;

- Risk Assessment: Identification of components having moderate risk or higher;

- System Threat Assessment Report (STAR): Description of the threat to be countered; and

• Test and Evaluation Master Plan (TEMP): Documentation of critical test objectives, approach, and methodology.

1.7 REFERENCES

1. DoDD 5000.1, "Defense Acquisition."

2. DoDI 5000.2, "Defense Acquisition Management Policies and Procedures."

3. DoD 5000.2-M, "Defense Acquisition Management Documentation and Reports."

4. DoD Long Range Logistics Plan, OASD (MRA&L).

5. AR 700-127, "Integrated Logistics Support."

6. AR 70-1, "Army Acquisition Policy."

7. MCO P4105.3, USMC Integrated Logistics Support Manual.

8. SECNAVINST 5000.2A, "Implementation of Defense Acquisition Management Policies, Procedures, Documentation and Reports."

9. AFR 800-2, "Acquisition Program Management."

10. AFR 800-8, "Integrated Logistics Support (ILS) Program."

11. AMCR 700-15, "Integrated Logistics Support."

2

ILS PLANNING

2.1 HIGHLIGHTS

- Acquisition Program/ILS Planning Relationship

- Integrated Logistics Support Management Team

- Integrated Logistics Support Plan

- Integrated Support Plan

2.2 INTRODUCTION

2.2.1 Purpose

To provide a managerial overview of the requirements and responsibilities for planning the ILS effort; to relate ILS planning to overall acquisition program planning requirements and describe the principal ILS planning documents.

2.2.2 Objective

ILS plans provide the details of the ILS program and their relationship with overall program management and ensure coordination of logistics issues among all members of the government/contractor management teams.

2.3 MANAGEMENT ISSUES

2.3.1 Background

The system acquisition process requires that an extensive set of plans be prepared. Nearly all of these plans require an ILS input. Once approved, they provide guidance and direction to the ILS effort. The preparation, coordination, use and revision of ILS-related plans is a major and significant task for the ILS manager.

2.3.2 Integrated Logistics Support Management Team (ILSMT)

DoDI 5000.2, Part 7A, "Integrated Logistics Support" requires the integration of ILS planning and execution within the system design and acquisition processes. Each Service requires that ILS managers establish an ILSMT. The team is formed before a contractor is selected so that it can help with the planning effort, which includes the request for proposal, source selection, and program management plans. It is composed of government and industry program management office members, and personnel from the using command and from commands and activities concerned with logistics, training, testing and other acquisition functions. If applicable, personnel from other Services may be included.

The ILSMT advises and assists the ILS manager with planning, coordinating and monitoring of schedules and contractor performance. It helps to ensure the accuracy and timeliness of government inputs, and to evaluate contractor compliance with applicable requirements, regulations, specifications, standards and guidelines. The government and contractor ILS managers generally co-chair the ILSMT. Meetings are often scheduled in conjunction with key program events. Their frequency depends on the intensity of ILS planning activity.

2.3.3 Acquisition Program Planning

Acquisition planning involves the preparation of many plans required for the management of the program. Some are specifically prepared to support decision makers at milestone review times. Key plans and other documents required for milestone reviews are listed on Figure 1-7 and in paragraph 1.6.4. The government or contractor ILS managers prepare or provide input to most of these plans.

2.3.4 ILS Planning

Key ILS plans include the (ILSP), the Integrated Support Plan (ISP), the Post-Production Support Plan (PPSP), and a deployment plan.

2.3.4.1. Integrated Logistics Support Plan (ILSP)

The ILSP is the principal logistics document for an acquisition program and serves as a source document for summary information required in such milestone documents as the MER and the TEMP. It must, therefore, be prepared, coordinated and approved in time to allow for development and incorporation of summary level data with the milestone documents. The purpose of the ILSP is to:

• Provide a complete plan for support of the deployed system;

• Provide details of the ILS program and its relationship with overall program management;

• Provide necessary information on ILS aspects necessary for sound decisions on further development/production of the basic system; and

• Provide the basis for preparation of ILS sections of the procurement package, e.g., SOW, Specification, and Source Selection and Evaluation Criteria.

The ILSP describes the overall ILS program, including requirements, tasks, and milestones for the immediate acquisition phase and plans for succeeding phases. The plan is tailored to the specific needs of each program and will address the total system, including the end item, training devices and support equipment. When approved, the ILSP becomes the implementation plan for all participating activities and is treated as an integral part of the total program planning process. Effective implementation of the ILSP is a major management challenge because of the numerous logistics support interfaces.

2.3.4.1.1 ILSP Time Phasing

The Government Program Office will prepare, coordinate and promulgate the initial ILSP during the CED phase. It provides the basis for other government and contractor planning during this phase and for ILS planning in follow-on phases. By Milestone I, the ILSP should include specific tasks to be accomplished during the DV Phase, identify the responsible Service agencies and activities, and establish the schedule for task completion. The ILSP should also project requirements, tasks and milestones for future acquisition phases.

During the DV and following phases, the ILS manager may obtain contractor assistance to review and update the ILSP. The plan will become progressively more detailed as the program design activity progresses. Before entering the EMD phase, the update of the full scope ILSP will be completed by the government ILS manager. The update will reflect the results of the DV, include pertinent details from the contractor-prepared ISP and describe the plan for the EMD phase.

During EMD and in subsequent phases, the ILSP will have continuous government and contractor involvement in reviewing, refining, expanding and updating the plan. The ILSP will be updated:

• When new program direction is received;

• When there are changes that involve personnel, training, facilities and other ILS planning elements;

• Before milestone decision reviews; and

• When there are major system configuration changes.

The responsibility of the government is to ensure that all milestones are listed, that the timing is correct, and coordination actions have been completed. The contractor should provide inputs as appropriate for ILSP updates.

2.3.4.1.2 ILSP Contents

The contents of the ILSP must reflect the needs of the specific system. The Army and the Air Force prescribe a three part plan (Section I. General; Section II. Plans, Goals and Strategy; and Section III. ILS Milestone Schedules). The Navy provides a more detailed list of contents that are also tailored to the four acquisition categories. The following are guidelines adapted from the service regulations.

A. General. This normally includes: (a) a system description including government Furnished Equipment (GFE) and associated support equipment; (b) program management organization and responsibilities, associated Services, agencies and working groups; and (c) applicable documents involving requirements, guidance and evaluation criteria.

B. Concepts, Goals and Strategy. The main body of the ILSP covers the following topics:

• Operational and organizational concept involving mission requirements, operational environment and other required LSA input parameters.

• Maintenance Concept.

• System readiness objectives for both peacetime and wartime situations.

• A logistics acquisition strategy involving contractual approaches and incentives for LCC, R&M and supportability goals.

• Logistics Support Analysis Plan (LSAP) which, because of its importance in realizing program and ILS objectives, may be provided as a separate document. This plan describes in detail the LSA strategy and the results expected.

• Supportability test and evaluation concepts involving identification of specific test issues related to overall ILS objectives and to each ILS element.

• The objectives, concepts, trade-off factors, goals, thresholds, special requirements, responsibilities, and validation and verification requirements for each ILS element. The manner in which the elements of

ILS are to be progressively specified, designed, tested and/or acquired and then integrated with the other elements will be documented.

• Planning for deployment and the transfer of logistics support responsibility will describe the procedures for the change over from contractor to government support addressing each of the applicable elements.

• Support resource funds involving ILS-related life-cycle funding requirements (funded and unfunded) will be identified by ILS element, program function and appropriation category.

• Post-deployment assessments involve plans for analyzing and assessing field data feedback related to materiel support and support system performance. The plans will address assessment methodology, identify milestones and responsibilities, and describe the strategies for improvements.

2.3.4.1.3 ILS Milestone Schedules

The ILSP also provides system program schedule charts showing the inter-relationship of logistics tasks and events to the overall program milestones and to each other. These charts focus on such elements as management, training, testing, maintenance, and supply support. They identify assignments, responsibilities, and events. Figure 2-1 is an example of a management information chart developed for the AMRAAM ISP. The ILS milestone schedules are the baselines for planning in the materiel acquisition process, therefore:

• System program schedule charts used by program management should depict the most essential support program milestones; these are the milestones that relate critical support capabilities to overall program success.

• Milestone data should include the nature and timing of activities of all supporting contractor and government organizations.

• Milestone schedule charts should include a system program schedule and a summary ILS program schedule. The program and ILS schedules highlight the relationships between key events on the two charts.

• Individual support element program plans should include a program schedule showing key program milestone achievements for that particular element.

• The integrated network schedules should show dependency relationships between support elements. Some of the features and benefits of the integrated network are:

— Computer-generated critical path methodology (such as PERT and CPM) to define critical paths and slack times;

—Clear visualization for management of interfaces;

— Integration with the program management information system (MIS);

— Illustration of the relationship between LSA results and the various ILS elements, to facilitate the identification of support equipment, acquisition events, procurement lead times, etc.;

— Compliance with the requirement of DoDI 5000.2, Part 7A, to establish an ILS MIS;

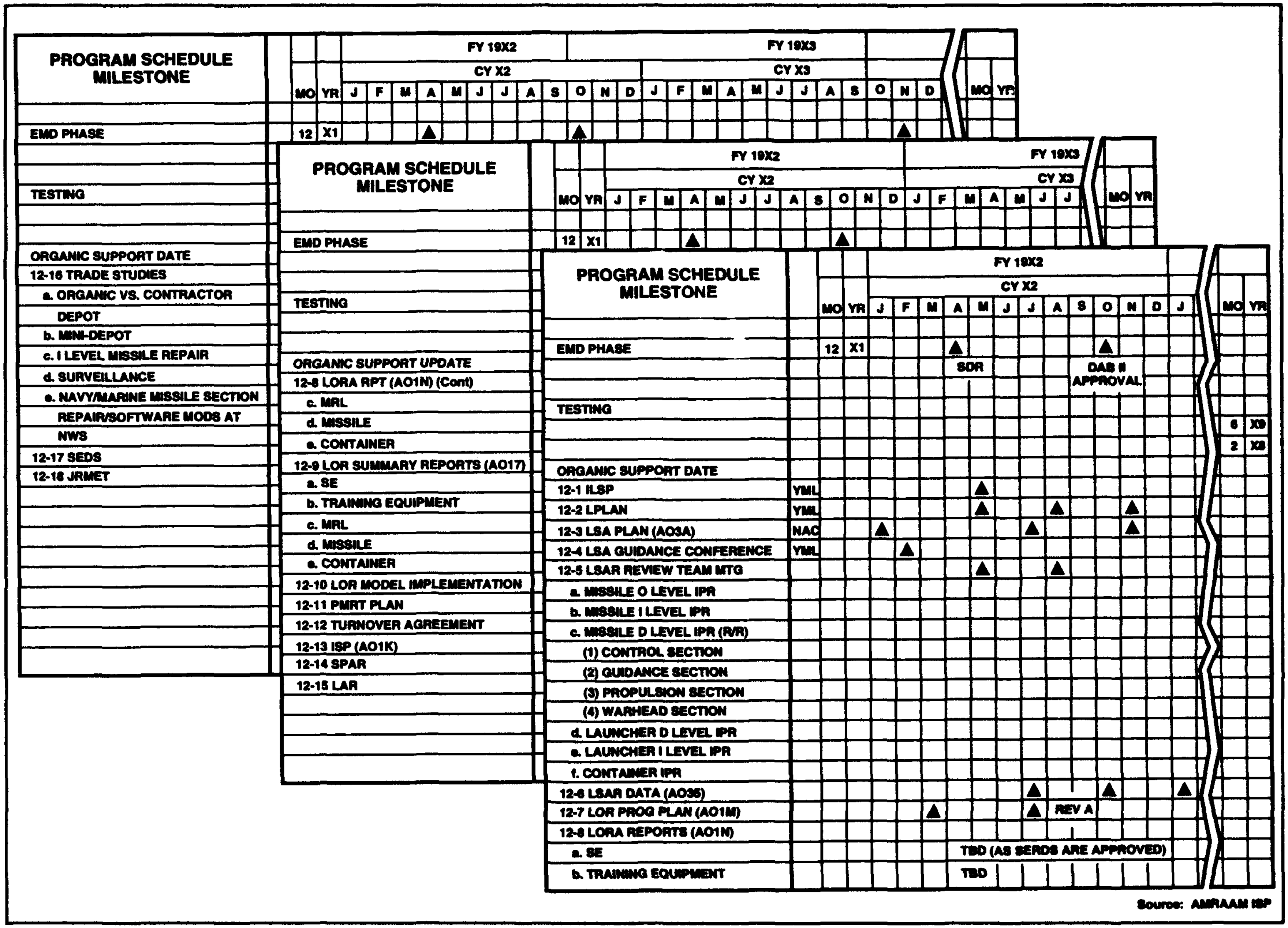


Figure 2-1. Logistics Support Management Information

— Potential to combine the ILS MIS with cost and manpower reporting for total ILS management control.

2.3.4.2 Integrated Support Plan (ISP)

Solicitation documents and contracts with industry and other performing activities will include a requirement to develop an ISP that sets forth the contractor's plan to accomplish the projected ILS efforts. The ISP activities may also be used to structure ILS studies and other deliverables for follow-on logistics efforts. Pertinent portions of the ISP are usually incorporated into updates of the government-prepared ILSP. The ISP is an iterative document that must be accepted and approved by the government. Data Item L-6138 provides preparation instructions. The contents of the contractor's ISP include:

- Organization
- Responsibilities
- Schedules
- Major Tasks
- Sub-plans (e.g., LSA, training, provisioning)
- Inter-relationships among logistics elements
- External Constraints
- Other Pertinent Factors

2.3.4.3 Post-Production Support Plan

The PPSP must deal with the often challenging need to sustain effective operation and readiness after contractor delivery of the last production system. (See Chapter 14.)

2.3.4.4 Deployment Planning

The ILS manager is responsible for preparing a plan that outlines the schedules, procedures and actions necessary to successfully deploy a new materiel system. Deployment planning is discussed in Chapter 13.

2.4 SUMMARY

There are several keys to a successful logistics program. They are:

- Logistics involvement in all program planning, beginning before program initiation (milestone 0) when the initial MSN is prepared;
- Effective use of the ILSMT in the planning process;
- Preparation of an ILS plan tailored to the system prior to Milestone I; and
- Implementation of the ILS plan as a current and integral part of the overall program.

2.5 REFERENCES

1. DI-P-7119, "Post-Production Support Plan."

2. DI-S-7120, "Supportability Assessment Plan."

3. DI-ILSS-80395, "Integrated Support Plan (ISP)."

4. DI-ILSS-80531, "Logistics Support Analysis Plan."

3

READINESS AND SUPPORTABILITY

3.1 HIGHLIGHTS

- ILS Issues in Mission Area Analyses

- Establishing Support Resource Constraints

- Use of Logistics Support Analysis (LSA) to Establish Readiness Objectives

- Establishing Supportability Design Requirements

3.2 INTRODUCTION

3.2.1 Purpose

To provide a managerial overview of the establishment of readiness objectives for a new materiel system and the translation of objectives into system supportability design factors and logistics support parameters.

3.2.2 Objective

The overall objective for a new materiel system is to provide a needed military capability at an affordable cost. Attaining military capability necessitates the achievement of peacetime and wartime readiness objectives. Supportability objectives and supportability design factors are formulated to attain the specified readiness levels within LCC targets and logistics constraints.

3.3 MANAGEMENT ISSUES

3.3.1 Background

Design factors must be established prior to Milestone II (transition to EMD) in order to influence rapidly evolving system design, objectives and thresholds and supportability. Requirements to establish these measures are stated in DoDI 5000.2, Part 7A, "Integrated Logistics Support." Figure 3-1 summarizes the ILS and identifies corresponding LSA tasks as documented in MIL-STD-1388-1A, "Logistics Support Analysis." These requirements and tasks provide the framework for discussion in this chapter.

3.3.1.1 Readiness

Readiness of a materiel system is future-oriented. It represents the system's ability to deliver (e.g., move and shoot, observe and record, communicate) during peacetime and wartime. The system readiness objectives are the criteria used in assessing the ability of a system to undertake and sustain a specified set of missions at planned peacetime and wartime operational tempos. No single universal measure of readiness is applicable to all materiel systems. Expressions of readiness assume forms that are dependent upon the system's design and the conditions of its use. Figure 3-2 lists examples of readiness measures currently employed by the Services.

ACQUISITION PHASE	PROGRAM REQUIREMENTS (DODI 5000.2, PART 7A)	LOGISTICS SUPPORT ANALYSIS TASKS (MIL-STD-1388-1A)
PRECONCEPT	• Identify support resource constraints (mission area analysis)	• Perform mission area analysis • Analyze intended use; identify supportability factors Use Study (LSA Task 201) • Select and analyze baseline comparison factors Comparative Analysis (LSA Task 203)
CONCEPT EXPLORATION-DEFINITION	• Define baseline operational scenarios for system alternatives • Identify support cost drivers and targets for improvement	• Identify peacetime and wartime employment Use Study (LSA 201) • Develop a baseline comparison system; determine supportability, cost and readiness drivers Comparative Analysis (LSA Task 203)
	• Identify and estimate achievable values of logistics and reliability and maintainability (R&M) parameters	• Identify design opportunities for improved supportability Technological Opportunities (LSA Task 204) • Define supportability related design constraints Mission Hardware, Software and Support System Standardization (LSA Task 202) • Update Manpower, Personnel and Training (MPT) constraints Comparative Analysis (LSA Task 203)
	• Establish system readiness objectives and tentative thresholds	• Establish readiness objectives (LSA Task 205.2.2)
DEMONSTRATION AND VALIDATION	• Establish a consistent set of objectives for readiness, R&M and logistics parameters	• Establish supportability characteristics and supportability related design factors (LSA Task 205)
	• Conduct trade-offs among design, support concepts and support resource requirements	• Perform evaluations of alternatives and trade-off analyses (LSA Task 303)

Figure 3-1.
Development of Readiness Objectives and Supportability Design Factors

The Services' warfare planners must define system readiness in terms that are:

- Quantifiable
- Measurable
- Precisely defined by readiness criteria
- Related to the projected peacetime and wartime operational tempos and conditions of use

MATERIEL CATEGORY	TYPICAL READINESS MEASURES
Aircraft	Mission Capable Rate Operational Availability Sortie Rate
Ground-Based Missile	Mission Capable Rate Operational Availability
Air-Launched Missiles	Asset Readiness (Qty)
Combat Vehicles	Mission Capable Rate Operational Availability
Ships	Operational Availability (applies to equipment and weapon system assigned to ships)

Figure 3-2. Examples of Readiness Measures

• Compatible with the Service readiness reporting system

3.3.1.2 Supportability

Supportability is the degree to which system design characteristics and logistics resources, including manpower, meet system peacetime readiness and wartime use requirements. Early program activity by the ILS Manager should:

• Define supportability objectives that are optimally related to system design and to each other.

• Ensure supportability objectives are an integral part of system requirements and the resulting design.

Supportability objectives prescribe conditions and constraints that drive the design of the system and its logistics support. These objectives are related to the planned operational role of the system and the overall support capability of the military services. The following are examples of supportability issues upon which specific objectives can be based:

• Operations and maintenance manpower and manhour constraints

• Personnel skill level constraints

• O&S cost constraints

• Target percentages of system failures (downing events) correctable at each maintenance level

• Mean down time in the operational environment

• Turn-around time in the operational environment

• Standardization and interoperability requirements

3.3.2 Mission Area Analysis

Requirements for new or modified materiel systems generally evolve from continuing analyses of the mission areas assigned to the military services. The purpose of these analyses is to identify deficiencies or to determine more effective means of performing assigned tasks.

SYSTEM MISSION REQUIREMENTS

- **Operational Concept**
- **Operational Environment**
- **Service Support Concept**
- **Performance Requirements**
- **Threat**
- **Mission**
- **Measures of Effectiveness**

DEFICIENCIES OF CURRENT SYSTEM

- **Quantitive and Qualitive Manpower Requirements**
- **Reliability & Maintainability (R&M)**
- **Performance O&S**
- **Support Equipment Requirements**

TECHNOLOGICAL OPPORTUNITIES

- **Materials**
- **Data Processing**
- **Computer Capabilities**
- **Manufacturing Technology**
- **Training Devices/Simulation**
- **BIT & BITE**

LOGISTIC CONSTRAINTS

- **Support Funding**
- **Existing Support Structure**
- **Affordability**
- **Manpower, Personnel and Training**
- **Standardization and Interoperability**

Figure 3-3.
Considerations in the Development of Readiness and Supportability Objectives

Logisticians play a substantial role in these analyses. Their assessment of current systems in the mission area should focus on deficiencies in their supportability performance (e.g., failure rates, maintenance times, fault detection and isolation capability) and on the adequacy of logistics support provided the system. Targets for improvement in both areas should provide the input for each Service's Logistics Research and Development Program. In addition, the mission area analysis should establish realistic bounds on the support resources that can be provided to a proposed new system. Support resource constraints must be identified in the MNS.

3.3.3 Readiness and Supportability Objectives

The development of wartime and peacetime readiness and supportability objectives must be accomplished by Milestone II (transition to EMD). The procedure employed requires evaluation in the areas of system mission requirements, deficiencies of current systems employed in the mission area, technological opportunities and logistics constraints. Figure 3-3 shows representative factors to be considered in each of these areas. During the CED phase, studies based on mission area and materiel system analyses are performed to quantify relationships among the conceptual hardware, mission and supportability parameters. The following paragraphs describe studies and analyses leading to the development of readiness and supportability objectives. The LSA is described in Chapter 7.

3.3.3.1 Use Study (LSA Task 201)

The Use Study is described in MIL-STD-1388-1A as "the prerequisite task to all others in the LSA program." It is a comprehensive analysis of how the new system will be used and supported in its mission area in peacetime and wartime. The Use Study should identify operating requirements (e.g., mission frequency and duration, distance driven, operating hours, rounds fired), number of systems per support unit, environmental factors and other descriptions of operation and support characteristics. The study will be based initially upon an evaluation of existing systems performing similar functions in the mission area with all values adjusted to the mission need of the new system.

3.3.3.2 Mission Hardware, Software and Support System Standardization (LSA Task 202)

From the earliest planning efforts, the PM must recognize the advantages as well as the constraints placed on his or her program by the emphasis on standardization. Standardization of parts and equipment across systems and military services can be a major cost-saving factor, but in order for it to be effective, policy and direction must be established so that the proper constraints can be included in system requirements documents. Standardization impacts the selection of program peripherals such as support equipment; major subsystems such as engines, radios, navigation, electronic countermeasure suites; and basic building blocks such as fasteners and connectors. Standardization should result in a reduction of design risk, parts stockage, and the proliferation of new or unique support items in the government supply system. Standardization should also be considered in the design of new subsystems and support equipment to develop them for use with more than one system. The Airborne Self Protection Jammer (ASPJ), an electronic warfare system designed for a wide variety of Air Force and Navy aircraft, illustrates the strengths and weaknesses of the concept.

There are certain disadvantages associated with standardization, among them restriction of the designer's ability to use advanced technology or innovative techniques. Directed standardization could force the new system to use support equipment that may not be as effective or economical as that designed specifically for the system. The impact on measures of effectiveness must be a consideration in each case.

North American Treaty Organization (NATO) interoperability requirements also impose constraints on system design. When required, the PM must ensure that the system and its subsystems are capable of being operated with or supported by NATO common ammunition, lubricants and other logistics pipeline assets.

Initial standardization studies are performed during the CED phase and provide program direction in two related areas:

(1) Setting constraints upon the prime system to be compatible with selected standard components, software and support equipment.

(2) Identifying components, software and support equipment requiring development for unique application to the prime system.

3.3.3.3 Comparative Analysis (LSA Task 203)

This analysis results in a Baseline Comparison System (BCS). The BCS represents the initial characteristics of the new system for the purpose of:

- Projecting supportability related design factors

- Determining supportability, cost and readiness drivers

- Identifying targets for improvement in the new system and in the supporting logistics support system

Characteristics and performance parameters assigned to the BCS should be derived from an existing system or a composite of existing systems and subsystems performing similar operational roles in the mission area. Different BCSs may be developed to represent the performance of design alternatives as designers attempt to maximize cost-effectiveness. Projections of support costs and resource requirements for the baseline are dependent on usage scenarios developed in the Use Study.

3.3.3.4 Update of Manpower, Personnel and Training (MPT) Constraints - Comparative Analysis (LSA Task 203)

System readiness is bounded by the availability and capabilities of personnel who must operate and maintain the system. The MPT resource constraints established prior to Milestone 0 are updated as system characteristics are progressively defined during development. Human factors engineering seeks a compatible man-machine interface. Constraints placed on design to achieve this compatibility must not, however, preclude the introduction of vitally needed technology enhancement. An effective working relationship among design, logistics, human engineering and training personnel is necessary to produce appropriate design, support concept and training programs required to support new technologies. The introduction of solid state and integrated circuit components is one example. The integrated approach commonly employed includes:

- Modular system design

- Automatic fault detection and isolation — built-in or off-line (automatic test equipment)

- Remove and replace-only corrective maintenance at organizational and forward intermediate levels

- Repair of printed circuit boards at rear intermediate and depot levels

- Training tailored to the skills required at each maintenance level

3.3.3.5 Technological Opportunities (LSA Task 204)

This study identifies and evaluates new technological opportunities available to improve operational performance of the new materiel system and of the logistics support system. These opportunities include new hardware or software technology developed through:

- Ongoing research, exploratory development and advanced development programs
- Other system development programs
- Commercial R&D programs

Technological improvements for materiel systems often result from development of improved components (e.g., improved propulsion subsystems and improved fire control components). The ILS manager should provide sufficient direction and incentives for contractors to adapt and develop technological improvements with the potential to reduce logistics support resource requirements thereby enhancing readiness.

Technological capabilities identified as attainable in the system development program should be incorporated into the BCS so that it evolves as a composite of current and projected enhanced components and better represents the supportability performance that the development program is capable of achieving. This approach is useful in establishing target supportability design values for the new system (see paragraph 3.3.4.2).

3.3.3.6 Establishing Readiness and Supportability Objectives (LSA Task 205.2.2)

Mission requirements and supportability constraints developed in LSA Tasks 201 through 204 must be synthesized to form a compatible set of readiness and support (R&S) objectives. The ILS manager may use computer models to simulate force level engagements and logistics support in an operational environment to assist in the decision process. The input to the simulations may include tentative values of system reliability, maintainability, maintenance turn around times, and mean downtime. Alternate support concepts can be tested. These variables can be used as inputs to the simulations which are applied to an operational scenario of specific duration. Outputs may include sorties completed, spares demand, maintenance delays, and sorties or missions not achieved. Simulations can be repeated to test the sensitivity of the system to R&S decisions and to determine the validity of R&S objectives.

3.3.4 Supportability and Supportability-Related Design Factors (LSA Task 205)

3.3.4.1 Measures of Performance

The R&S objectives must be translated into explicit supportability related design factors that govern design of the materiel system including each of its components and logistics support parameters that govern drive of the logistics support system.

Figure 3-4 displays examples of these measures.

3.3.4.2 Development of Measures of Performance

An initial estimate of system supportability design factors may be derived from the performance parameters of a composite baseline comparison system which incorporates projected technology enhancements (see paragraph 3.3.3.3). This approach has been employed with naval air-

Supportability Design Factors (Materiel Systems)	**System Reliability (Mean Time Between Failures)** **System Maintainability (Mean Time to Repair)** **Maintenance Burden (Maintenance Man-hours Per Operating Hour)** **Built-In-Fault Isolation Capability (Percent Successful Isolation)** **Transportability Requirements (Identification of Conveyances on which Transportable)**
Logistics Support Parameters (Logistics System)	**Provisioning Objective; e.g., Spare to Availability Target** **Supply Support Objectives; e.g., Fill Rates, Order and Ship Times**

Figure 3-4.
Examples of Supportability-Related Design Factors and Logistics Support Parameters

- **Estimate technologically attainable operational parameters for WBS level 3 components.**
- **Combine component parameters to derive system level supportability design factors.**
- **Estimate technologically attainable parameters of logistics support.**
- **Perform simulations to determine attainment of the readiness objectives.**
- **Repeat the steps above to obtain consistent readiness, R&M and logistics parameters.**

Figure 3-5.
Development of Supportability-Related Design Factors and Logistics Support Factors

craft. The steps are summarized in Figure 3-5 and described as follows.

The R&M or other appropriate operational parameters are assigned to each of the Work Breakdown Structure (WBS) level 3 components of the new system — e.g., airframe, propulsion unit, fire control, etc. (The levels 1, 2 and 3 breakdown for aircraft systems is identified in MIL-STD-881A, "Work Breakdown Structures for Defense Materiel Items.") Each parameter is an engineering estimate of the value that technology is capable of achieving in the ensuing system development program.

System level supportability design factors are derived by mathematically combining the operational parameters assigned to the components. Appropriate techniques are described in DoD 3235.1-H, "Test and Evaluation of System Reliability, Availability and Maintainability, A Primer."

The projected capability of the logistics system can be estimated by evaluating ongoing studies to improve performance of the current logistics system. These might include improvements in data processing, automated warehousing and transportation methods.

The adequacy of the technological projections in achieving system readiness objectives should be evaluated by computer simulation techniques. It is likely that the process will need to be iterative to establish a consistent set of objectives for readiness, R&M and logistics parameters as required by Part 7A of DoDI 5000.2, and LSA Task 205.

3.3.5 Evaluation of Alternatives and Trade-Off Analysis (LSA Task 303)

The purpose of this task is to determine the best balance among design characteristics, support concepts and support resource requirements. The following discussion cites trade-offs that significantly impact system design.

3.3.5.1 Repair Level Analyses

Repair level analyses determine whether components should be repaired or discarded and, if repaired, at what maintenance level. Analytic techniques and computer models available to support these decisions determine economic trade-offs among investment costs component procurement costs and O&S costs. The decisions provide input to both maintenance planning and maintainability design. Ease of removal and disassembly must be considered. When repair is not required or is deferred to higher level maintenance, design techniques that reduce production costs and extend component life can be used. For this reason, repair level analysis decisions should be made selectively, starting in the CED phase with major components and continuing through EMD and beyond.

3.3.5.2 Diagnostic Trade-Offs

Diagnostic capabilities inherent in the design of a materiel system or support equipment may be traded with manpower and personnel skill requirements and changes in maintenance concepts. The development of Very High Speed Integrated Circuits (VHSIC) and associated architecture is an example. This developing technology gave the opportunity to develop built-in fault isolation to the printed circuit board level. Development of this degree of built-in fault isolation reduced manpower and skill requirements at the organizational level and reduced the need for intermediate maintenance. These trade-offs must be evaluated by designers and logisticians personnel starting in the CED phase.

3.3.5.3 Survivability Trade Offs

Decreased vulnerability to the effects of battle damage can enable more rapid restoration of force levels and increased sustainability of combat operations. The benefits of improved survivability can be realized most fully when the logistics system can restore the damaged, but recoverable, items to operating condition close to the battle area. An effective battle damage assessment and repair program requires:

- Combat scenario modeling to determine potential lethal and reparable equipment casualties

• Attack mode and materiel system modeling to provide estimates of combat damage to the system

• Historical analyses of combat damage and repair techniques on similar systems

• Development of expedient assessment and repair procedures and their incorporation in technical manuals and training programs

• Determination of additional personnel required to perform wartime battle damage assessment and repair

• Computation of supply support stockage levels based upon combat damage estimates and wartime utilization rates

• Determination of additional transportation requirements for battlefield recovery

System engineers must investigate alternative survivability designs and logistics support capabilities in the CED phase and refine the design in the follow-on development phases.

3.4 SUMMARY

• Initial LSA activities prior to Milestone 0 and during the CED phase should be performed as part of a mission area analysis.

• R&S analysis should be based on:

- System mission requirements
- Deficiencies of current systems
- Technological opportunities
- Logistics constraints and limitations

• The R&S objectives can be developed within a tailored but structured analytical process that includes:

- Mission area analysis
- Support constraints identification
- Use studies
- Comparative analyses
- Technological opportunities
- Mission hardware, software and support system standardization
- MPT constraints updates

• Supportability design factors may be developed by an iterative process of projecting technological improvements for major components into system level factors and the performance of readiness simulations.

3.5 REFERENCES

1. MIL-STD-1388-1A, "Logistics Support Analysis."

2. DoD 3235.1-H, "Test and Evaluation of System Reliability, Availability and Maintainability, A Primer."

4

CONTINUOUS ACQUISITION AND LIFE-CYCLE SUPPORT

4.1 HIGHLIGHTS

- The need for Continuous Acquisition and Life-Cycle Support (CALS)
- CALS in the acquisition process
- CALS standards
- CALS key players

4.2 INTRODUCTION

The CALS is a joint initiative between industry and the DoD. Its goal is to use the inherent features of digitized data to revolutionize the functions of data-gathering, data storage and data-transfer technologies associated with the development of defense systems. The result will be systems that are cheaper, more reliable, and easier to maintain. In 1988, the Deputy Secretary of Defense directed contractual implementation of CALS requiring technical data access and delivery in digital form for new weapons systems. This policy has been incorporated into the DoDI 5000.2.

Good business sense demands that the price of weapons system, as reflected in LCC, be controlled and reduced. Industry has taken a number of steps to cut costs, improve development and production processes, and be competitive in the international and national environment. The successful lessons learned in industry are now being applied to the way in which the government and defense contractors conduct business.

The OSD has taken major steps to improve efficiency through the use of information technology. The highest level strategy is entitled Corporate Information Management (CIM). CIM is managed by the Director of Defense Information and implemented through the Defense Information Systems Agency (DISA). A key tenet of CIM is that data be developed and purchased once, but used many times.

CALS is part of the CIM initiative. It is an evolutionary strategy to focus the DoD system acquisition process into a seamless process from the concept exploration to operations and logistics support. Life-cycle linkage involves a joint commitment between DoD and industry to link contractor data systems and processes with DoD data requirements and processes. This creates the rapid digital interchange of technical information necessary to develop and support modern systems.

The basic tools for this linkage are being improved dramatically. Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) tools affe t not only **what** work is done, but also **how** work is done. Rather than blueprints and drawings, they produce product modeling data which describe manufactured items with great detail and accuracy. This has necessitated a total rethinking of business processes related to acquisition logistics and logistics support.

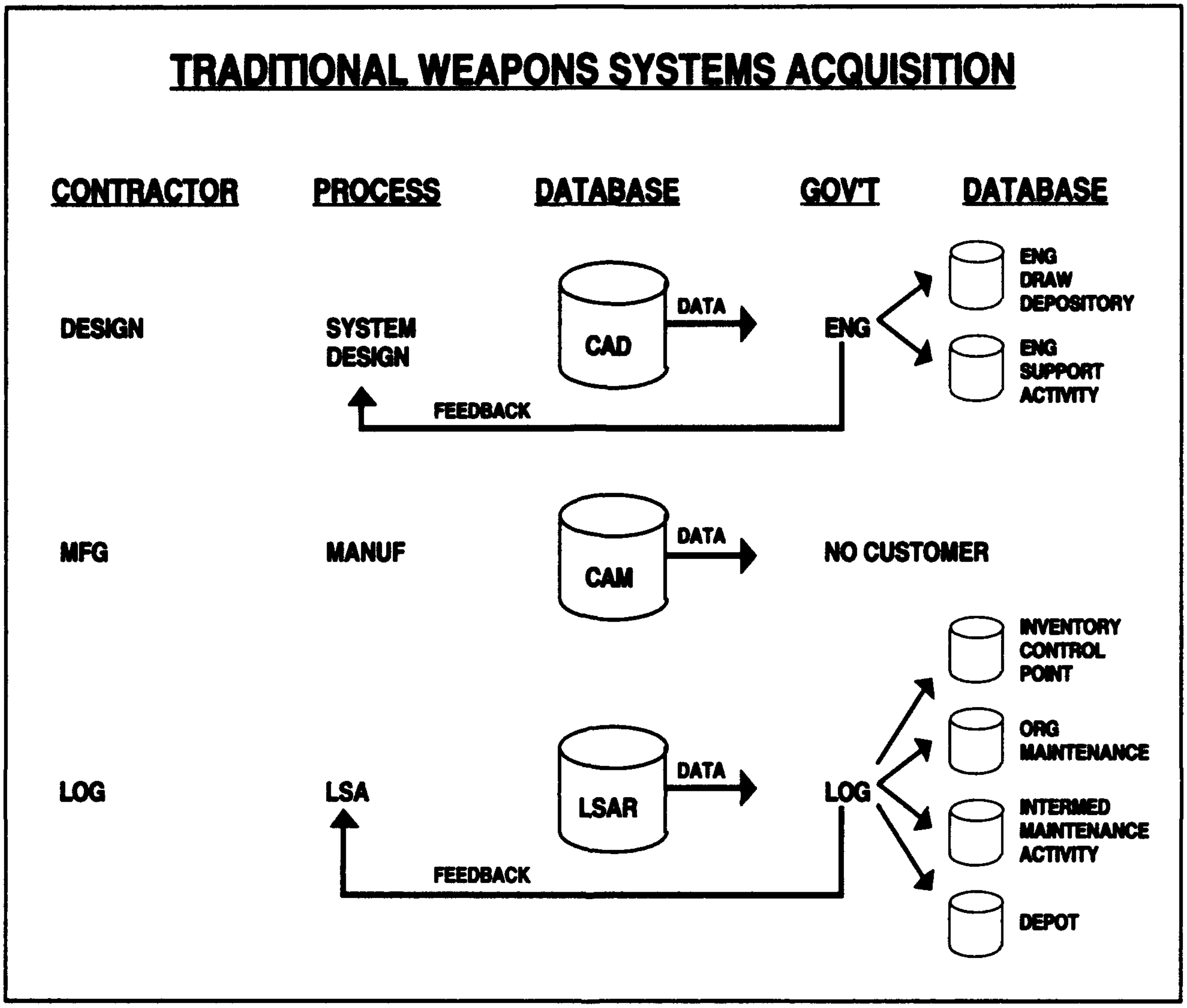


Figure 4-1. Traditional Weapons Systems Acquisition

4.3 TRADITIONAL LOGISTICS SUPPORT

Figure 4.1 contains a generic diagram of DoD's traditional approach to system acquisition. In this case, a defense contractor receives a contract to carry out a number of tasks, among them the design, manufacture and logistics support of a weapons system. The contractor designs the system using CAD tools and, as part of this process, creates a database. (The database is not a separate product, but is developed as an integral part of the design process.)

The CAD data is traditionally transformed by the contractor into discrete data deliverables required by the Contract Data Requirements List (CDRL). The government then sends the resultant information to a number of engineering databases. In this case only two are shown: an engineering data repository and an engineering support activity. As a result, the contractor has developed one database and the government has created two serial databases; all use the same information but are separate and independently maintained.

In manufacturing, a different approach is taken. The contractor traditionally develops manufacturing processes using CAM data, which then supports Computer Integrated

Manufacturing within the contractor's enterprise. Often this information has no customer in the government because the data is peculiar to the contractor's processes and facilities. Some information is related to CDRL requirements, but this information does not go to the government in any integrated manner. Unless the information is retained by the contractor for other purposes, the government is unaware of its existence.

The third area illustrated in Figure 4-1 is the contractor's logistics requirements. LSA is traditionally done in an electronic format (frequently from CAD/CAM data) in which the analysis results in a database documented in LSA records. While the data is created as an integral part of the analysis and manufacturing process, the development of the LSA database is frequently a separate and distinct effort. The data delivered to the government is sent to various government activities with specific functional missions (inventory control points, organizational maintenance activities, intermediate maintenance activities, and depot maintenance activities, etc.).

In summary, this traditional approach transforms the contractor's three databases into a minimum of six discrete databases that are functionally and logically separate. The data in them cannot be easily reconciled with the other databases or with the original, contractor generated database. Furthermore, a great deal of information in the contractor's CAM database is not provided to the government. This information handling process is inefficient and costly.

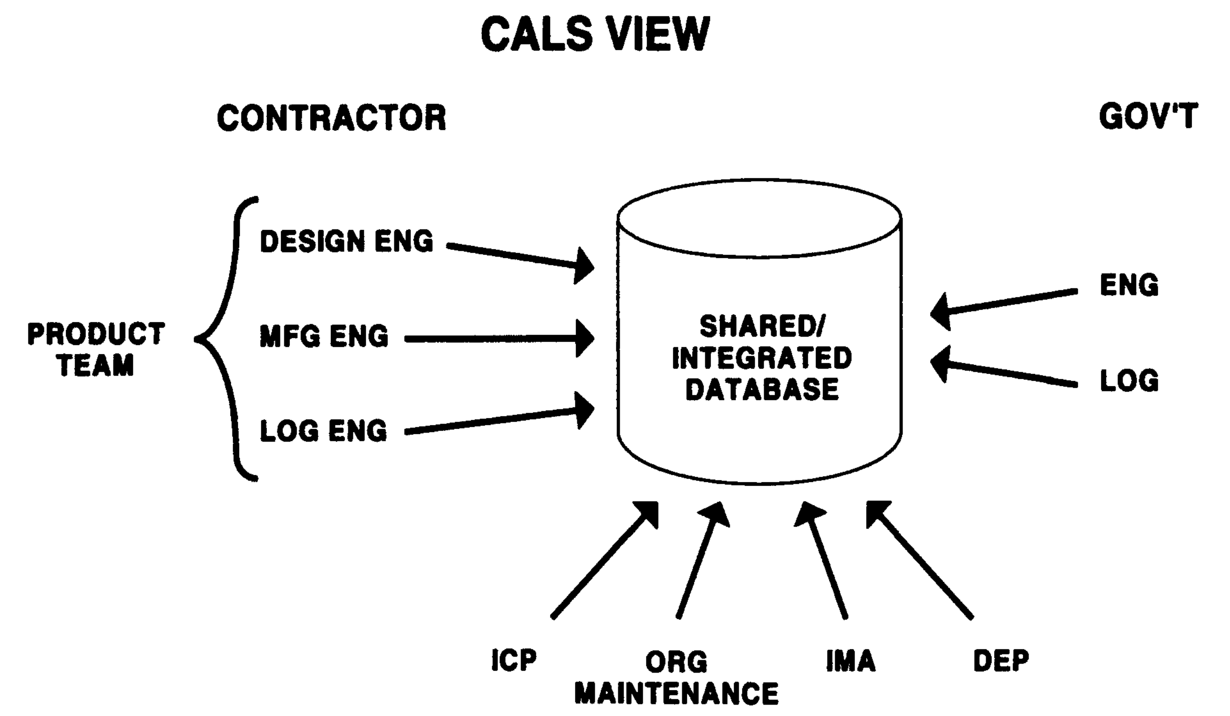
Why would DoD have taken this approach if it is inefficient? There are two basic reasons. First, the process was heavily influenced by the way information was handled in pre-computer age business practices — it was an efficient way to handle information on paper. Second, there was a time when this was the best way to handle even computerized information. Database management tools and computer memory capacity could not handle information on an enterprise-wide basis.

The most effective approach was to separate a business entity into its functional components because information technology only had the capacity to deal with the volume of data at that level. Furthermore, many of the best software packages were designed for specific functional products and were not compatible with other hardware and software systems. Management was aligned along functional specialties so that both the information technology and the management structure were compatible.

4.4 THE CALS APPROACH

Operating and managing at the functional level is no longer effective or efficient and, because of the increased power and memory capacity of modern computers and communications networks, *it* is no longer necessary. Modern information technologies are efficient at the total enterprise level (see Figure 4-2). The development of an integrated database makes a number of different management techniques possible.

The contractor can design and plan manufacturing and logistics using an integrated product team that can include contractor, subcontractors and government personnel communicating in a real-time partnership. Likewise, functional units such as the inventory control points and the operational, intermediate and depot level maintenance activities can input and access information directly from the integrated source.



1) Treat information as a separate, shared resource
2) Develop a logical information design across processes
3) Develop a neutral format (standards) for information exchange

a) Short-term solution: translators between databases
b) Long-term solution: neutral format to feed individual databases
c) Best solution: one logical info model with access to "ALL"

Figure 4-2. CALS View

The key features to this new approach are as follows:

• Advanced information management technologies allow industry and government to treat information as a readily shared resource.

• Logical information designs allow the development of information systems cutting across functional processes to support management throughout the enterprise.

• Neutral formats (standards) allow information exchange regardless of the specific hardware or software used at activity sites.

In the short-term, this type of information structure is being developed by taking the so-called "islands of automation" that were developed under the functional concept and linking them using advanced translators. A longer term solution is to have neutral formats and standards, capable of accessing information, form logical and compatible databases. The best solution, and one that is in the capability of present technology, is to develop one logical data information model for a weapons system that is open to all who have a need for data regarding that system.

4.5 PROGRAM MANAGEMENT OFFICE IMPLEMENTATION

Individual program management offices are responsible for contracting for specific information technology projects built around the CALS initiative. Because each system is unique, the exact method of contractual implementation varies depending on the system and the phase that the contract is meant to support. CALS implementation generally requires the following:

4.5.1 Data Requirements

The traditional Data Call process remains very much the same as far as the definition of data required by the government is concerned. The objective of CALS is not to create additional data, but to make data available in a format easily accessed by those who need it. Some data may have to be delivered in paper copies or as a document to be viewed. Other data may be delivered as processable data files that can be loaded into government computers. The term "delivery" for digital data is redefined as access, not necessarily the actual transfer of information.

The difference between traditional data delivery and CALS access to data can be summarized as the difference between a push and a pull logistics requirement. The traditional method was push. Ultimate users ordered the data they thought they might need as part of the contracting process. Once the order was placed, the contractor pushed the information to the user in accordance with the contract. Often, users did not know exactly what information would be necessary; so, to allow for all contingencies, they ordered more data than was ultimately required.

With the CALS concept, the government and contractor together decide what information needs to be included in the contractor's integrated technical information database; and establish protocols, priorities, and procedures for access. Users who are granted access can use the information in one of five basic ways: view only; annotate and excerpt; update and maintain; process and transform; or archive. Once the database is established, information is a pull commodity. Users pull the information they need when they need it from the database. Contingency information can be left in the database to be used only if and when it is needed.

4.5.2. Government Concept of Operations (GCO)

The information requirements and the methods of delivery are consolidated in a Government Concept of Operations (GCO). The GCO is a statement describing the specific needs of the government for technical information throughout the current phase of the life-cycle. It gives an overview of who the information users will be, what they will do with the data, and how they expect to access data. It also states the government's preference for information provided through an integrated information system and shared data environment. The GCO can be incorporated into Section L of the solicitation or may be an attachment in Section J.

4.5.3. CALS Implementation Plan

The offeror responds to the GCO with a complete implementation plan for using modern information technology throughout the contractual effort. This is tailored to the specific information technology capabilities of the individual offeror and the specific needs of the government program office. The CALS Implementation Plan can be a stand-alone document or may be incorporated into the proposal itself as directed in Section L of the solicitation. The evaluation of the plan should be part of the overall evaluation process; the general importance of the Plan should be described in Section M. The provisions of the CALS Implementation Plan should be incorporated as a contract requirement.

4.5.4. Contractor Integrated Technical Information Service

During the period of contract performance, the database containing the preponderance of information on the weapons system will be owned by the contractor. Although much of the information will eventually belong to the government, a goal of the CALS initiative is to use information in the location and format in which it was created. The Contractor Integrated Technical Information Service (CITIS) is a contractual requirement that allows the government to have access to the contractor's database.

The CITIS is ordered under a separate contract line item in the contract which has two general provisions. First, it requires that the contractor develop an integrated database including the CAD, CAM, LSAR and other data in a relational structure so that all data is compatible and consistent across functional lines. Second, it allows the government access to contractor-generated technical information. The specific requirements of the CITIS and the cost of the service to the government are subject to negotiation as part of the normal contracting process.

4.6 INFRASTRUCTURE MODERNIZATION PROJECTS

The CALS Concept of Operations focuses on the maintenance of an integrated database and allows the government to access the data through the CITIS. To be effective, the government infrastructure must be able to receive, use, and transmit integrated digital data. A modernization program is underway to upgrade the government's capability to function in the CALS environment.

The first step in this modernization process involves transitioning the contractor's database to the government. At the end of the production cycle, this database, along with government-furnished information regarding in-service support information, must be combined and integrated as the Integrated Product Database (IPDB) to support the government's life-cycle requirements. The IPDB contains all product definition and support data for a weapons system, whether the data was first generated by the government or the manufacturer. The goal of the IPDB is to have the information available to those who need it, when they need it, regardless of their geographic location.

The transition may take three forms as follows: (1) keep the database under the technical control of the contractor, add provisions for the addition of government-furnished information, and pay for continuing access and update of the database; (2) move the contractor's database as a deliverable from the production contract to a government agency, which will then update the database with government-furnished information and maintain the database throughout the lifecycle; or (3) develop the IPDB with either contractor or government resources, then contract on a competitive basis with companies whose expertise is to maintain and update databases.

The next step in infrastructure modernization is to develop the capability to effectively use the integrated information in the IPDB. Two information systems programs proposed by the military services have been designated as Lead CALS Programs. They are Joint CALS Program (JCALS) and the Joint Engineering Data Management Information and Control Systems (JEDMICS).

The JCALS is an evolutionary program that has identified a series of functional requirements inherent in the logistics process in weapons systems. Seven functional areas from the total requirement were designated as Resource Critical Information (RCI) areas, among them are LSA/LSAR, Provisioning Technical Documentation, Procurement Data Packages, Training Plans, and Depot Maintenance Planning Documents. The Defense CALS Executive recently tasked the JCALS Program Office with adding the capability to develop and maintain integrated electronic technical manuals.

The objective of JCALS is to tie all of the RCI areas into a single source of data, the IPDB. The IPDB is a continuation of the contractor's integrated technical database that is operated by the contractor, by the government, or by a third party. A critical effort in adapting the IPDB to specific needs is the development of a Global Data Dictionary to define data across functional lines so that a common understanding of the data elements will be established.

The eventual goal is to have a system in which updated information can be instantly processed through all the critical areas. For example, once an engineering change proposal has been approved, all technical documentation, including engineering drawings, technical manuals and training manuals, would reflect the change simultaneously.

The JEDMICS program was an outgrowth of the Navy's effort to provide a digital repository with immediate access from multiple user sites for all engineering drawings. The program has been expanded to provide a means to acquire, store, manage and distribute engineering data necessary to support spare parts and repair functions. The objective of the JEDMICS Program Office is supporting a joint orientation.

These are two programs which affect all military services and have been designated as joint programs by OSD. There are several programs managed at the Service and agency levels that provide CALS capabilities for various facets of the weapon systems life cycle. In cases where the same functional requirement crosses Service lines, there will be other joint offices established where standardization will lead to greater efficiency, improved business methods, and cost savings.

One such program in existence today is the Flexible Computer Integrated Manufacturing (FCIM) Program. It was developed from the Rapid Acquisition of Manufactured Parts (RAMP) program, a joint effort between the Navy and the South Carolina Research Authority and from similar programs initiated in the Army and Air Force. The purpose of FCIM is to provide automated tools that design the manufacturing process using product modeling data information from either a CAD design and CAM manufacturing model. This allows the production of small batches of spare parts efficiently with the elimination of much of the manual work done.

Since many spare part requirements do not have the required CAD/CAM data available, FCIM includes a number of modern technology systems to provide a means for rapid reverse-engineering to provide the product modeling data. The Program Management Office for this program is called the

Joint Center Flexible Computer Integrated Manufacturing.

4.7 IMPACT OF CALS ON THE LOGISTICS COMMUNITY

As the DoD logistics structure evolves and is continuously modernized and improved, individual program offices will have to ensure that their technical data requirements are delivered and used in a manner compatible with these infrastructure requirements. This does not mean that one rigid logistics system will apply to all programs; however, certain standards have been established which most program management offices will be required to maintain. Rather than a standard system, CALS is a system with standards.

The key impact on logisticians will be the need for close working relationships between functional experts. The data input during the provisioning process will be used to develop the technical manuals and training courses. With the development of Integrated Electronic Technical Manuals (IETM) as part of the CALS initiative, paper books will no longer be needed in the field. Portable Maintenance Aids (PMAs) will take their place and some training will be incorporated into the IETM to provide just-in-time training.

The provisioner, the technical manual developer, the trainer, and other logistics specialists will all work from the same integrated database. Much of the database will be developed and maintained by the contractor. This will create a need for standardization and cooperation unprecedented in the history of military logistics. Both acquisition and sustainment logistics will become part of a seamless process that begins before concept exploration and ends when the last unit is provided for disposal.

The modern logistics system based on the CALS concept will be a system with continuously updated and modernized standards. Common definitions and standards for data will exist DoD-wide and all functional specialists will use common data. The logistics business process associated with those standards will, therefore, have to be reviewed, evaluated, and updated on a regular basis in accordance with the principles of continuous process improvement.

4.8 CALS STANDARDS

In the past, the DoD has often used its own resources to develop military standards for a number of products. In the areas of information products DoD has taken a different approach and has worked with the Department of Commerce to have the National Institute for Standards and Technology (NIST) serve as the executive agent for developing CALS standards. The standards that have been issued are not military standards in the classic sense; they are based on national and international commercial standards developed by the business community. These standards reflect the trend toward digital exchange of technical information. The standards are fundamental for CALS success.

The MIL-STD-1840 is the parent military standard for other CALS technical standards which govern the automated interchange of technical information. Listed below are other standards.

- MIL-D-28000 - deals with technical illustrations, engineering drawings and numerical control manufacturing information using a neutral format called Initial Graphics Exchange Standard (IGES)

- MIL-M-28001 - defines the Standard Generalized Markup Language (SGML) used as a neutral format for the exchange of information for processing text data

• MIL-R-28002 - provides a format for the digital delivery of some types of graphics images

• MIL-D-28003 - provides the format for two-dimensional illustrations in technical manuals. Digital delivery of this type of data comes under the standard format called Computer Graphics Metafile (CGM).

All these standards and specifications have been approved by the commercial and international organizations who have the responsibility for developing information technology standards. The standards are in use and have proved to be effective in passing the required information in a standard digital format and can be cited in contractual documents. The standards are under constant review and are updated on a routine basis.

These standards and specifications will eventually be replaced by an international standard known as "STEP," which stands for Standard for the Exchange of Product model data. The American standard for product modeling data was called "PDES" (Product Data Exchange Standard). The American standard has been merged with the international standard and is sometimes called PDES/STEP. The objective of PDES/STEP is to have one standard for all types of digital data exchange, both graphics and text. This standard is still under development with the NIST and a consortium of American Businesses under the title, PDES Incorporated, working with the International Standards Office. The NIST has also developed a standard for IETM.

Another standard, ANSI X12, developed in the commercial marketplace, can be used for the exchange of business information. This standard, published by the American National Standards Institute, supports a process called Electronic Commerce or Electronic Data Interchange (EC or EDI) that applies to transportation, banking and related industries and is used widely in commerce today. EDI applies a complementary methodology to the CALS technical data standards. The Defense Logistics Agency (DLA) is the DoD executive agent for EDI implementation and the policy responsibility for EDI has been consolidated under the OSD CALS Executive.

Any contractual requirement to deliver data in accordance with a standard implies that the receiving activity has some means to ensure that the provider complies with the standards. In the case of CALS standards, DoD has established a facility as part of the CALS Test Network (CTN). Through the CTN both industry and government can test, evaluate, and demonstrate the interchange and functional use of digital technical information exchange. The CTN can also provide training, a central library of CALS technical information, and acquisition program integration support.

Using these CALS-selected standards, program offices and defense contractors can employ the different types of hardware and software used in an open systems environment. Many software products on the commercial market are already written to these standards. In a study by West Virginia University, researchers concluded that small contractors could establish a basic CALS capability using commercially available hardware and software at a cost of under $5,000.

4.9 KEY PLAYERS IN CALS IMPLEMENTATION

CALS is a joint DoD and industry initiative. The key industry organization is the CALS

Industry Steering Group (ISG). The ISG is a committee of the National Security Industrial Association (NSIA) and represents over 110 organizations and companies dedicated to the implementation of the CALS initiative. The ISG takes an active and substantial part in setting CALS policy and procedures. Within DoD, functional responsibility for CALS is with the Principle Deputy Under Secretary of Defense (Acquisition and Technology). The Principle Deputy is assisted by the CALS Management Advisory Council, a consultant group of senior executives from the military services and the DLA. The senior executive responsible for implementation is the Defense CALS Executive who serves as the head of the CALS Evaluation and Integration Office. This office oversees CALS policy development and monitors the use of funding provided by the Congress for specific CALS infrastructure programs. Each year the Defense CALS Executive is required to present a report to Congress on the status of CALS implementation.

The Joint Logistics Systems Center (JLSC) at Wright-Patterson Air Force Base in Dayton, Ohio, focuses on business process improvements including the use of the CALS concept in logistics management. The JLSC exercises management control over common logistics requirements and over funding for many service programs having common logistics applications. Over time, all common logistics functions will interface into a standardized logistics system. This system will be formed through the implementation of major infrastructure modernization programs such as JCALS, JEDMICS, and FCIM. Through evolution, the JLSC will guide DoD from its current use of four distinctly different logistics systems to a single, unified system that supports the requirements of all Services and agencies.

While CALS standards and policies will emphasize uniformity and standardization at the system level, current information technology is flexible enough to allow a substantial degree of decentralization at the user level. For this reason the military departments and agencies will continue to have primary responsibility for CALS implementation. Service cooperation is taking place on many levels to ensure compatibility with major CALS infrastructure modernization activities.

Each Service has provided points of contact to assist in CALS implementation; as have many individual commands. Besides these sources of current information, there are a number of CALS Shared Resources Centers established across the nation to provide specific CALS information to both government and industry offices. Furthermore, CALS lessons are being provided as input to required courses which are a result of the Defense Acquisition Workforce Improvement Act (DAWIA).

4.10 SUMMARY

The implementation of CALS is an evolutionary process guided not by rigid standards and specifications but by principles of common sense and good management. Information must be managed through a centralized control, but execution must remain decentralized. This process requires the elimination or integration of existing information systems and other systems performing the same functions for different services.

The process has the greatest impact on the logistics function because information exchange is such an integral part of logistics management. Functional logistics managers will be held accountable for the controllable costs of developing and operating logistics information systems. This requires reviewing and evaluating logistics practices and procedures on a regular basis to validate the best public and private sector achievement of management goals.

These principles lead directly to a need for common definitions and standards for data throughout DoD and industry, a computing and communications infrastructure that is transparent to the ultimate user, and automation and integration of information that is consistent across many different acquisition programs. This requires an unprecedented level of cooperation and trust between government and industry.

4.11 REFERENCES

1. MIL-HDBK-59, *CALS Program Implementation Guide.*

2. DoDI 5000.2, Part 6, Section N, "DoD Implementation of CALS."

3. MIL-F-CITIS, "Contractor Integrated Technical Information Services."

4. *CALS Training Manual for Industry Middle Managers*, West Virginia University, Concurrent Engineering Research Center.

MODULE

II

Developing the ILS Program

When accomplished early and through the system engineering process, design and support decisions have the greatest impact on system performance, LCC, and readiness and supportability characteristics. This module describes the ILS impact on design and logistics support requirements; the integration of readiness, supportability, and LCC into the ILS process; LSA and its documentation; and test and evaluation procedures that assure the adequacy of planned ILS capabilities.

5

ILS IN THE SYSTEM ENGINEERING PROCESS

5.1 HIGHLIGHTS

• Integration of Support Requirements in the Design Process

• System Engineering and the R&M Interface

• Achieving Support "Design-To" Parameters

5.2 INTRODUCTION

5.2.1 Purpose

To provide a managerial overview of the system engineering process which formulates logistics support "design-to" parameters consistent with established readiness objectives.

5.2.2 Objective

The objective of integrating ILS with system engineering is to ensure that the disciplines of the design process and R&M engineering are employed in developing "design-to" support parameters for the system. This objective is part of the overall program management initiative to:

• Achieve readiness objectives that are challenging but attainable;

• Establish realistic R&M requirements to achieve these objectives;

• Identify support and manpower drivers; and

• Consider logistics support requirements in system design trade-offs.

5.3 MANAGEMENT ISSUES

5.3.1 Background

System readiness is a primary objective of the acquisition process. DoDI 5000.2, Part 7A, "Integrated Logistics Support," emphasizes early identification of such supportability design requirements as R&M and the use of contractor incentives for timely attainment of readiness objectives. To achieve this, a real-time iterative relationship between the ILS process and the product definition (design) process is necessary. The ILS success hinges on how the readiness and supportability characteristics are designed into the system during early development (CED and DV). System engineering, when carried out properly, integrates logistics requirements such as survivability, R&M into design specifications.

5.3.2 System Engineering

System engineering is the application of scientific and engineering efforts to:

(1) Transform an operational need into a description of a system configuration that best satisfies the user's needs according to established measures of effectiveness;

(2) Integrate related technical parameters and assure compatibility of all physical, functional and technical program interfaces in a

manner that optimizes the total system definition and design; and

(3) Integrate the efforts of all engineering disciplines and specialties into the total engineering effort.

5.3.2.1 Integration of ILS into the System Engineering Process

Figure 5-1 illustrates the analytical and decision-making process involved in the application of system engineering to acquisition management for the CED and DV phases. Within the framework of this process, the government operational needs are analyzed; the various design concepts are synthesized, evaluated, and optimized in trade-off studies; and the best design is defined in the system specification. Support design parameters should flow from this process.

The upper portion of Figure 5-1 portrays those efforts and activities that define the overall requirements for prime equipment and associated software. The lower portion of Figure 5-1 contains efforts and activities that define the related logistics support requirements. Supportability objectives often conflict with other design objectives like speed, range, size, etc. Trade-offs, therefore, become an essential part of the design process.

Integration begins by defining trade-off decision criteria. These are modified as the design evolves. The contractor and government ILS managers must work together to incorporate support features into the system (type A) specification which prescribes performance requirements to be achieved during the detailed design effort.

5.3.2.2 Management Linkages

Throughout the development process, it is critical to the success of the logistics support activity to balance integration of multiple technical design needs with ILS management functions. Figure 5-2 has been derived from a diagram of functional linkages used by General Dynamics/Fort Worth for an aircraft program. This figure shows a broad array of functional disciplines in organizational cells on the left side of the linkage diagram. It illustrates the complexity of integrating support into the design process of large programs. The system engineering management challenge is to ensure that the support is integrated. Successful integration requires that the ILS manager play a strong role in both the system engineering and ILS processes and their management linkages.

Figure 5-2 highlights the linkages that incorporate ILS into the system engineering process. The ILS manager's role in relationship to these interactions, is discussed in the following five subparagraphs:

- "System Engineering Supportability Characteristics Ouputs" are developed under the cognizance of the ILS manager by ILS, R&M, LCC, safety, and other discipline specialists participating in system engineering support criteria studies prior to EMD.

- The functional baseline prescribes system performance requirements. The allocated baseline prescribes performance requirements for major components of the system designated as configuration items. Both are developed during early development phases. During this baseline setting-stage, the success achieved by the ILS manager in influencing design is demonstrated by the inclusion of effective supportability characteristics and requirements in the System Specification (Type A) of the functional baseline and Development Specifications (Type B) of the allocated baseline. This program phasing relationship stresses the im-

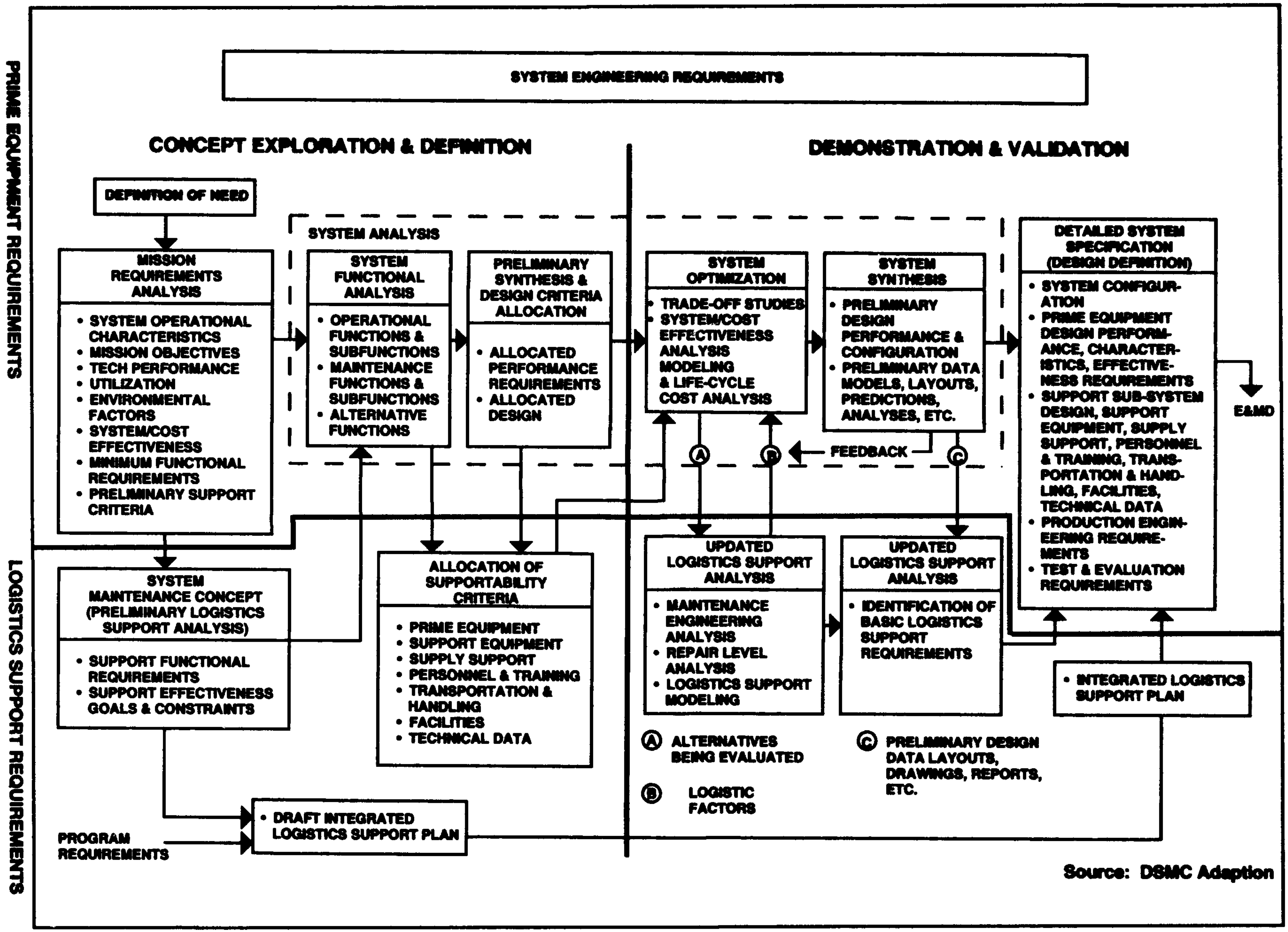


Figure 5-1. ILS and the System Engineering Process

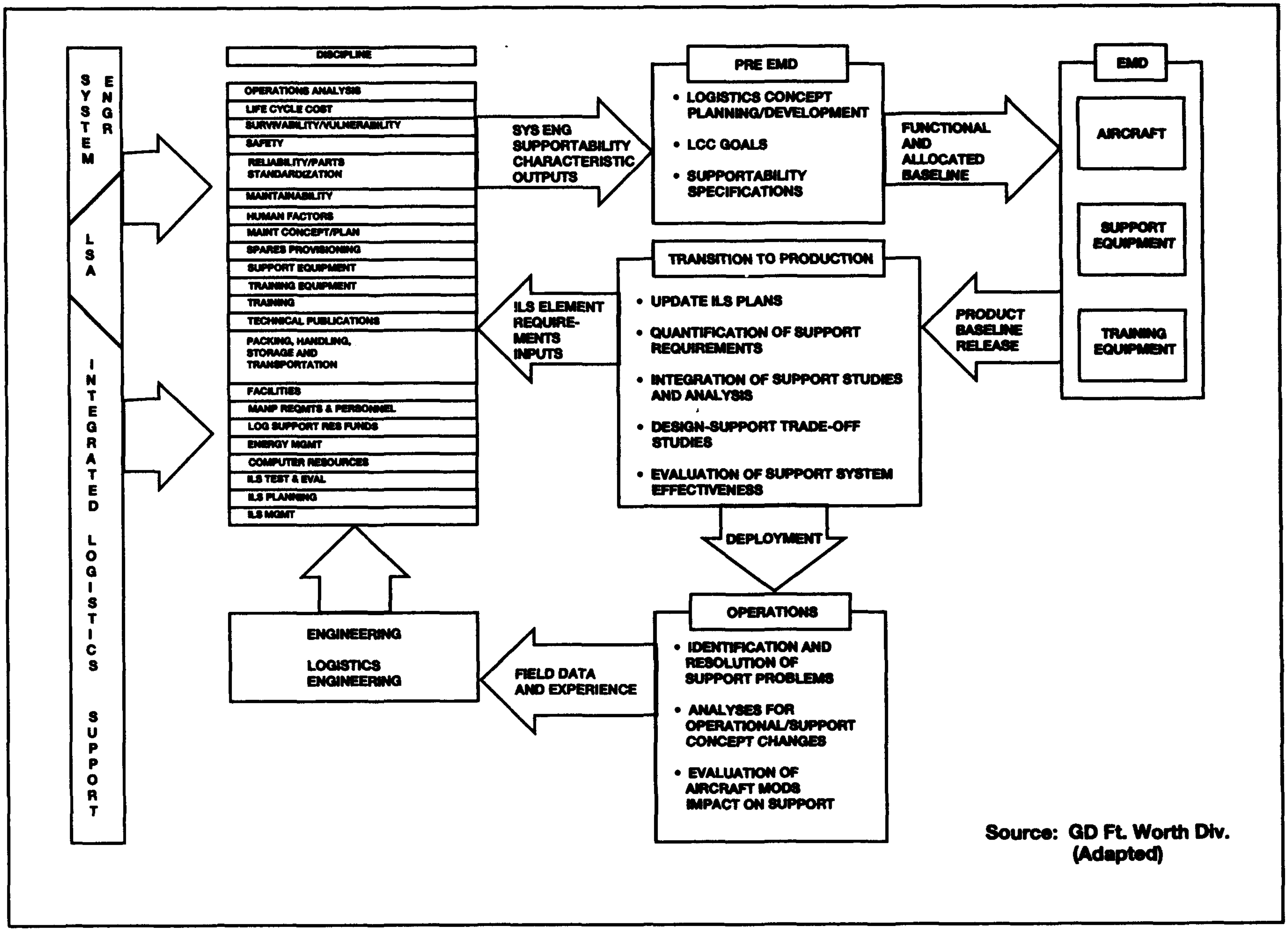


Figure 5-2. Typical Contractor Systems Engineering Linkages with Logistics Support Elements

portance of early CED phase analyses and inputs from the government and contractor ILS and R&M specialists.

Figure 5-3 shows the phasing of the functional, allocated and product baseline linkage events and their related specifications with respect to other system acquisition management milestones. The dotted lines on the specifications portray the period of documentation review, while the solid lines portray continued use under government configuration management. The format of the Type A specification has provisions for identification of supportability characteristics (such as R&M) and logistics concept requirements (maintenance, supply, facilities, etc.). Requirements of the Type A system specification flow down to Type B development specifications on major components and software. These specifications (A and B) are the requirements that drive the engineering design activities during EMD (upper right in Figure 5-2).

• The "Product Baseline Release" provides detailed design documentation for the transition to production. The timing of the various "ILS Element Requirement Inputs" is also of critical interest to the ILS manager. Timely release of the major end items and their support and training equipment designs is required for scheduling logistics activities such as preparation of final technical manuals, preparation and processing of provisioning documentation, and development of packaging requirements.

• The ILS manager must participate in scheduling "deployment" to ensure that all support has been acquired and can be provided concurrent with, or prior to, this initial deployment. This topic is discussed in greater detail in Chapter 13.

• "Field Data and Experience" provides the means for assessing supportability related performance and attained readiness, instituting required improvements, and updating the ILS elements. The ILS manager must ensure adequate planning for collection and utilization of this feedback.

5.3.2.3 Acquisition Streamlining

DoDI 5000.2, Part 10C, "Acquisition Streamlining," states that all acquisitions shall be streamlined and contain only those requirements that are essential and cost-effective. Acquisition process requirements, which include ILS, "shall be tailored to meet specific needs of individual programs ...." DoDI 5000.2, Part 7A, prescribes compatible requirements to tailor all ILS activities, LSA tasks, and associated documentation requirements.

5.3.2.4 Logistics Support Analysis and System Engineering

Logistics Support Analysis (LSA) is a design analysis tool employed as part of the ILS program. As stated in MIL-STD-1388-1A and illustrated in Figures 5-4 and 5-5, LSA is an integral part of the system engineering process. LSA provides for:

• Initial determination and establishment of supportability criteria and constraints as input to the system design and

• Evaluation of alternatives and tradeoff analyses between different support alternatives and among support, design and operational alternatives.

5.3.3 Reliability and Maintainability (R&M)

R&M parameters are the ILS manager's most effective tools for influencing and interacting with the system engineering process.

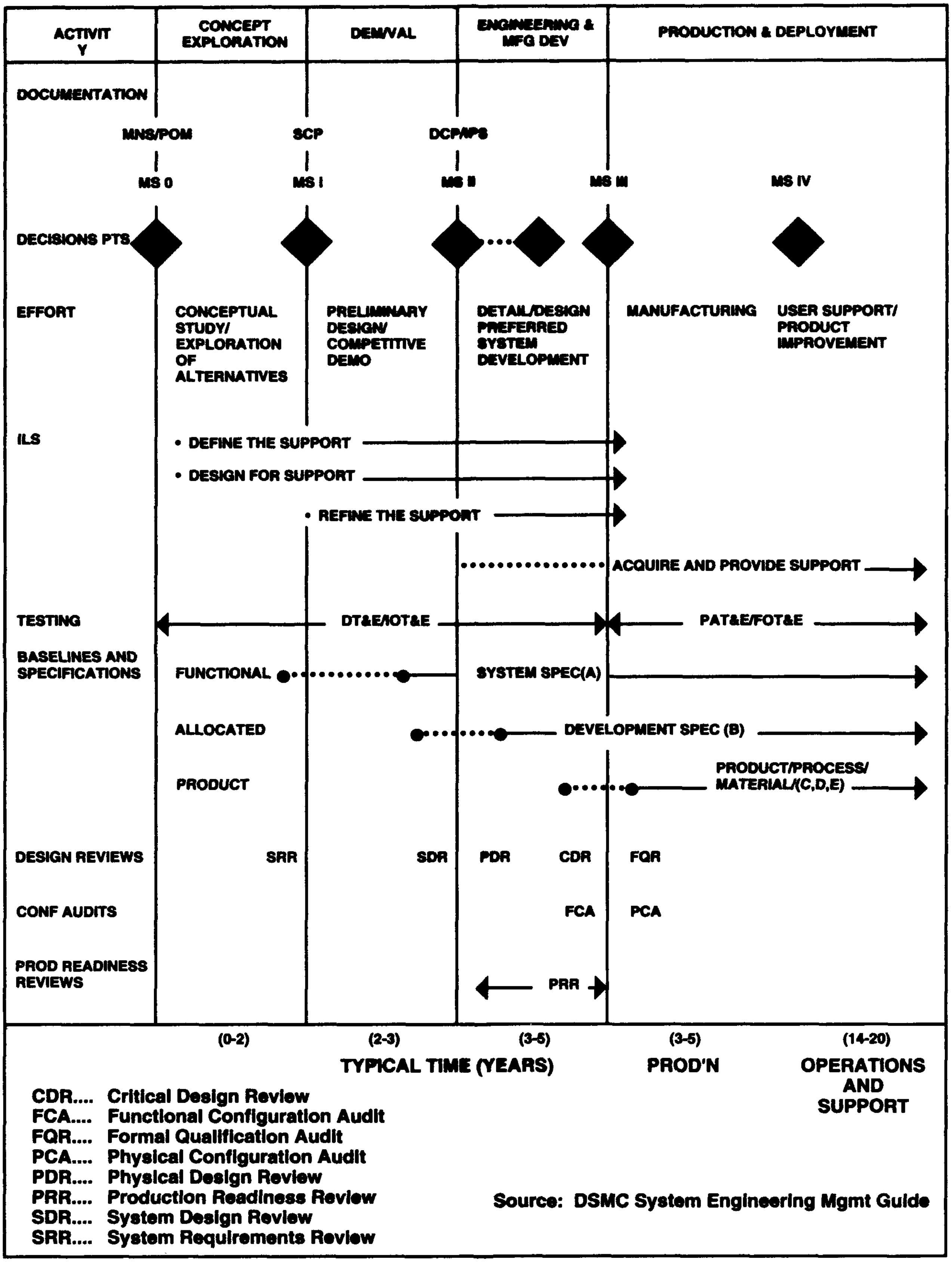


Figure 5-3. System Acquisition Management

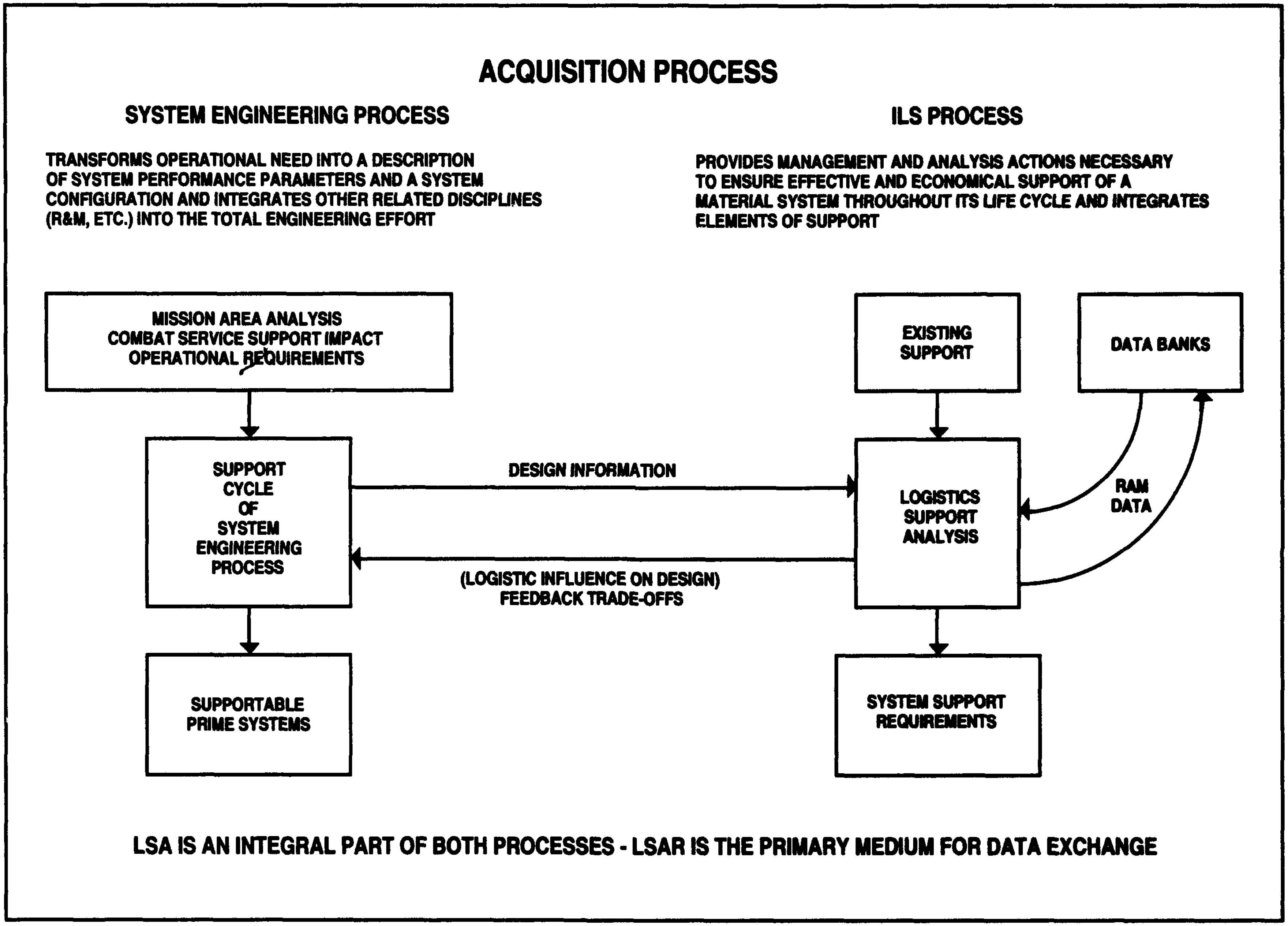


Figure 5-4. Relationship of LSA to ILS and System Engineering

SYSTEM ENGINEERING ACTIVITY	RELATED LSA TASKS
Design and Configuration Management	**Identification of Components, Maintenance Planning, Task Analysis, Cataloging (For Supply Support)**
Reliability Data; e.g., Component MTBF	**Design Interface, Maintenance Planning (Repair Level Analysis, Maintenance Man-Hour Requirements), Supply Support (Provisioning Studies)**
Maintainability Data; e.g., Component MTTR	**Design Interface, Maintenance Planning (Repair Level Analysis/Maintenance Man-Hour Requirements)**
Failure Modes Effects and Criticality Analysis	**Design Interface, Reliability Centered Maintenance (RCM) - Development of Scheduled Maintenance Services**
	Development of System Troubleshooting Instruction
Life-Cycle Cost	**Logistics Trade-off Analyses, Maintenance Planning (Repair Level Analyses), Supply Support (Provisioning Studies)**
Human Factors Engineering	**Design Interface, Personnel Skill Requirements, Training and Training Device Requirements**
Safety Engineering	**Design Interface, Maintenance Procedures**

Figure 5-5. System Engineering Activity Supporting LSA

Establishment of effective R&M objectives for the total system and their allocation to lower level components are a vital influence on "design-to" mission success and O&S costs. Throughout the development process, measured progress toward achieving R&M values for the system and its components should result in reducing logistics support requirements and attaining system readiness objectives. Various forms and uses of R&M parameters are summarized in Figure 5-6 and commented on below:

• Readiness is determined by mean time between downing events and mean time to restore the system.

• Mission success is greatly influenced by mission reliability (mean time between critical failures that impact the mission) and mission maintainability (mean time to restore functions during the mission).

• Maintenance manpower requirements and costs are affected by the interval between and the manhours to perform maintenance actions.

• Logistics support costs related to parts are determined by the mean time between the removal of reparables and consumables and the total of all costs to remove, replace, transport and repair components at all levels of maintenance.

The ILS manager must ensure that the R&M parameters can be related to both peacetime and wartime operational environments, scenarios, and the support that will be provided under these conditions. Failure to fully account for the effects of item design, quality, operation, maintenance and repair can lead to a substantial shortfall in operational performance and an unprogrammed overrun of logistics support costs.

Reliability is not a static parameter. Reliability growth is programmed during development by application of reliability development/growth testing (also called Test, Analyze and Fix). Reliability growth is projected and evaluated during phases I and II and quantifiable objectives are established for exit criteria. Figure 5-7 illustrates the planned reliability growth program for the AMRAAM missile during the development program. The anticipated maturity growth is portrayed against the minimum Joint Service Operational Requirement (JSOR) threshold and the greater contract goal.

5.3.4 Concurrent Engineering

The Office of the Under Secretary of Defense for Acquisition has defined concurrent engineering as "the integrated process of engineering the product concurrent with the processes to manufacture the product with emphasis on efficiency, increased quality, and reduced cost."

A key aspect of integrated product development is the inclusion of all "ilities," including logistics supportability, and all disciplines, including logistics, in the initial process of defining design requirements and their documentation in system and development specifications. MIL-STD-1388, Logistics Support Analysis, defines tasks fully compatible with the objectives of concurrent engineering.

5.3.5 ILS Management Techniques In System Engineering

5.3.5.1 Analysis and Trade-off Studies

Much of the logistics-oriented system engineering activity in early development consists of structured studies. Trade-off analysis continues throughout development as detailed design and testing provides greater amounts of higher quality data. The ILS manager and supporting ILS element spe-

OBJECTIVE	R PARAMETER	M PARAMETER
Readiness	Mean Time Between Downing Events	Mean Time to Restore Systems
Mission Success	Mission Time Between Critical Failures	Mission Time to Restore Functions
Maintenance Manpower and Costs	Mean Time Between Maintenance Actions	Direct Manhours per Maintenance Action
Logistics Support Cost	Mean Time Between Removals	Total Parts Cost per Removal

Figure 5-6. System R&M Parameters

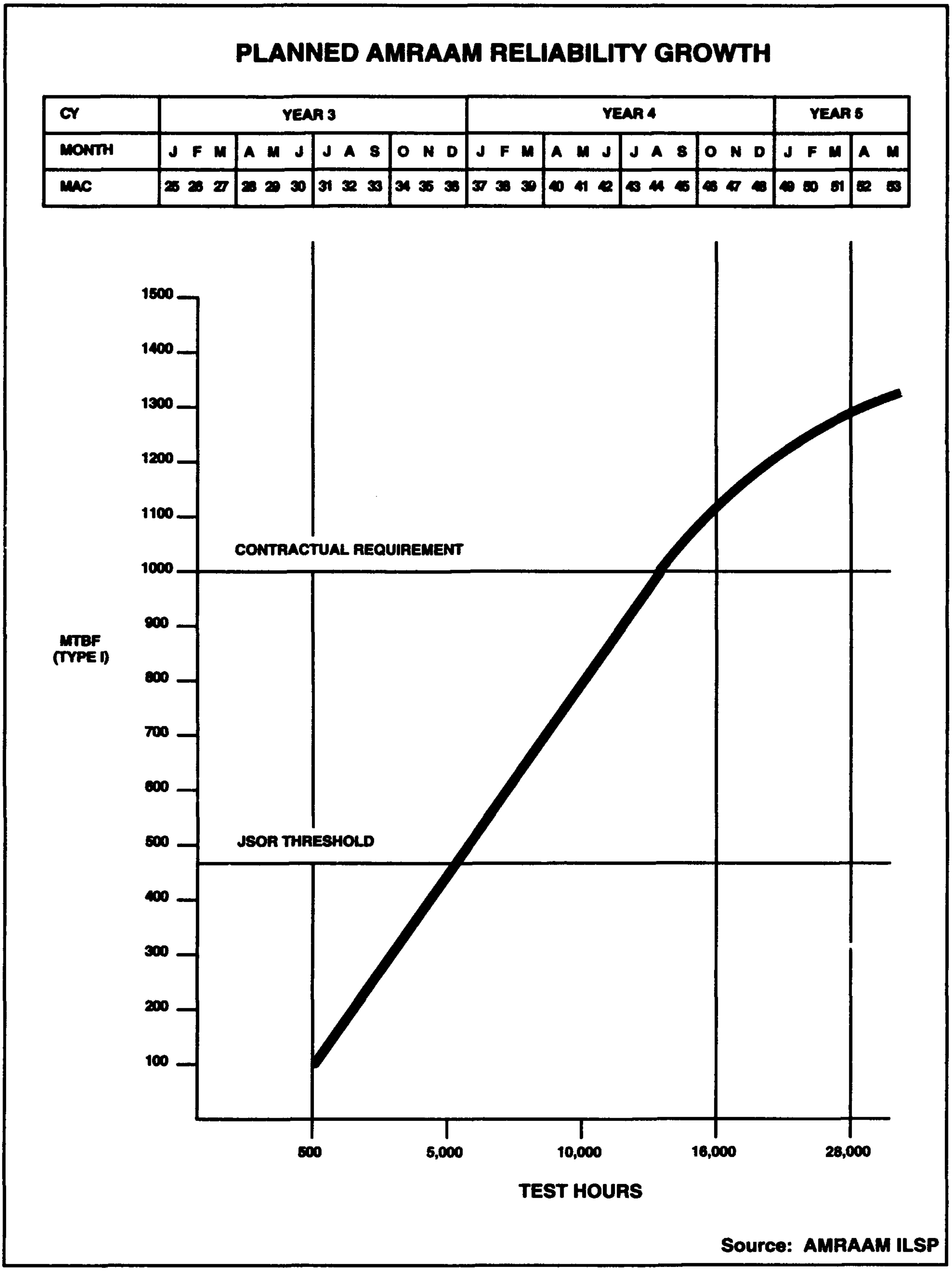


Figure 5-7. Typical Reliability Growth Curve

cialists should participate in system analysis and trade-off studies throughout the system's life cycle. The ILS manager should:

• Become actively involved in the mission need and use studies (Chapter 3) by providing support element experience factors, challenges and objectives to be used in the design synthesis consideration of all system engineering input elements;

• Establish a visible and documented ILS management control system that effectively uses the LSA outputs to provide supportability input to the decision making process; and

• Participate fully in the technical reviews (e.g., system requirements review, system design review, software specification review, preliminary design review) that establish performance and design parameters for the system and its major hardware and software components, preparing effectively for these reviews by performing the LSA tasks that establish readiness and supportability objectives (see Chapter 3 and Figure 3-1).

5.3.5.2 Support System Design

The support system design functions usually include the design of automatic and nonautomatic test and support equipment, simulators, training equipment, mobile maintenance trainers; analysis of maintenance and repair facility requirements; and packaging and transportation studies. Using LSA and standard study techniques, the ILS manager should:

• Integrate system performance and support requirements using the system engineering techniques and identify test requirements and other support parameters in system specifications;

• Identify "design-to" requirements early and refine them throughout the life cycle;

• Analyze Government Furnished Equipment (GFE) support system items (existing or new) and integrate these items into the total system design;

• Emphasize hardware, firmware, and software interface design considerations and specifications to provide early identification of risk and resolution of problems; and

• Include support system design items in the System Configuration Management Program to provide total system consideration of proposed changes.

5.3.5.3 Software

Software design and support considerations are of vital concern to the ILS manager. The ILS manager should:

• Participate fully in development and implementation of a software management system which parallels the hardware system — this will provide a controlled and structured development process involving appropriate design specifications, design reviews, milestones, documentation, configuration control and identification, and validation and verification;

• Develop a control system to identify and provide the status of hardware design, firmware and software design, and support interface specifications; and

• Develop a software support plan for user programmable firmware and software which highlights documentation, training, support equipment, and facility requirements.

Because of the increasing role of software and firmware in materiel system and support system designs, the PM and ILS manager must make special efforts to budget for, and fund early efforts that identify and evaluate software maintenance requirements; update these requirement projections in successive phases; and plan for the needed software maintenance and support hardware and services.

5.4 RISK MANAGEMENT

5.4.1 Delayed Definition of Logistics Criteria

5.4.1.1 Risk Area

Delayed decisions on reliability and supportability requirements result in less than optimum support. Once the design is committed, the options become limited. Many early fighter aircraft suffered from having design optimized for performance without comparable attention to support aspects such as maintenance accessibility and spare parts reliability. As a result, turnaround times and O&S costs were excessive. Manpower requirements for some aircraft models approached the unacceptable level of 100 maintenance manhours per flying hour (MMH/FH).

5.4.1.2 Risk Handling

System level logistics requirements (such as basing constraints, use of existing test facilities, sortie turnaround time, etc.) must be fully addressed in original concept documents. They are required program inputs to the formal specification generation and configuration management processes.

5.4.2 Impact of Engineering Changes

5.4.2.1 Risk Area

A high number of design changes made during the development program can overwhelm ILS planning and create an inability to fully reflect ILS and O&S cost considerations in engineering change decisions.

5.4.2.2 Risk Handling

System developers have used a number of modeling techniques to cope with rapid changes. An F-16 system simulation model was used to determine the impact of proposed engineering changes on requirements for logistics support items. The F-16 LCC model provided O&S cost estimates for design alternatives. Similar model development is recommended for new programs and funding for initiation and maintenance should be budgeted. LCC models provide the capability to assure that every design decision is made with full awareness of ILS impacts.

5.4.3 Unrealistic R&M Requirements

5.4.3.1 Risk Area

The establishment of unrealistic R&M requirements (as part of the Pre-Program Initiation or CED phases) can lead to increased design and development costs incurred because of excessive design iterations. This, in turn, can cause program delays and costly program support system restructuring in later phases.

5.4.3.2 Risk Handling

The ILS manager should insist that "Testing Realism" be applied to R&M goals. This can be accomplished in the CED Phase by simulation of R&M goals using prior system achievements as a comparative baseline and estimating the impact of the technological enhancements and unique applications on these prior system baselines.

5.5 SUMMARY

• The system engineering process can produce a balanced design that will reflect the impact of various R&M options and other specialty engineering analyses dealing with readiness objectives and O&S costs.

• Integration of the LSA process into the system engineering process simplifies ILS management.

• Unrealistic R&M requirements can be avoided by analyzing the achievements of prior systems and the impact of the technological enhancements incorporated in the new system.

• An ability to simulate, analyze and design in supportability can result in obtaining a better real time "balance" among operational performance, supportability and ownership costs.

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11. MIL-STD-471, "Maintainability Verification/Demonstration/Evaluation."

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6

LIFE-CYCLE COST AND SYSTEM READINESS

6.1 HIGHLIGHTS

- Achieving LCC Objectives
- Importance of Front-End LCC Analysis
- Cost-Estimating Methods
- Responsibilities for Cost Analysis
- Relationship of LCC to System Readiness
- Time Phasing of Cost Analyses
- Influencing System Design and Logistics Choices
- Trade Studies and Design-to-Cost

6.2 INTRODUCTION

6.2.1 Purpose

To relate the LCC concept to ILS and system readiness.

6.2.2 Objective

DoDD 5000.1, "Defense Acquisition" establishes DoD policy as follows:

- Once initiated, all programs must strike a sensible balance among cost, schedule, and performance considerations, given affordability constraints.

- LCC shall be a major consideration at each milestone beginning with the new start decision milestone (MSI).

DoDI 5000.2, "Defense Acquisition Management Policies and Procedures" states that "acquisition programs shall be managed with the goal to optimize total system performance and reduce the cost of ownership."

These policies require the PM to ensure that LCC influences the system design and the logistics engineering process during all acquisition phases. In accomplishing this goal, the PM requires a comprehensive, accurate, and current LCC estimate to support each management decision where cost is significant.

An LCC estimate covers all costs to the government (R&D production, O&S and disposal costs) during the system's life cycle.

An LCC estimate should have sufficient accuracy to permit comparison of relative costs of design and acquisition alternatives under consideration by management. In addition, the LCC estimate must demonstrate whether a system meets affordability constraints, in other words, that it can be procured, operated, and supported efficiently and effectively for the programmed and budgeted resources in the years required. Uses of LCC estimates are shown in Figure 6-1.

6.3 MANAGEMENT ISSUES

6.3.1 Backgro

There are few decisions made during a program's life cycle that don't affect LCC.

I. INPUT TO ACQUISITION DECISIONS AMONG COMPETING MAJOR SYSTEM ALTERNATIVES

II. INPUT IN REQUIREMENTS DETERMINATION

III. WITHIN A SELECTED SYSTEM ALTERNATIVE

- A. PROVIDE IDENTIFICATION OF COST DRIVERS
- B. PROVIDE AN INDEX OF MERIT FOR TRADE-OFF EVALUATIONS:
  1. DESIGN
  2. LOGISTICS
  3. MANUFACTURING

IV. BASIS FOR OVERALL COST CONTROL

Figure 6-1. Uses of Life-Cycle Cost

Programmatic and design choices can cause a wide LCC variation and have a significant effect on the system's readiness. The use of LCC is usually most effective during the early phases of the acquisition cycle. By Milestone II, roughly 85 percent of the system's LCC has been committed by design and logistics choices made prior to this point (see Figure 6-2).

The decisions with the greatest chance of affecting LCC and identifying savings are clearly those impacting acquisition and O&S costs undertaken in the Preconcept, CED and DV phases. (See Figure 6-3). The two main goals of LCC analysis are to:

• Identify the total cost of alternative means of countering a threat, achieving production schedules, and attaining system performance and readiness objectives; and

• Estimate the cost impact of the various design and support options.

6.3.2 Design to Cost

The purpose of Design-To-Cost (DTC), described in DoDI 5000.2, Part 6K, is to establish cost as a design constraint early in acquisition life cycle and to achieve a proper balance among development, production and O&S costs. Figure 6-4 depicts a notional relationship of LCC to acquisition cost and O&S cost as a function of system reliability. In this simplified portrayal there is one value of reliability that achieves the "proper balance" to minimize LCC. This relationship is really significantly more complex. In recent programs there has been an emphasis on better planning and quality engineering production costs. The result has been better process control, reduced inspection, reduced rework, higher reliability, and lower acquisition and O&S costs. In essence, the acquisition cost curve has been shifted to the right, and the proper balance also shifts.

The cost measure employed in DTC is average unit procurement cost, which is defined as "the recurring flyaway, rollaway, sailaway cost (including nonrecurring production costs) adjusted to include data, training, support equipment, and initial spares costs." The milestone decision authority (e.g., the DAE for ACAT ID pro-

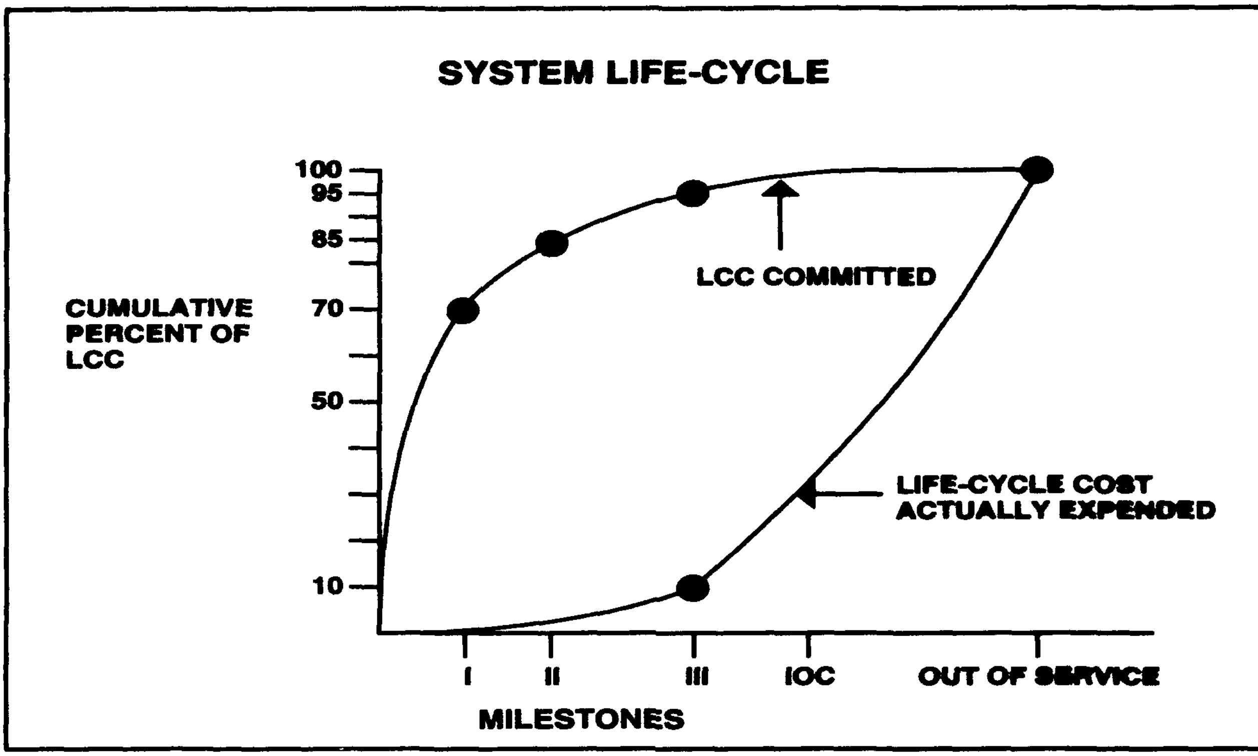

Figure 6-2. Typical Life-Cycle Cost Commitment

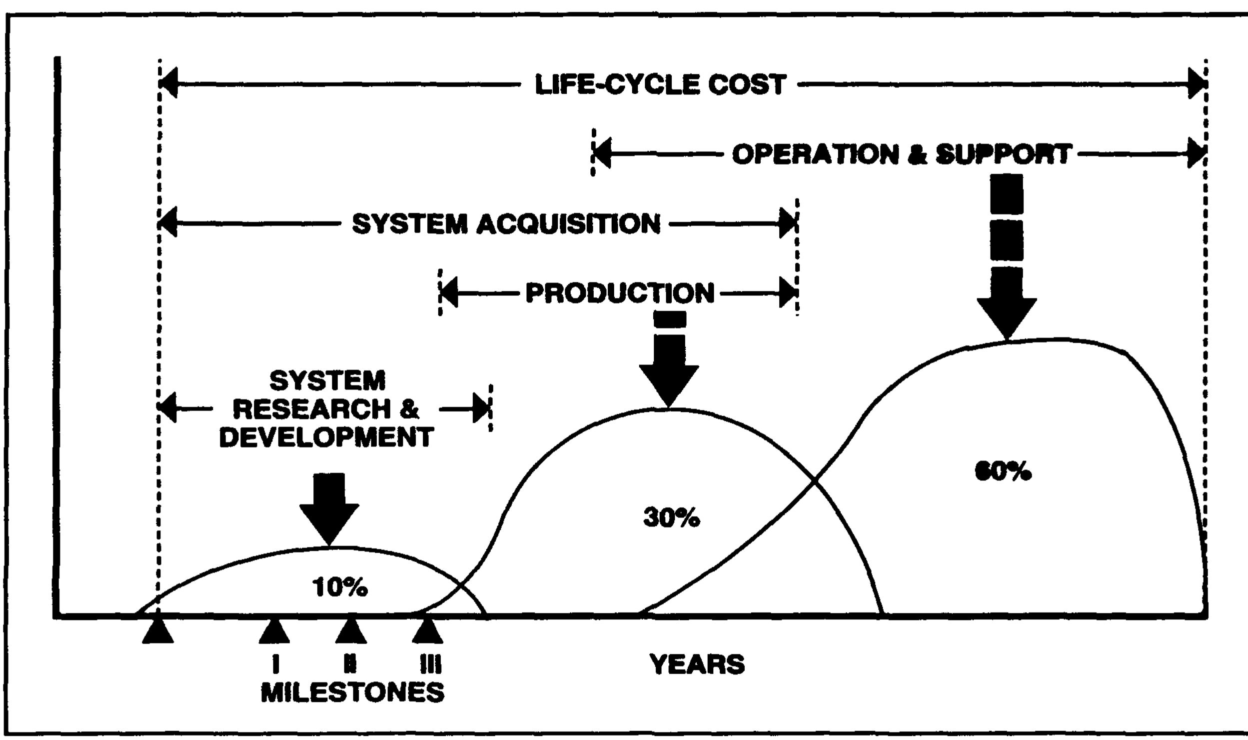

Figure 6-3. Typical Life-Cycle Cost Distribution

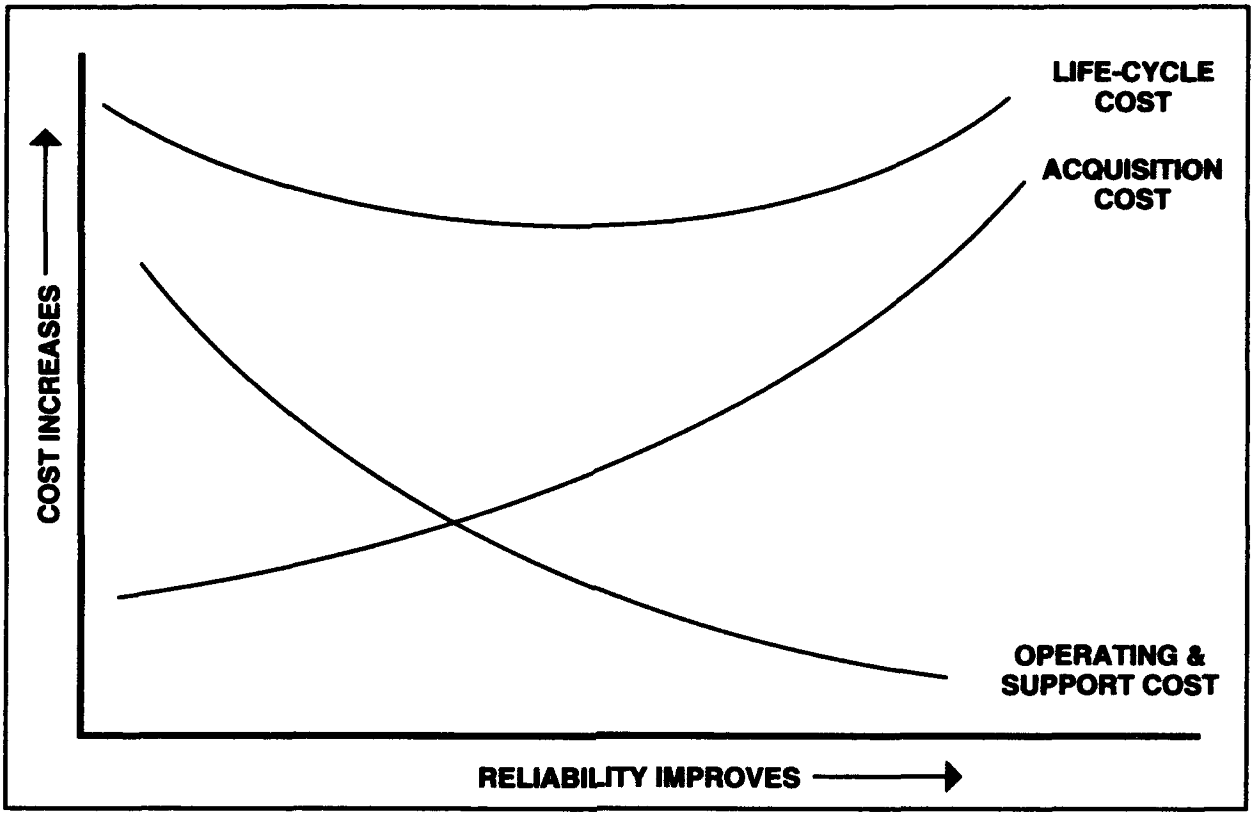

Figure 6-4. Life-Cycle Cost and Reliability Trade-off

grams) may decide to include a design-to objective for O&S costs. When employed, these should be stated in the form of design-controllable factors that significantly affect O&S costs and that can be measured during test and evaluation. R&M measures are examples.

The PM should allocate DTC objectives in accordance with the program WBS. Initial DTC activity should focus on identifying cost drivers, potential risk areas, and cost-schedule-performance trade-offs. As development continues, DTC effort should be directed to areas requiring corrective action because of excessive costs.

From a logistician's viewpoint, DTC should include a focus on O&S cost parameters to ensure that the acquisition process yields effective, reliable systems that can be maintained within available resources. A system that has a low acquisition cost, but is too costly to operate and support, is as unsatisfactory as one that is less costly to maintain but is too expensive to acquire in the required quantity.

6.3.3 Cost Analyses and Documents

Specific cost analyses and documents are discussed below. The detail and breadth of cost data included and the purposes of the analyses differ. The same cost-estimating methodology (refer to 6.3.4) applies to each; however, the cost estimates documented by the program manager at the same point in time must match.

6.3.3.1 Affordability Assessments and Constraints

Affordability Assessments and Affordability Constraints are interactive. The PMs prepare Affordability Assessments to support Milestone I and all subsequent milestone decision reviews. The assessments may be portrayed in terms of LCC for the new program in comparison to total Defense Planning Guidance and long-range modernization and investment plans. The objective of the assessment is to ensure that sufficient resources, including manpower, have been or can be programmed to support projected development, testing, production, fielding and support requirements.

Affordability Constraints are documented by the milestone decision authority in the Acquisition Decision Memorandum. Refer to DoDI 5000.2, Part 4D, "Affordability" and DoD 5000.2-M, Part 4G, "Affordability Assessment (Format)."

6.3.3.2 Cost and Operational Effectiveness Analysis (COEA)

COEAs are aids to the evaluation of conceptual and system design alternatives and the performance of trade-off analyses. Common measures of effectiveness and cost are established for each alternative. Measures of effectiveness should be defined to assess operational capabilities in terms of engagement or battle outcomes. LCC for each alternative is the common cost measure.

One basic approach is to make equal-cost or equal-effectiveness comparisons. Using an equal-cost comparison, we set the same LCC for each alternative and determine which alternative provides the greatest effectiveness. Using an equal-effectiveness comparison, we fix the effectiveness to be obtained and determine which alternative achieves that level of effectiveness for the least cost.

COEAs are performed to evaluate alternative selections for the Milestone I and II decision reviews. Depending upon changes during EMD, the COEA for Milestone III can vary from a minor update to a new analysis. A new COEA may be required at Milestone IV to support a recommendation for a major modification. Refer to DoDI 5000.2, Part 4E, "Cost and Operational Effectiveness Analysis" and DoD 5000.2-M Part 8, "Cost and Operational Effectiveness Analysis."

6.3.3.3 LCC Estimates

Two separate LCC estimates are prepared in support of Milestone I and all subsequent milestone reviews. The Program Life-Cycle Cost Estimate (PLCE) is prepared by the PM. An Independent Cost Estimate (ICE) is prepared by an organization that does not report through the acquisition chain.

The OSD Cost Analysis Improvement Group (CAIG) plays a major role in cost analysis for ACAT ID programs. The preparers of both estimates provide draft copies of the estimates and brief the CAIG in advance of the milestone reviews. The CAIG reports on the results of the analysis to the Defense Acquisition Board (DAB), the DAB committees, and the DAE. The DAB, in turn, provides recommendations on cost (and all acquisition issues) directly to the DAE. The CAIG similarly supports the DoD Component (Service) Acquisition Executive on major defense programs that have been assigned to the services for milestone management (ACAT IC programs). Refer to DoDI 5000.2, Part 10A, "Cost Estimating" and 13C, "Cost Analysis Improvement Group Review Procedures"; DoDD 5000.4, "OSD Cost Analysis Improvement Group"; and DoD 5000.2-M Part 4C, "Program Life-Cycle Cost Estimate Summary" and Part 15, "Program Office and Independent Life-Cycle Cost Estimates."

6.3.3.4 Program Baselines

Program baselines contain key cost, schedule, and performance thresholds and objectives. Thresholds are minimum acceptable values to the user. Objectives are improved values (lower cost, earlier completions and higher performance) that benefit the program. Contractor incentives are generally used to encourage accomplishment of objectives.

Program baselines are prepared by the PM in support of milestone reviews. The milestone decision authority documents approval, with modifications when noted, in the Acquisition Decision Memorandum. The baselines are in essence a contract between the PM, the milestone decision authority and all intermediary authorities in the direct and streamlined decision chain. The number of parameters for cost, schedule and performance is kept small; the control extended up to the milestone decision authority is limited to the key parameters most essential to the program. Baselines are limited to one or two pages in length.

Program baselines are established as follows:

- The Concept Baseline, approved at Milestone I, applies to DV phase activities;

- The Development Baseline, approved at Milestone II, applies to EMD phase activities; and

- The Production Baseline, approved at Milestone III, applies to P&D phase activities.

Program objectives and thresholds evolve from broad and general values at Milestone I, to system-specific and detailed requirements at Milestone II, with further refinement at Milestone III. Refer to DoDI 5000.2, Part 11A, "Program Objectives and Baselines" and DoD 5000.2-M, Part 14, "Acquisition Program Baselines."

6.3.3.5 Selected Acquisition Reports (SARs)

Congress has established requirements for cost, schedule and performance reports on major defense programs. Mandatory reports are submitted to Congress annually. An SAR baseline is established after each milestone decision. The SAR baseline contains estimates of specified cost, schedule and performance parameters that have been established by the acquisition milestone decision. On an exception basis, quarterly reports are submitted to Congress when actual values vary from the baseline values by amounts more than stated tolerances — for example, a 15 percent or more increase in program acquisition unit cost.

SARs provide cost data in Congressional appropriation categories (RDT&E, Procurement, Military Construction) and in the broad category of O&S. The O&S costs are further divided into the costs of personnel, consumables, depot maintenance, contractor support and others. Actual values of funds programmed, obligated, and expended are documented in the annal SARs and, when required, in quarterly exception reports. Refer to DoD 5000.2-M, Part 17.

6.3.4 Cost-Estimation Methods

The cost-estimation method chosen should be based on the objectives of the analysis, the level of detail in the available data, the level of system definition and the acquisition phase of the program. Analysts are encouraged to employ alternative cost-estimating methods concurrently to expose such hidden factors as design and schedule risk areas and to reinforce the estimates derived. A cost estimate should be as accurate as the data and applicable methodology will allow.

In the Preconcept, CED and early DV phases, cost estimates are generally made on the system level, reflecting the lack of detail design available. In the late DV, EMD, PD and O&S phases, cost estimates generally reflect engineering detail design; the system cost is the sum of the cost estimates for each system component. Data in these phases is derived from the design engineering and LSA/Logistics Support Analysis Record (LSAR) processes and adjusted to reflect experience data as appropriate. LSAR data may initially consist of engineering estimates, which are updated with test results in the EMD and P&D phases, and with field experience in the O&S phase.

6.3.4.1 Parametric Cost Estimates

A parametric cost estimate for a new system is developed from Cost-Estimating Relationships (CERs) statistically derived from data which shows a relationship between a particular cost and cost driving variable(s) for existing systems. CERs require engineering and physical characteristics data from a group of comparable existing systems. Parametric cost estimates generally are made on a system level in the Preconcept, CED, and DV phases. The system level estimates typically have high uncertainty, based upon the limited system design completed during these early phases.

An example of a CER can be an expression that estimates the cost of a new sonar based on a statistical analysis of related data for a group of 20 existing sonars. The CER may express the cost of the new sonar as a function of its expected weight, target detection range and reliability.

6.3.4.2 Analogous Cost Estimates

The cost analogy technique relates the cost of a new system to a similar existing system or a composite of similar systems. The analysis develops a cost complexity factor that explicitly adjusts for differences in technological, operational or logistical variables between the two systems. System cost estimates based on analogies are usually made in the CED and DV phases and are moderately uncertain, reflecting preliminary system design definition.

An example of a cost analogy is the estimation of the cost of a new fire control system based upon an existing fire control system. The analysis may identify technology changes in the system's computer. The cost estimate for the new computer may be derived by applying a complexity factor to the cost of the existing computer. The overall cost for the new fire control system may then be determined by applying the same or similar techniques to all other components of the fire control system.

6.3.4.3 Engineering Cost Estimates

The engineering cost-estimating technique (also known as the "bottoms-up" cost-estimating technique) uses known or estimated costs of lower level items (such as level four items on a WBS) and aggregates them into the total costs of a higher level item, taking into consideration the costs of associated and interconnecting equipment. Engineering type estimates are generally made in the late DV, EMD, P&D and O&S phases. The engineering cost-estimating technique typically has low uncertainty (higher confidence) because it is based on detailed system design.

The cost of each lower level item can be estimated by a different method (parametric, analogy or actual) to achieve the greatest cost accuracy possible for that item. For example, the cost of a new anti-submarine warfare aircraft can include the previously mentioned parametric estimate of the new development sonar, and the analogous estimate of the fire control system, plus the known costs (actuals) of standard components incorporated in the design.

6.3.4.4 Updated Cost Estimates Based on Actuals

Cost estimates are updated based on system characteristics as well as actual costs that the contractor and government incurred for earlier versions, production runs or operations. Sources of actuals are characteristic charts, government ledgers, contracts, usage reports, manpower documents, and maintenance facility records. Actual costs are generally incorporated into the analysis in the late EMD, P&D and O&S phases.

6.3.5 Relationship of LCC to System Readiness

DoDI 5000.2, Part 7A, "Integrated Logistics Support" requires establishment of peacetime and wartime readiness objectives and thresholds and the need to identify the most cost-effective approach to support the system. LCC analysis helps to achieve these objectives by evaluating the cost implications of various design and logistics support alternatives.

Early in the acquisition cycle, the LCC analysis concentrates on quantifying the cost implications of selected design alternatives that provide the desired level of performance. Early ILS activities focus on designing supportability characteristics into the system and evaluating the cost of ownership and support requirements. These tasks frequently require the expenditure of higher development costs in return for lower O&S costs.

In later stages of the acquisition cycle, evaluations are oriented toward identifying lower cost means of support to achieve readiness objectives. In particular, support elements such as manpower and spares are evaluated to identify cost-effective alternatives by which required readiness levels can be achieved and sustained during actual operations.

Figure 6-5 illustrates how the cost analysis process helps to achieve readiness at an affordable cost by allowing comparisons between various logistics support and design alternatives. Each curve represents all designs which meet a constant value for a specific program performance parameter (such as operating range, weight, "kill" probability, ordnance delivered or velocity). Through analysis, the cost and readiness associated with each design are estimated. The detailed logistics support considerations of readiness analysis are discussed in Chapter 8. Cost and readiness goals can be graphically represented. The preferred design choice is one that meets the performance objectives (the particular curve), is affordable (less than or equal to the cost goal), and meets the readiness objective (greater than or equal to the readiness goal).

Comparisons of design alternatives can result in the trade-off of design, logistics, LCC and/or readiness requirements in attempting to design the system to fulfill the user's needs. The range of design, performance, and logistics options depicted in Figure 6-5 as Alternative A does not meet either the cost or readiness goals. Alterna-

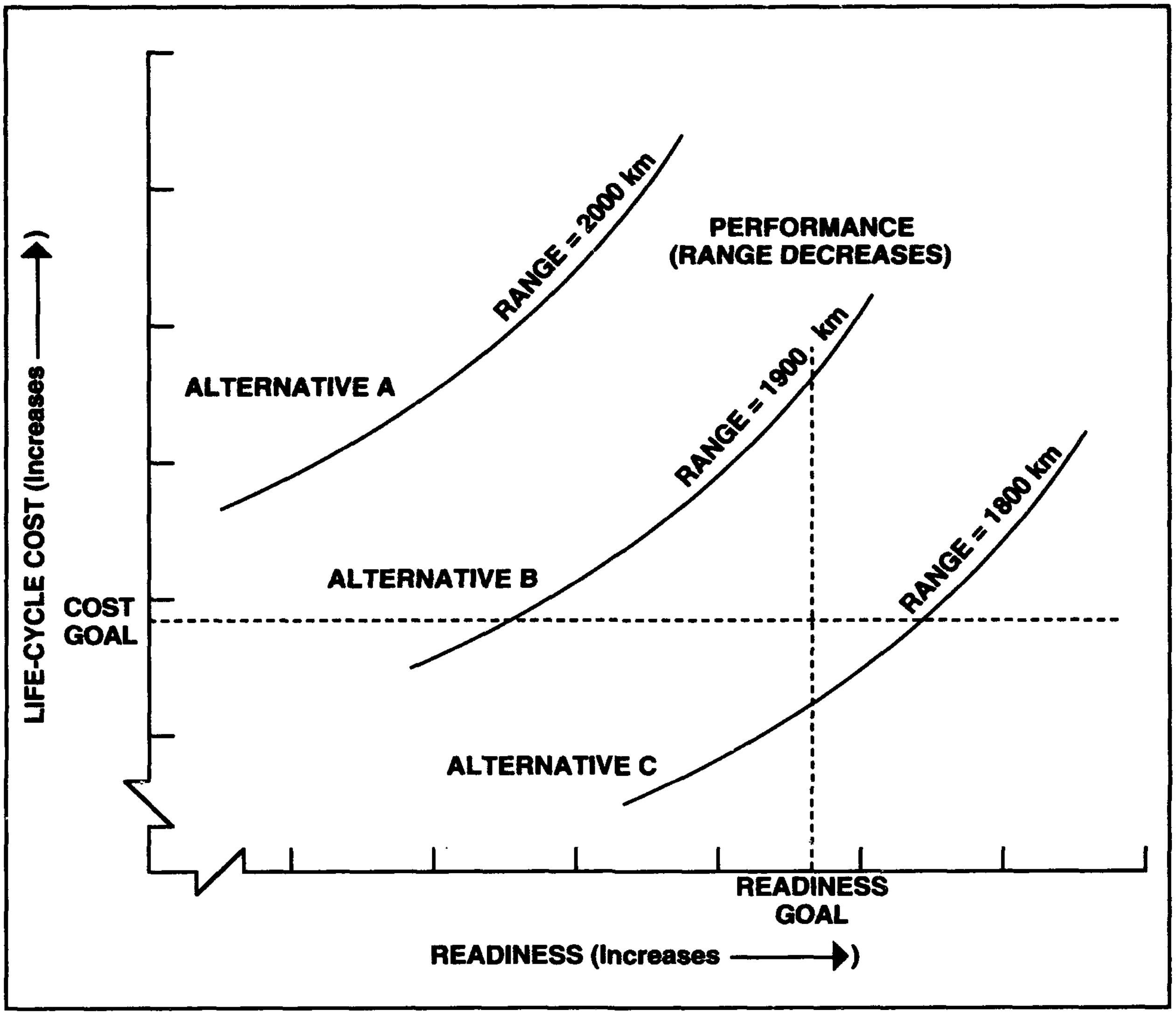

Figure 6-5. Performance/Readiness/Cost Trade-off

tive B can meet the cost goal by sacrificing readiness or it can meet the readiness goal by exceeding the cost goal. Alternative C can meet both cost and readiness goals. However, care must be taken to ensure that the range (performance level) represented by Alternative C effectively counters the threat for which the program is intended.

6.3.6 Time Phasing of DoD Cost Activities

Figure 6-6 summarizes the major cost activities and documents for the periods prior to Milestone 0 and each life-cycle phase.

6.3.6.1 Pre-Milestone 0

The first opportunity to influence the LCC of the new system is by entering manpower, training or other cost-related constraints in the "Constraints" paragraph of the MNS. LSA task 203 "Comparative Analysis" develops this input (refer to 3.3.3.2).

6.3.6.2 Concept Exploration and Definition Phase

Conceptual alternatives selected for evaluation during this phase are subjected to

PRE MS O	CED	DV	EMD	P&D	O&S
Identify Support Resource Constraints in MNS	Establish LCC Estimates for Competing Alternatives	Identify Cost Drivers	Provide Realistic Estimates of Production Costs	Update COEA	Estimate LCC Impacts of Product Improvements
Analyze Support Costs of Current Systems	Conduct COEA's of Alternatives	Conduct COEAs of Alternatives	Update COEA	Prepare PLCE	Monitor Cost Performance of Deployed Systems
Include Logistics Resource Requirements in POM and Budget Estimates	Conduct Trade-offs among Cost, Schedule and Performance	Conduct Trade-offs among Cost, Schedule and Performance	Prepare PLCE	Prepare ICE	
	Prepare PLCE	Prepare PLCE	Prepare ICE	Perform a Should Cost Analysis	
	Prepare ICE	Prepare ICE	Document Cost Thresholds in Production Baseline	Document Affordability Constraints in ADM (MS IV)	
	Document Cost Thresholds in Concept Baseline	Document Cost Thresholds in Development Baseline	Refine Unit Procurement Cost Objective	Estimate LCC Impact of Product Improvements	
	Establish a Unit Procurement Cost Objective	Refine Unit Procurement Cost Objective	Document Affordability Constraints in ADM (MS III)		
	Document Affordability Constraints in ADM (MS I)	Document Affordability Constraints in ADM (MS II)			

Abbreviations

ADM - Acquisition Decision Memorandum
COEA - Cost & Operational Effectiveness Analysis
ICE - Independent Cost Analysis
LCC - Life-Cycle Cost
MNS - Mission Need Statement
PLCE - Program Life-Cycle Cost Estimate

Figure 6-6. Time Phasing of DoD Cost Activities

COEAs and trade-offs. The objective is to select at least one optimal and cost-effective alternative that can be developed, produced, and supported within the DTC and Affordability Assessments that are also established during this phase. Logistics parameters (e.g., component failure rates) that drive O&S costs for each alternative should be identified. The program cost analyst should participate in the preparation of the initial LSAP and later updates to ensure that LSAR will support development of engineering cost estimates in later acquisition phases.

Cost-related documents that support the Milestone I Decision Review, (and subsequent decision reviews as shown on Figure 6-6) include the COEA, PLCE, ICE, Affordability Assessment and the Concept Baseline.

6.3.6.3 Demonstration and Validation Phase

The milestone decision authority approves milestone support documentation, with changes as appropriate, and establishes affordability constraints for the program.

Demonstration-Validation phase activities include:

(1) Continued COEAs and trade-offs;

(2) Identification of cost risks and drivers and design approaches to reduce risks and costs; and

(3) Updates of the PLCE, ICE and DTC objectives and thresholds.

The cost analyst must also establish contractual requirements for the contractor to submit Cost Management Reports (refer to DoD 5000.2-M, Part 20).

The cost analyses performed in this phase must provide credible estimates of the relationships of acquisition to O&S cost for alternative support concepts as well as design alternatives. The results of these cost trade-off analyses are most useful when the estimate provides sensitivity data that includes the cost range or exposes the cost risk areas associated with the engineering or support alternatives. The achievability of DTC objectives should be verified during this phase by performing simulations and system tests.

6.3.6.4 Engineering and Manufacturing Development (EMD) Phase

By this stage, sufficient LSAR data is available to support cost analyses at the subsystem and even the component level. LSAR data is particularly helpful in estimating two of the larger O&S costs — manpower and spares. The LSA records contain estimates of maintenance manhours, repair parts consumption rates, and requirements for support equipment, training devices, and facilities. Explicit plans should be developed for cost analysis updates during the subsequent P&D and O&S phases.

LCC for each piece of equipment may be estimated discretely, with the system LCC being an aggregation of all of these equipment estimates. During EMD, the LCC analysis must address the risks uncovered during the previous phase by quantifying their potential cost impacts and ultimately demonstrating their affordable resolution. The cost estimates during EMD should be relatively more accurate because they typically address more detailed issues and in particular may become a significant factor in the production decision. The achievement of DTC objectives should be verified during development and operational testing during this phase.

6.3.6.5 Production and Deployment (P&D) Phase

In the P&D phase, LCC shifts toward contract monitoring, "should cost" analyses, and cost analysis of product improvement proposals. COEAs of alternative major modification proposals to support a Milestone IV "Major Modification" decision may be appropriate.

The "should cost" analysis is a contract pricing method that is intended to assess a contractor's cost proposal, supporting data, and rationale, as well as to establish the government's negotiating objectives. "Should cost" analysis incorporates a comprehensive audit and assessment, including pricing, engineering and management analysis of the contractor's system engineering, manufacturing, program management and subcontracting operations. The negotiating objectives are based on the "should cost" projection derived from the in-depth review of the contractor's method of operation; thus, reflecting what an item ought to cost, based on achievable efficiencies, economies and reasonable overall management of contract performance.

The Value Engineering Program establishes benefit-sharing (Government and Contractor) incentives to reduce LCC. Refer to DoDI 5000.2, Part 6 O, "Design for Manufacturing and Production" and DoD 5000.2-M, Part 13, "Value Engineering Report."

6.3.6.6 Operation and Support Phase

The LCC activities for the O&S phase use the maintenance data collection and cost databases to monitor the cost and performance of the deployed system.

6.4 RISK MANAGEMENT

6.4.1 Lack of LCC Impact on Design and Logistics Support Process

6.4.1.1 Risk Area

LCC analysis is most effective when it is integrated into the engineering and management process. Integration must start with program initiation. Once the ability to influence design is lost, it is very difficult and always more costly to re-establish. Most performance and schedule risks have cost impacts. Performance risks result from requirements that are very costly, or from engineering requirements beyond foreseeable technical capabilities for hardware development. The result can be increased cost from design, development, and test of a replacement item; contract termination costs; increased program buy; and increased O&S costs. Schedule changes can increase costs whether they are shortened or lengthened.

6.4.1.2 Risk Handling

The following strategies can maximize LCC influence on the design and logistics engineering choices and minimize the cost consequences of performance and schedule risks.

• PM must require government engineers, cost analysts and logisticians to work together to prepare joint management recommendations such as:

— Source selection criteria

— Contract incentives and award fees

— Design-to-Cost program

— Cost and engineering deliverables

— System Requirements for SOW in Request for Proposal (RFP)

— Requirements for LSA and LSARs.

• PM must encourage contractor designers, logisticians and cost analysts to work together by requiring a DTC program starting in the CED phase.

• The government and the contractor must identify cost drivers early and challenge system requirements that are cost drivers.

• PM must establish broad performance requirements in the SOW to allow opportunities for design trade-offs.

• PM must require early LCC analyses as deliverables from system contractors and require the cost studies to have design engineering participation and system engineering approval.

• PM must set realistic DTC goals for acquisition and O&S cost drivers. These goals should be assigned to design managers.

• PM must determine readiness and cost drivers to influence the design to reduce O&S costs and balance O&S with development and acquisition costs.

• PM must require trade-off studies to find best alternatives among cost, schedule and performance considerations.

6.5 SUMMARY

• An objective of the ILS program is to help achieve the system readiness objective at an affordable LCC.

• By Milestone II, about 85 percent of LCC is effectively established because of early design and logistics choices.

• O&S costs are normally the largest contributors to LCC.

• LCC cost estimates can influence design and logistics choices through trade-off studies and the DTC Program.

• Early identification of cost and readiness drivers must influence design to control O&S costs.

• The cost analysis program must be planned carefully and managed to provide timely support to the PM.

• Many specific PM actions can be taken to enhance the effectiveness of LCC contributions to achievement of system goals.

6.6 REFERENCES

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7

LOGISTICS SUPPORT ANALYSIS

7.1 HIGHLIGHTS

- Managing the LSA Process

- Government and Contractor Responsibilities

- LSA Task Requirements

- LSA Documentation

- LSA Automation

- Data Verification

- Tailoring LSA and LSAR

7.2 INTRODUCTION

7.2.1 Purpose

To provide an overview of the Logistics Support Analysis Process. (Applications of LSA are described in Chapters 3 and 8.)

7.2.2 Objective

The LSA is an analytical effort to influence the design of a system and to define support system requirements and criteria. The objective of LSA is to ensure that a systematic and comprehensive analysis is conducted on a repetitive basis through all phases of the system life cycle in order to satisfy readiness objectives at an affordable cost. The selection, level of detail, and timing of the analyses are structured and tailored to each system and program phase. The LSAR are designed to be a standardized medium for systematically recording, processing, storing, and reporting data. The LSA data is the basis for determining and budgeting for the logistics support resources (maintenance manpower, training requirements, supply support, etc.) required to attain peacetime and wartime system readiness objectives.

7.3 MANAGEMENT ISSUES

7.3.1 Guidance

Requirements for LSA are established by DoDI 5000.2, Part 7A, "Integrated Logistics Support." The guidance for LSA tasks is in MIL-STD-1388-1A "Logistics Support Analysis," and the guidance for LSAR is in MIL-STDS-1388-2A and 2B, "DoD Requirements for a Logistics Support Analysis Record."

MIL-STD-1388-1A defines analysis requirements: LSA task inputs are identified to include what the government must provide to the contractor; the expected outputs from each LSA task are specified; Data Item Descriptions (DIDs) are referenced; instructions for tailoring analysis requirements are provided.

MIL-STDS-1388-2A and 2B provide the primary guidance for recording the results of LSA. Narrative reports, such as the Use Study Report, are also used to document the results of selected LSA tasks and subtasks. MIL-STD-1388-2B, dated February 1991, has superseded MIL-STD-1388-2A. A program to convert data from the 2A to the 2B format is available; however, it is expected that many ILS managers of previously established LSA databases will continue to update the 2A-formatted data for the remaining life of these existing materiel systems. For this reason, both 2A and 2B are described later in 7.3.3.

7.3.2 LSA Requirements

The LSA process is structured to provide early design influence to obtain a ready and supportable system at an affordable LCC. The LSA process is composed of a planned series of tasks, which include examination of all elements of a system to determine the logistics support required to make and keep that system usable for its intended purpose (refer to Figure 1-4).

7.3.2.1 Government and Contractor Roles

There are unique and joint roles for the government (requiring authority) and contractor (performing activity) and their logistics specialists involved in the LSA tasks. The timing of these tasks is related to the program acquisition phases. Figure 7-1 supplements the following time-phasing discussions.

Government management of the LSA process begins in the preconcept phase, before the program is formally initiated, and continues throughout the life of the system. The government preconcept tasks determine an initial LSA strategy, help define initial support criteria and influence efforts of the potential performing activities (competing contractors) through CED, DV and into EMD. Early analyses are performed to influence system design and operational concepts; estimate logistics requirements of alternate concepts; and relate design, operation and support characteristics to system readiness objectives. These early analytical tasks influence consideration of support in the system engineering definition of system hardware and software; evaluation of alternative designs; and identification of overall resource requirements.

The government's verification tasks begin early in the process using simulation models and baseline comparison systems and continue in conjunction with the contractor throughout the life cycle.

The contractor's LSA tasks are initiated as part of the preproposal effort in preparation for a competitive CED proposal. The contractor's competitive proposal will respond to the specific and tailored RFP requirements and will identify the planned LSA approach, key issues to be addressed and task scope. It is important, therefore, that the government accurately describe which ILS issues are to be addressed by LSA. The government must also understand the cost, time and workload requirements generated by LSA.

Following CED contract award, the contractor(s) and the government logistics management specialists will jointly pursue the LSA tasks. The analytical tasks started during the preconcept and CED phases will continue and increase progressively in detail as the acquisition program moves into its successive phases.

The validity of the analysis and the attendant data products must be demonstrated. Results of formal test and evaluation and post-deployment assessments are analyzed

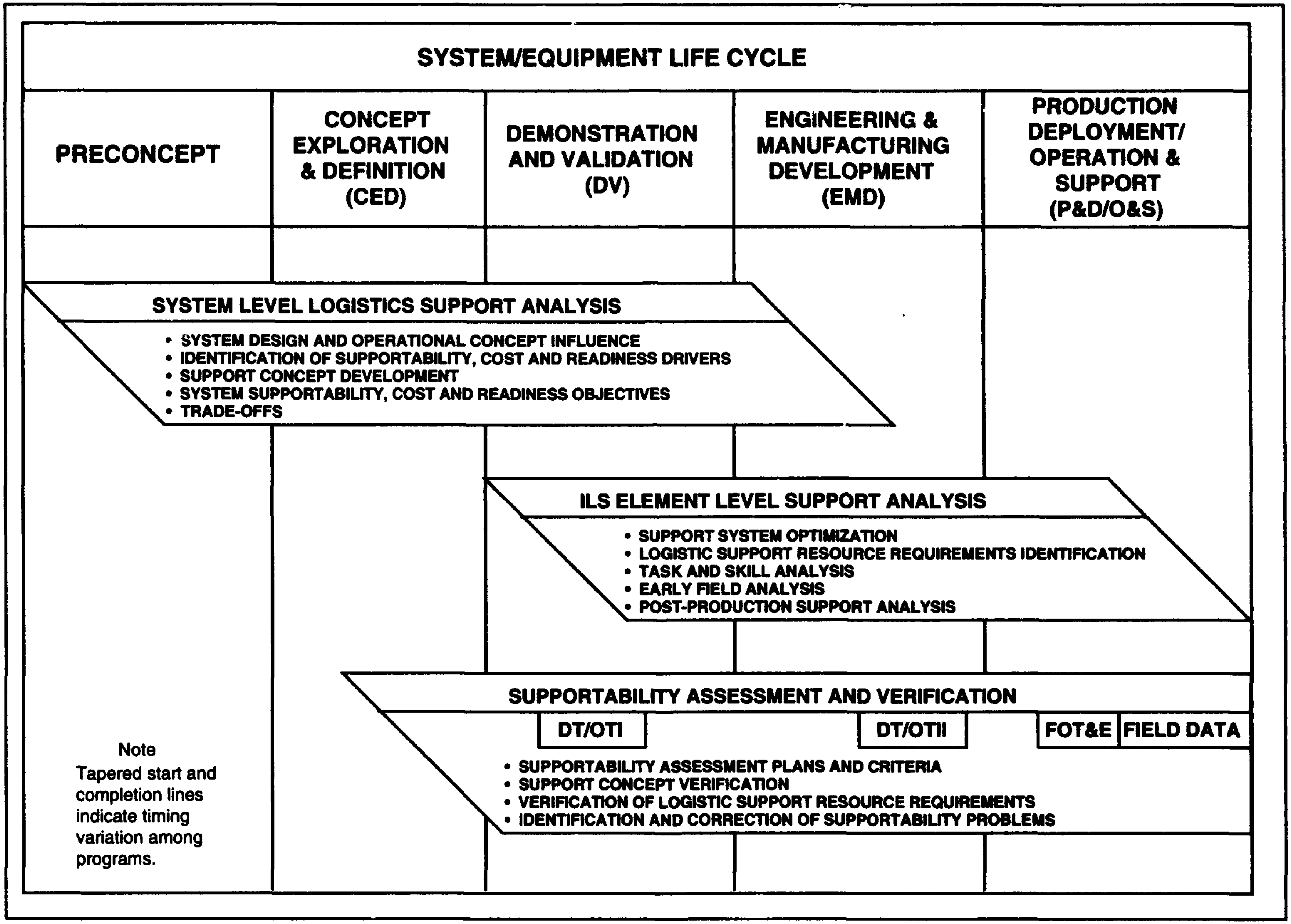


Figure 7-1. Logistics Support Analysis Process Objective By Program Phase

by both the contractor and the government, and corrective actions are implemented as necessary. The processes of testing, evaluating and correcting deficiencies in both the materiel system and its logistics support continue throughout the life cycle.

The government ILS manager's supervision of the contractor's LSA role involves the following tasks:

- Provide LSA guidance;
- Identify LSA task requirements;
- Assess compliance with contractual requirements;
- Provide models and input parameters (e.g., LCC, stockage levels, and level of repair);
- Conduct periodic reviews;
- Provide government data and factors for use studies; and
- Provide the government-developed Joint Service LSAR ADP System or approve an alternative contrac'or-proposed program or other independently developed proprietary software program.

7.3.2.2 Logistics Inputs for Trade-off Analysis

The LSA conducted prior to program initiation identifies constraints and targets for improvement. This early effort provides supportability inputs into system engineering trade-offs conducted during the CED and DV phases. Unless evaluation of supportability factors is timely, the design process will proceed to solidify without logistics input.

7.3.2.3 LSA Task Requirements

The LSA efforts are detailed in MIL-STD-1388-1A and consist of five general task sections involving 15 tasks with 77 subtasks. The following paragraphs summarize the five task sections. (The Military Standard should be consulted for details.) The general time phasing of the overall LSA process is shown in Figure 7-1. The time phasing and repetitive nature of the individual tasks all provided in Figure 7-2.

Task Section 100: Program Planning and Control -

Management and control of the LSA effort involves the development of a proposed LSA strategy, requirements for the LSA plan and provision for design reviews, including procedures and schedules. LSA planning and management are the responsibility of the government program and ILS managers.

Task Section 200: Mission and Support System Definition -

The tasks contained in this section identify the operational role and intended use of the new system and establish support resource constraints, readiness objectives, supportability design requirements and measures of logistics support. During the early phases of an acquisition program these analytical tasks provide the greatest opportunity for the government to influence the design of the system for supportability (see Chapter 3).

LSA TASK SECTIONS AND TASKS	Pre-Concept	CED	DV	EMD	P&D/O&S	Design Changes
Task 100: PROGRAM PLANNING AND CONTROL						
Early LSA Strategy (101)	X	X	X			
LSA Plan (102)		X	X	X	X	X
Program & Design Reviews (103)		X	X	X	X	X
Task 200: MISSION AND SUPPORT SYSTEM DEFINITION						
Use Study (201)	X	X	X	X		
System Standardization (202)		X	X	X		X
Comparative Analysis (203)	X	X	X	X		
Technological Opportunities (204)		X	X			
Supportability Factors (205)		X	X	X		X
Task 300: PREPARATION AND EVALUATION OF ALTERNATIVES						
Functional Requirements Ident. (301)		X	X	X		X
Support System Alternatives (302)		X	X	X		
Evaluation of Alterations & Tradeoffs (303)		X	X	X		X
Task 400: DETERMINATION OF LOGISTIC SUPPORT RESOURCE REQUIREMENTS						
Task Analysis (401)			X	X		X
Early Fielding Analysis (402)				X		X
Post-Production Support (403)				X	X	X
Task 500: SUPPORTABILITY ASSESSMENT						
Supportability Assessment (Test, Evaluation and Verification) (501)			X	X	X	X

Figure 7-2. Acquisition Phase Timing of LSA Tasks

Task Section 300: Preparation and Evaluation of Alternatives -

The tasks contained in this section are highly iterative in nature and are applicable to successive phases of the preproduction part of the life cycle as well as to production design changes. The tasks are generally performed in sequence. Functions are identified, alternatives are developed to satisfy the functions, and evaluations and trade-offs are conducted. The process is then repeated at increasingly lower levels of the system's WBS in the classic system engineering manner.

Task Section 400: Determination of Logistics Support Resource Requirements -

This portion of the LSA defines requirements for the ILS elements. Operational and maintenance tasks are analyzed to determine the support resources required. As development progresses, increasingly more specific design and operational data is used to identify logistics resource requirements to more detailed levels. This section includes an early assessment of the impact of the new system on operational forces and planning to provide continued support after the system is no longer in production.

Task Section 500: Supportability Assessment -

The supportability test and evaluation program serves three objectives throughout a program's life cycle: (1) develop logistics test and evaluation requirements as inputs to system test and evaluation plans; (2) demonstrate contractual compliance with design requirements; and (3) identify supportability problems requiring corrective action (see Chapter 9).

7.3.3 LSA Documentation

The LSAR, a subset of LSA documentation, are generated as a result of performing the LSA tasks specified in MIL-STD-1388-1A. MIL-STDS-1388-2A and 2B accommodate the maximum range of data potentially required by the military services in all ILS functional areas for all types of materiel systems, throughout the entire acquisition life cycle. This approach facilitates standardization of formats and definitions of data elements. Several LSA tasks are recorded in such narrative documents as the contractor's LSA Plan (Task 102), Alternative Support Systems (Task 302), and Early Fielding Analysis (Task 402).

It is vital that the ILS manager tailor these data requirements. If task results are to be performed by the contractor for the government, the SOW for the LSA program must establish the requirement. Standard or specially created DIDs may be used to specify report format with delivery instruction detailed on the CDRL, DD Form 1423. ILS managers should be aware of the amount of documentation they may be generating. Only the LSA documentation that is required should be ordered by the government. The ILS manager needs to determine what data are needed and when. From this determination, he or she can identify the output reports, the LSA tasks and subtasks, and LSA data required to meet the program needs. The manager should also ensure that sufficient qualified personnel are available to apply the LSAR data output effectively.

7.3.3.1 MIL-STD-1388-2A

Figure 7-3 identifies the 15 standard records of MIL-STD-1388-2A and relates them to the applicable LSA tasks and system engineering specialties. MIL-STD-1388-2A is based upon 80-column Hollerith punchcard technology. It requires replication of identical data on individual cards of each of the records.

7.3.3.2 MIL-STD-1388-2B

MIL-STD-1388-2B uses current integrated database technology in lieu of the punchcard process of MIL-STD-1388-2A. The new standard was developed under the leadership of the OSD (Weapon System Improvement Group) and the U.S. Army Materiel Readiness Support Activity (MRSA). It is based on the joint efforts of the military services, the Federal Aviation Administration, and private industry. Figure 7-4 summarizes key improvements provided by the new standard.

The LSAR data is recorded in relational data table groups listed in Figure 7-5. These are further divided into individual tables identified by two-digit codes. For example, data for A - Operations and Maintenance Requirement are recorded in tables AA through AK (e.g., AA - Operations and

Data Record	Record Title	Related LSA Task No.	Specialty
A	Operation and Maintenance Requirements	205	R&M
B	Item Reliability & Maintainability Characteristics	205, 301, 401, 501	R&M
B1	Failure Modes and Effects Analysis	301	R&M, Safety
B2	Criticality and Maintainability Analysis	301	R&M, Safety
C	Operation and Maintenance Task Summary	301, 401, 501	M
D	Operation and Maintenance Task Analysis	301, 401, 501	M
D1	Personnel and Support Requirements	301, 401, 501	M, Human Factors
E	Support Equipment and Training Material Description and Justification	401, 501	M, Tng, Testability
E1	Support Equipment and Training Material	401, 501	M, Tng, Testability
E2	Unit Under Test Description and Justification	401, 501	M, Testability
F	Facility Description and Justification	401, 501	Facilities Engineering
G	Skill Evaluation and Justification	401, 501	Human Factors, Tng
H	Support Items Identification	401, 501	Packaging Supply
H1	Support Items Identification (Application Related)	401, 501	Supply
J	Transportability Engineering Characteristics	401, 501	Transportability Engrg

M: Maintainability
R: Reliability
Tng: Training

Figure 7-3. LSA/LSAR Relationships (MIL-STD-1388-2A)

- Provides reports in tailored formats and flexible selection of data elements through a relational database.
- Requires less storage space and provides greater efficiency through an integrated database.
- Allows maximum use of industry-developed integrated data systems tied to engineering, manufacturing and product support databases to determine logistics support requirements.
- Accommodates and promotes current database technology.

Figure 7-4. MIL-STD-1388-2B Improvements

through AK (e.g., AA - Operations and Maintenance Requirements, AB - War Peace Operation and Maintenance Requirement). Figure 7-5 also relates the data tables groups of MIL-STD-1388-2B to applicable LSA tasks and system engineering specialties.

7.3.4 LSAR Automation

The LSAR data may be prepared and maintained manually using the required MIL-STD-1388-2A or 2B format. It may also be maintained automatically through use of computer technology or by combining manual and automatic techniques.

The Joint Service LSAR ADP system is a standard automated data system developed by the Services for use in preparing MIL-STD-1388-2A data. The MRSA is the lead activity in the application of the standard system. MRSA will provide the software and instructions for the ADP system on request and is available to assist in setting it up at a contractor's facility. More sophisticated and proprietary software have been developed by independent contractors and validated by MRSA for use with MIL-STD-1388-2A data. The software is used to create the LSA records and, in turn, three "LSAR master files" and, in turn, LSAR output reports. The master files are LSA-015, Sequential Task Description; LSA-060, LSA Control Number Master File; and LSA-061, Parts Master File. Upon transition to in-house government control, the government activity takes possession of the master files to continue LSAR update and printout of output reports. (Figure 8-3 identifies a partial listing of LSAR output reports).

The MRSA has responsibility to validate proprietary software programs that contractors use to prepare automated MIL-STD-1388-2B data tables and LSAR records and reports. The MRSA has developed a 2A to 2B data conversion program.

7.3.5 Data Verification

7.3.5.1 LSA Input Data

Figure 5-4 identified principal system engineering data sources employed in the performance of LSA. Most LSAs are performed by a separate ILS group within a contractor's program office or by a supporting activity, and not by the same system engineering personnel who perform the design, R&M, etc. In view of these typical arrangements, the responsibility for ensuring the timely use of appropriate system engineering input for all analyses falls upon the contractor and government ILS managers. Key personnel in the contractors' ILS activity and the government ILS manager must be conversant with the language of the associated system engineering disciplines in order to ensure an effective linkage. System engineering is dynamic and iterative. For example, component reliability values progress from allocations, to predictions, to measurements, to projec-

Data Table Group	Table Group Title	Related LSA Task No.	Speciality
X	Cross Functional Requirement	301, 401, 501	
A	Operations and Maintenance Requirements	205, 301, 303	R&M
B	Reliability, Availability and Maintainability; Failure Modes, Effects and Criticality Analysis; and Maintainability Analysis	205, 301, 401, 501	R&M, Safety
C	Task Analysis and Personnel and Support Requirements	301, 401, 501	R&M, Supply
E	Support Equipment and Training Material Requirements	401, 501	M, Tng, Testability
U	Unit Under Test Requirements and Description	401, 501	M, Testability
F	Facilities Considerations	401, 501	Facilities Engineering
G	Personnel Skill Considerations	205, 301, 401, 501	Human Factors, Tng
H	Packaging and Provisioning Requirement	401, 501	M, Supply
J	Transportability Analysis	401, 501	Transportability Engrg

M: Maintainability
R: Reliability
Tng: Training

Figure 7-5. LSA/LSAR Relationships (MIL-STD-1388-2B)

tions of mature values (reliability growth). The ILS manager should:

- Verify that input data are updated in a timely manner by the managers of the associated system engineering disciplines;

- Verify that the system engineering data are expressed in a format compatible with LSA input requirements — or can be readily converted to the required format; and

- Verify that the input data are appropriate for the time frame that the LSA is addressing.

For example, a repair level analysis to support maintenance planning for the operational phase requires the following five steps:

(1) projections of repair task frequencies (derived from reliability data);

(2) projections of repair task durations and manpower burden (derived from maintainability data);

(3) projections of component prices (from LCC studies);

(4) identification of support equipment requirements (from system design studies); and

(5) estimates of other logistics support costs (training, publications, transportation, etc.).

7.3.5.2 LSAR Data Quality Assurance

The LSA records define and quantify logistics support resource requirements. The assurance of qualitative and quantitative validity of these records is required to preclude misidentification; and to minimize under or over procurement of support resources (supply support, support equipment, etc.).

The LSA input data must be converted to detailed LSA records. Some conversions require application of complex models, such as Repair Level Analysis (RLA) and Reliability Centered Maintenance (RCM). Others follow detailed procedures prescribed in MIL-STD-1388-2A or 2B, for example, the conversion of reliability estimates of mean time between maintenance actions to estimates of maintenance replacement rates (employed in provisioning computations).

The LSAR Quality Assurance procedures must validate the process employed by the logistics support personnel. Suggested procedures are listed in Figure 7-6. AMC Pamphlet 700-11 provides more detailed guidance.

7.3.6 Tailoring LSA/LSAR

7.3.6.1 Tailoring LSA

The key to a productive and cost-effective LSA program is proper tailoring of the LSA subtasks so that the available resources are concentrated on the tasks that will most effectively benefit the program. Limitations on acquisition funding require that the LSA effort be applied selectively in order to improve hardware design and support concepts, as well as to collect data. The government ILS manager plays a significant role in the tailoring process. Appendix A to MIL-STD-1388-1A provides excellent guidance for tailoring LSA requirements to fit the needs of a specific program. The LSA efforts are tailored in several ways. First, they are tailored by task and subtask and by the depth of the analysis (how much of the task). This aspect of LSA tailoring involves consideration of:

- Type of program (Developmental, product improvement, NDI, etc.);
- Amount of design freedom;
- Time and resources available;
- Work already done;
- Past experience and historical data; and
- Procurement considerations.

Programs are also tailored in terms of acquisition phase timing and required updating. Figure 7-2 shows the normal program time phasing for various LSA tasks. In addition, tailoring can dictate which activity will perform the task or subtask.

7.3.6.2 Tailoring LSAR

Tailoring LSAR data are mandatory for government program and ILS managers. The tailoring decisions should be based on the LSA tailoring process described in the preceding paragraph, related engineering and ILS element analysis efforts which result in LSAR data, and a determination of data elements required to satisfy DID requirements. In addition, LSAR data records

Contractor	Government
• Develop detailed LSA/LSAR process - selection, addaption and augmentation of MIL-STD-1388-1A and 2A or 2B	• Establish an LSA management team - review and approve contractor procedures
• Develop self-check procedures	• Review and approve
• Train and certify logistics support personnel to perform the procedures	• Monitor/evaluate
• Establish, schedule and implement multidisciplinary audit reviews	• Establish, schedule and implement independent (government) audit reviews
• Identify problems and implement corrections	• Identify problems and approve corrections
• Repeat audits	• Repeat audits

Figure 7-6. LSAR Quality Assurance Procedures

may be tailored because, of system hardware level or complexity. Appendix E to MIL-STD-1388-2A and Appendix D to MIL-STD-1388-2B provide guidance for tailoring the LSAR.

A basic approach to the tailoring of LSAR requirements is to start with the output or end uses of the data and determine data requirements in the following manner:

• The ILS manager, supported by functional specialists (manpower, publications, etc.) determines exactly what logistics resource information is required and it is needed in the acquisition life cycle of the specific system.

• The ILS manager then determines which of these requirements can be supported by LSAR data and whether they require the depth of detail that LSAR provides; as opposed to less detailed parametric estimates.

• The ILSMT identifies the input records (LSAR) needed to obtain the selected output requirements and determines the appropriate timeframe. Sample input-output relationships are shown in Figure 8-3 of this guide. Detailed input-output relationships for all LSA records are illustrated in Figure 90 (Appendix E) of MIL-STD-1388-2A. Input-output relationships for all data tables are illustrated in Figure 14 (Appendix B) of MIL-STD-1388-2B.

7.3.7 LSA/LSAR Relationship Summary

Figure 7-7 summarizes the relationships among the ILS requirements, LSA tasks, LSA documentation, ILSP, and the acquisition life-cycle phase.

7.4 RISK MANAGEMENT

7.4.1 Failure to Apply LSA during Concept Exploration and Definition

7.4.1.1 Risk Area

Failure to participate in the definition of system concepts can produce a system design in later phases that does not meet supportability objectives and requires excessive or unattainable O&S costs and manpower to meet readiness objectives.

7.4.1.2 Risk Handling

The LSA must be integral to the system engineering program in order to achieve an effective design for supportability. The LSA activity during the CED phase also provides the basis and planning for the ILS program in DV and later acquisition phases.

7.4.2 Invalid Application of Component R&M Data

7.4.2.1 Risk Area

Design and manufacture determine the mean life and failure rate of components when viewed in isolation. When the system is engaged in its military operational role, these same components should be expected to exhibit replacement rates higher than their handbook value or inherent reliability alone would indicate. The consequences of improperly computed material replacement rates are invalid manpower requirements, incorrect supply support stockage lists and invalid repair level analyses.

7.4.2.2 Risk Handling

Differences between operational and inherent failure rates are attributable to –

- Environmental factors
- Failures induced by interacting components
- Personnel related failures
- No-defect removals

MIL-STDS-1388-2A and 2B contain explicit mechanisms to convert inherent failure rates to their expected operational values. Estimates of the effects, from the factors listed above, may be derived from field data on similar components. In addition, computed material replacement rates should be updated directly when the system undergoes operational test and later field deployment.

7.4.3 Failure to Structure/Tailor LSA/LSAR Requirements

7.4.3.1 Risk Area

Failure to establish an LSA plan specifically designed to meet the needs of the system can result in excessive costs; the performance of unwanted analysis, while failing to complete needed studies; and the development of excessive documentation, while overlooking critical information needs. ILS lessons learned from reports and discussions with ILS managers have provided numerous examples of these deficiencies.

7.4.3.2 Risk Handling

The ILS managers' LSA/LSAR objective should be to obtain only what is needed and use what is obtained. The process of fitting the activity to the need, discussed in this chapter, is an essential aspect of tailoring.

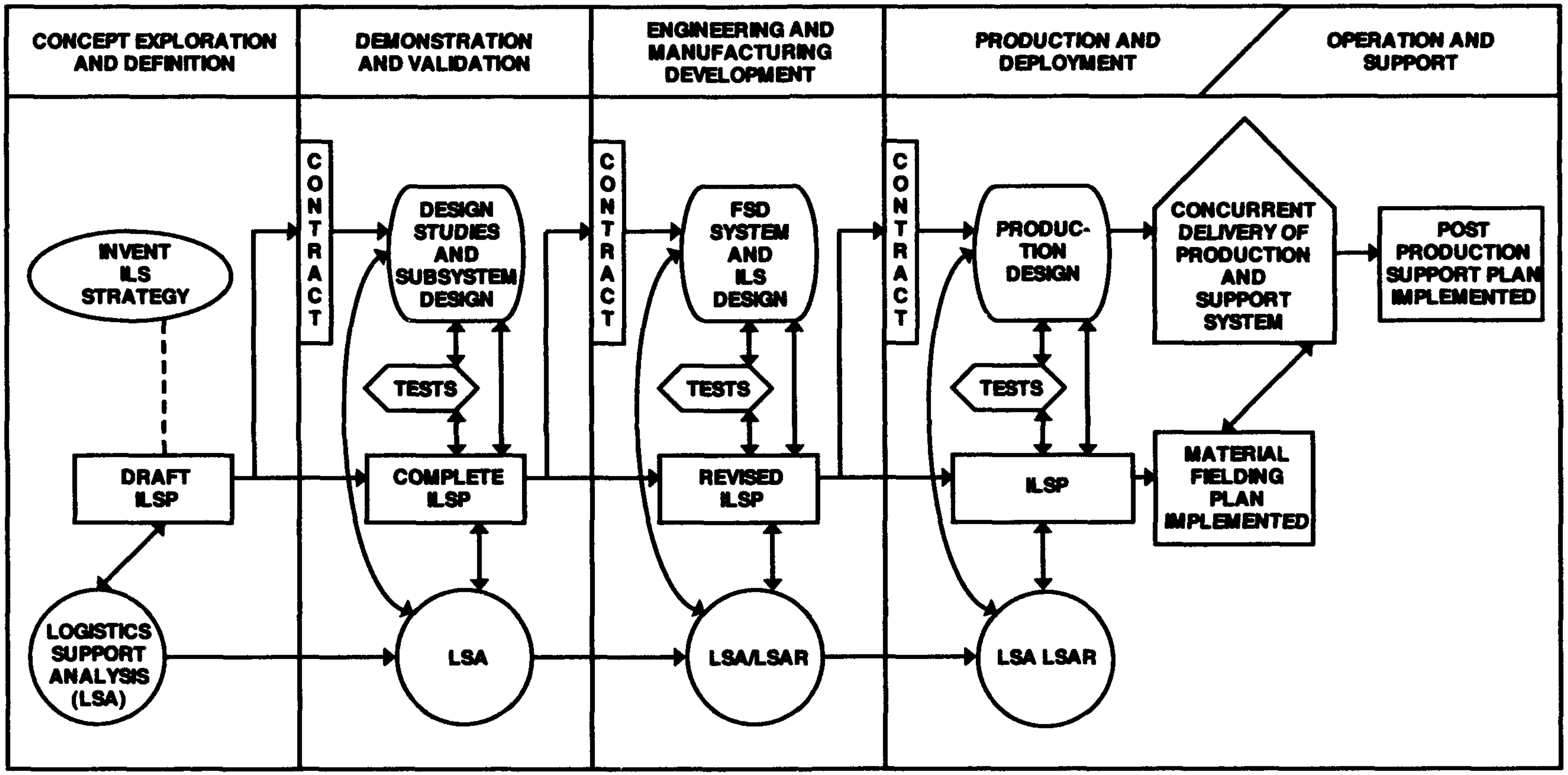


Figure 7-7. The Integrated Logistics Support Process

7.5 SUMMARY

• Application of LSA is mandatory for all materiel systems.

• Applications must be tailored to the requirements of each acquisition to ensure cost-effective implementation.

• The LSA programs for major systems are relatively costly. These costs are most warranted when LSA is used as the integrated source and record for development of ILS planning and definition of ILS products. The program that provides front-end strategy and funding for LSA and other ILS activities is more likely to be successful.

7.6 REFERENCES

1. MIL-STD-1388-1A, "Logistics Support Analysis."

2. MIL-STDS-1388-2A and 2B, "DoD Requirements for a Logistics Support Analysis Record."

3. AMC Pamphlet 700-11, "Logistics Support Analysis Review Team Guide."

8

LOGISTICS SUPPORT RESOURCE REQUIREMENTS

8.1 HIGHLIGHTS

- Use of LSA to define ILS resource requirements

- Determining quantitative logistics requirements to attain readiness objectives

- Data input, LSA tasks, time phasing issues, LSA records and LSAR associated with each ILS element

- Managing logistics support resources for accelerated acquisitions

8.2 INTRODUCTION

8.2.1 Purpose

To provide a managerial overview of methods used to determine the logistics support resources (i.e., the ILS elements) required to achieve system readiness objectives.

8.2.2 Objective

The primary objective of any new materiel system is to provide a needed military capability at an affordable LCC. Readiness is one of the principal determinants of military capability. The objective of the activities described in this chapter is to define the logistics resources needed to support system operational performance and to achieve peacetime and wartime readiness objectives.

8.3 MANAGEMENT ISSUES

8.3.1 Support of Operational Performance

Logistics support resource requirements are driven by the systems' operational R&M characteristics and the R&S objectives established as firm objectives prior to the Milestone II decision. As shown in Figure 8-1, the system operational R&M characteristics are determined by the supportability design characteristics of the system, the projected operational role and the operational support the system will receive in its operating environment. The operational support consists of the trained manpower, support equipment, technical manuals, embedded computer systems and facilities that directly support the operational performance of the system.

8.3.2 Attainment of Readiness Objectives

The R&S objectives are driven by system design R&M, the characteristics and performance of the support system, and the quantity and location of support resources.

Logistics support is key to attaining readiness objectives. The ILS elements are partly unique to the system and partly a characteristic of the overall support structure for all systems. The unique elements (maintenance manpower, spares and repair parts stockage, special support equipment and additional quantities of common equipment) can be designed or selected to achieve a specified

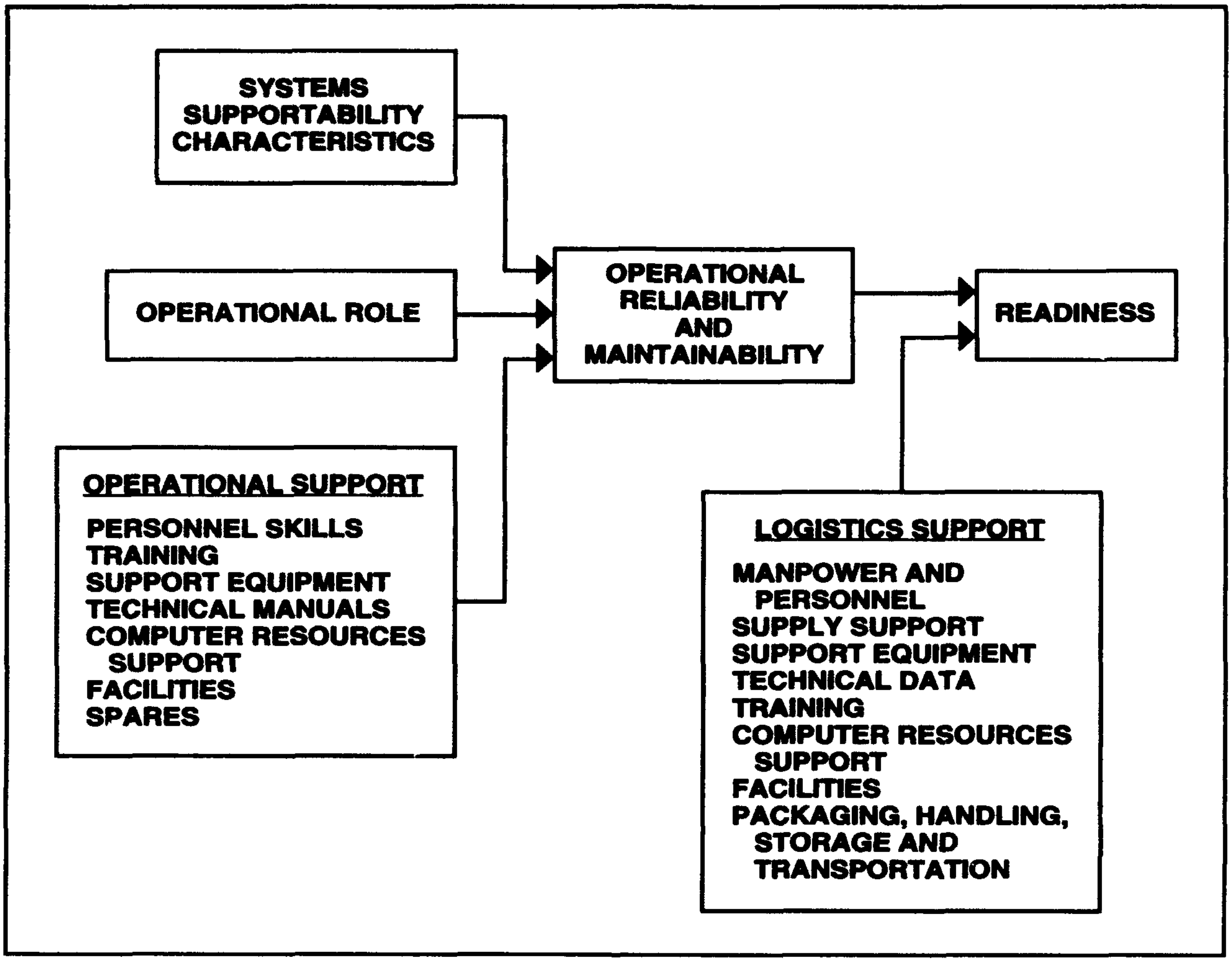


Figure 8-1. ILS and R&M Readiness Relationships

system readiness level. The effectiveness of common support elements (for example, existing storage and transportation capabilities) can be quantified using such parameters as order and ship time and fill rate. The parameters should be based upon the demonstrated and projected performance of the common support structure. Given target or measured values of operational R&M and the parameters describing the effectiveness of logistics support, computer simulations may be used to model the attainability of a readiness objective (see 9.3.4).

Sustaining wartime readiness adds the dimensions of combat exposure and duration to the peacetime measure of readiness. Wartime readiness objectives usually take the form of a specified level of operational availability over a postulated duration and intensity of combat. Clearly, wartime requirements for manpower, supply support and transportation are substantially greater than peacetime requirements because of higher use rates and exposure to combat damage. For example, an M-1 Abrams tank which might fire twenty training rounds per year in peacetime, could fire three times that amount in a single day of high intensity combat. Additional considerations for combat sustainability are listed in Figure 8-2.

8.3.3 Analytical Techniques

Within the overall framework of Systems Engineering, LSA employs a number of

ILS ELEMENT	MAJOR SUSTAINABILITY CONSIDERATIONS
Maintenance Planning	• Evaluate impact of increased mission tempo and of battle damage assessment and repair on logistics support
Manpower & Personnel	• Assess impact of higher wartime system utilization, requirements for battle damage assessment and repair, and the impact of personnel casualties
Supply Support	• Compute wartime consumption rates (parts, POL, ammunition); develop war reserves and combat supply support stockage; assess industrial preparedness; address cannibalization of parts from battle damaged systems
Technical Manuals	• Incorporate instructions for battle damage assessment and repair
Training	• Develop training requirements for battle damage assessment and repair and support increased need for replacement of trained personnel
Transportation	• Evaluate intertheater, intratheater and battlefield recovery and transportation requirements

Figure 8-2. Sustaining Wartime Readiness

analytical techniques. The techniques that apply to the determination of resource requirements for two or more ILS elements are Failure Modes, Effects and Criticality Analysis (FMECA); Repair Level Analysis (RLA); Reliability-Centered Maintenance (RCM) Analysis; Task Analysis; and Damage Mode and Effects Analysis (part of FMECA). They are addressed below.

8.3.3.1 Failure Modes, Effects and Criticality Analysis

The FMECA is an essential function in the engineering design process that provides input to the identification of functional requirements (LSA Task 301) and maintenance task analysis (LSA Task 401). The main purpose of the FMECA is to identify potential design weaknesses through systematic consideration of the likely modes in which a component or equipment can fail, causes for each mode of failure and the effects of each failure. (See MIL-STD-785, "Reliability Program for Systems and Equipment Development and Production" and MIL-STD-1629, "Procedures for Performing a Failure Mode, Effects and Criticality Analysis.") Reliability engineers should initiate the FMECA during the CED phase as soon as preliminary design information is available at the higher system levels. The FMECA should be extended to lower levels in later acquisition phases as more information becomes available. Its first purpose is the early identification of possible catastrophic and critical failures, so they can be eliminated or minimized through design correction or preventive operational or maintenance tasks. The results of the FMECA may be recorded in the LSAR database (see chapter 7). The FMECA also provides input to the –

• Identification of requirements for corrective maintenance

• Performance of reliability-centered maintenance (see 8.3.3.3)

• Development of troubleshooting procedures in technical manuals/orders

• Performance of maintenance task analysis

8.3.3.2 Repair Level Analysis

The RLA is a technique that establishes whether an item should be repaired; and at what level of maintenance. The RLA provides vital input to maintenance task analysis (see 7.3.5.1).

8.3.3.3 Reliability Centered Maintenance Analysis

The purpose of an RCM analysis is to identify the essential preventive maintenance tasks required to retain the safety and reliability inherent in system design. The requirement to perform RCM is contained in DoDD 4151.16, "DoD Equipment Maintenance Program." Each Service has developed procedures for its application. General application guidelines have been developed by United Airlines under contract to the DoD: Reliability-Centered Maintenance by F. Stanley Nowlan and Howard F. Heap, 29 December 1978.

The FMECA (see 8.3.3.1) provides an essential input to RCM analysis. Failure modes that impact safety, prevent mission performance, or require costly repair are identified as candidates for preventive maintenance tasks. Tasks include crew monitoring procedures servicing and lubrication, scheduled inspection procedures and (when justified by a statistically significant relationship between failure probability and accrued usage) a scheduled replacement or repair procedure. The application of RCM results in the –

• Identification of failure modes requiring additional design evaluation

• Establishment of scheduled preventive maintenance tasks for inclusion in technical manuals/orders

• Establishment of overhaul selection procedures for end items and components

8.3.3.4 Task Analysis

Task analysis consists of a detailed analysis of the operations and maintenance tasks required for a new system. The specific objectives of this analytical activity are to –

• Identify logistics support resource requirements for each task

• Identify new or critical logistics support resource requirements

• Identify transportability requirements

• Identify support requirements which are outside established goals, objectives or constraints

• Provide data to support the development of design alternatives to reduce O&S costs, optimize logistics support resource requirements or enhance readiness

• Provide source data for preparation of required ILS documents (technical manuals, training programs, etc.).

Task analysis breaks each task into specific subtasks in order to identify skill requirements, elapsed time, task frequency, personnel required at each maintenance level, support equipment, repair parts, requirements for new or modified facilities and training support. The government should require the contractor to perform selected high pay-off task analyses during the DV phase. Task analyses to assess the impact of proposed design changes on all ILS resources requirements will be required during all phases.

The LSA Task 401, "Task Analysis", addresses the specific purpose, description, input and output of task analysis. In addition, Logistics Engineering and Management by B. Blanchard has an excellent discussion of task analysis.

8.3.3.5 Damage Modes and Effects Analysis (DMEA)

The ability of a system to survive an enemy attack directly impacts its wartime sustainability. The DMEA (Task 104 of the FMECA, MIL-STD 1629) serves to influence system and component design and to identify the additional logistics support resources required to achieve the wartime readiness objectives. The frequency and severity of combat damage occurrences are estimated through combat simulations and tests. Additional manpower, supply support, transportation and skills associated with restoring a battle-damaged system to ready status are then computed (see 3.3.5.3). Data on combat damage to aircraft and combat vehicles sustained in the Southeast Asia and the Yom Kippur wars are recorded in the Survivability/Vulnerability Information Analysis Center (SURVIAC) data base at Wright-Patterson AFB, Ohio.

8.3.4 Developing ILS Elements

The LSA is an integral part of Systems Engineering. The LSA defines, quantifies, schedules and documents required levels of logistics support. This section provides a broad overview of the development of the ten ILS elements (DoDI 5000.2, Part 7A, "Integrated Logistics Support") with a focus on the linkage of basic source data to LSA (MIL-STD-1388-1A), to LSAR (MIL-STD-1388-2A), to LSAR reports, and where applicable, to models and other studies (as displayed in Figure 8-3). The LSA data generated by the system developer are documented in 15 data records. Records related to individual ILS elements are identified in Figure 8-3. The government-developed Joint Service LSAR automated system (or other government-validated system) is capable of recording data in an automated format (e.g., disk or tape) and producing LSAR reports to support the development or selection of ILS elements (see Chapter 7).

8.3.4.1 Maintenance Planning

This is the process conducted by the government and contractor to explore alternatives and to develop the maintenance concepts and maintenance requirements for the life of the system. Maintenance planning is the lead analytical activity and provides input to the development of the remaining logistics support elements.

The DoDI 5000.2 (Part 7A) requires the development of a baseline support concept during the CED Phase and a maintenance concept and supporting analyses during DV. Detailed operation and maintenance tasks are identified during the DV and EMD phases. Maintenance planning identifies the level of maintenance at which each task (e.g., remove, disassemble, fault

ILS ELEMENT	BASIC SOURCES	LSA	RCDS	TBLS	LSAR REPORTS	OTHER STUDIES	FOLLOW-ON MODELS
MAINT PLANNING	• SERVICE MAINTENANCE SYSTEM • OPERATIONAL CONCEPT • R&M PROGRAM DATA • HISTORICAL DATA	• USE STUDY • FUNCTIONAL REQUIREMENTS IDENTIFICATION • TASK ANALYSIS • REPAIR LEVEL ANALYSIS	A B B_1 B_2 C D D_1 E E_1 H H_1	X A B C E U H	LSA-003 MAINTENANCE SUMMARY LSA-004 MAINTENANCE ALLOCATION SUMMARY LSA-024 MAINTENANCE PLAN	• BATTLE DAMAGE SIMULATION	• MAINT SIMULA-TIONS
MANPOWER AND PERSONNEL	• DESIGN DATA • R&M PROGRAM DATA • HISTORICAL DATA	• MAINTENANCE PLANNING • COMPARATIVE ANALYSIS • ANALYSIS OF EXISTING MANPOWER	A B B_1 B_2 C D D_1 E E_1 F	X A B C E	LSA-001 DIRECT ANNUAL MAINTENANCE MAN-HOURS	• AVAILABLE MAN-HOURS • INDIRECT PRODUCTIVE TIME • BATTLE DAMAGE SIMULATION	• MANPOWER MODELS
SUPPLY SUPPORT	• R&M PROGRAM • HISTORICAL DATA	• MAINTENANCE PLANNING • TASK ANALYSIS	D D_1 H H_1	X H	LSA-036 PROVISIONING REQUIREMENTS	• BATTLE DAMAGE SIMULATION	• "SPARE TO AVAIL-ABILITY" MODEL
SUPPORT EQUIPMENT	• LISTS OF STANDARD SUPPORT EQUIP • MAINTAINABILITY ENGINEERING	• MAINTENANCE PLANNING • TASK ANALYSIS	C D D_1 E E_1 H	X C E U H	LSA-005 SPT EQUIP UTILIZATION SUMMARY LSA-007 SPT EQUIP RQMTS LSA-070 SPT EQUIP RECOMMENDATION DATA LSA-076 CALIB & MEAS RQMTS SUMMARY (2B)		
TECHNICAL DATA	• SYSTEM FUNCTIONAL RQMTS • DESIGN DATA • STANDARDS AND SPECIFICATIONS • PERSONNEL CAPABILITIES (TARGET AUDIENCE)	• MAINTENANCE PLANNING • TASK ANALYSIS	C D D_1 H H_1	X C U H	LSA-015 (2A) SEQUENTIAL TASK DESCRIPTION LSA-018 TASK INVENTORY SUMMARY (2B)		
TRAINING AND TRAINING SUPPORT	• EXISTING PERSONNEL SKILLS AND TRAINING PROGRAMS • EXISTING TRAINING DEVICES	• COMPARATIVE ANALYSIS • FUNCTIONAL REQUIREMENTS IDENTIFICATION • TASK ANALYSIS	C D D_1 E E_1 G	X C E G	LSA-011 SPECIAL TRAINING EQUIPMENT/ DEVICE SUMMARY LSA-014 TRAINING TASK LIST REPORT		
COMPUTER RESOURCES SUPPORT	• DESIGN SPECIFICATIONS • TEST REQUIREMENTS	• FUNCTIONAL REQUIREMENTS IDENTIFICATION • TASK ANALYSIS	C D E E_1	X C E U			
FACILITIES	• SYSTEM DESIGN CONCEPT • EXISTING FACILITIES	• MAINTENANCE PLANNING • TASK ANALYSIS	B C D E E_1 F G	X C F	LSA-012 FACILITY REQUIREMENT		
PACKAGING, HANDLING, STORAGE AND TRANS	• SYSTEM DESIGN • EXISTING STORAGE AND TRANSPORTATION	• MAINTENANCE PLANNING • TASK ANALYSIS	H J	X H J	LSA-025 PACKAGING REQUIREMENTS DATA LSA-026 PACKAGING DEVELOPMENT DATA		

Figure 8-3. Development of ILS Elements

locate) is performed, what support equipment is required, task times and frequencies, and input information to identify requirements for all ILS resources.

As indicated in Figure 8-3, source data includes current characteristics of the standard maintenance system employed by the Service to support similar items in the mission area, operational concepts, R&M program data (prediction, simulations, and test) and historical data on like and similar components in deployed systems. Analytic techniques to assist in the performance of maintenance planning are described in paragraph 8.3.3. The results of the analyses are documented on the LSA records and tables identified in Figure 8-3. The LSAR reports provide a convenient display of maintenance planning as a guide for the identification of other logistics support resource requirements. LSA-003, "Maintenance Summary" compares maintainability parameters achieved by system design to the required values. The LSA-004, "Maintenance Allocation Summary" lists maintenance task allocation by such functions as test, service and replace. The LSA-016, "Preliminary Maintenance Allocation Chart" provides preliminary descriptions of task allocation as analyses are performed. Finally, LSA-024, "Maintenance Plan" documents the results of the maintenance planning effort — that is, the what, the how and the who of performance and support for all maintenance tasks.

8.3.4.2 Manpower and Personnel

This element encompasses the identification and acquisition of military personnel with the skills and grades required to operate and support a system over its lifetime at peacetime and wartime rates. The DoDI 5000.2, Part 7A requires identification of manpower constraints prior to Milestone 0 and an initial estimate of manpower requirements during the CED Phase. Initial estimates are based upon analysis of a baseline comparison system (LSA Task 203) derived from a similar system or systems in the mission area (see 3.3.3.2). Several analytical models are available. For example, the Navy-developed Hardware and Manpower (HARDMAN) model is an analytical tool that predicts quantitative manpower and personnel requirements in different skill specialty code categories.

As the system design is completed during EMD, data becomes available to enable the development of more precise manpower estimates based upon detailed task analyses. The source data identified in Figure 8-3 are used to identify the estimated frequency and duration of individual tasks derived from predictions, simulations, test and field data and historical data on like and similar components. Paragraph 8.3.3 above describes LSA techniques.

Maintenance manpower requirements are recorded on the records and table groups identified in Figure 8-3. The LSAR ADP system is capable of displaying the recorded data in formats convenient for use in manpower computation models. The LSA-001, "Direct Annual Maintenance Manhours" lists the direct annual maintenance manhours of each required Skill Specialty Code (SSC) at each level of maintenance. The LSA-002, "Personnel and Skill Summary" identifies man-hours; time and the required number of personnel by task, work unit code, or technical manual functional group code.

Each Service has its own procedures, manpower standards and manpower models for converting direct annual manhours to quantitative and qualitative manpower requirements. The ILS manager determines the skills, tasks and knowledge required to operate and support the new system and the manhours required to maintain it at each maintenance level. Manpower and Personnel activities of the Services convert the manhour values into the quantitative manpower authorizations. During the P&D or O&S phase, manpower and personnel specialists survey deployed units to refine the manpower authorizations. The ILS manager and supporting staff should be familiar with and participate in their Service's manpower computation procedures.

8.3.4.3 Supply Support

Supply support encompasses all actions required to identify and obtain the spares and repair parts needed to support peacetime and wartime readiness objectives. The input data listed in Figure 8-3 are used to determine the anticipated rate of replacement of the items based upon initial predictions, simulations, test and field data and historical data on like and similar components. The LSA tasks included in maintenance planning identify the mission criticality of parts, authorized maintenance levels, peacetime and wartime replacement rates and estimates of part failures due to battle damage.

Data elements in MIL-STDS-1388-2A and 2B support all required provisioning actions. Report LSA-036, "Provisioning Requirements" provides provisioning list deliverables. Replacement rates related to battle damage may be included in LSA procedures or developed by separate battle damage simulations.

"Sparing to availability" is the term generally applied to models that compute stockage levels by item and quantity required to support peacetime and wartime readiness levels. The ILS manager should understand the computational methodology and assume direct responsibility for supply, maintenance, transportation and procurement performance parameters employed in the model. Sparing to availability models simulate multiechelon supply support from wholesale stockage points (e.g., DLA supply centers, Service depots, contractor warehouses) to the ultimate user, who may be a high priority operational unit in a distant country or at sea or many other locations. The ILS manager must ensure that order and ship time, fill rates, maintenance turn around times and other parameters employed in the model realistically portray the impact and interaction of the supply, transportation, maintenance and procurement systems. (Examples of sparing to availability models are The Army Selected Essential-Items Stockage for Availability Method (SESAME) model and the Navy Availability-Centered Inventory Model (ACIM).)

Supply studies are performed starting in the DV Phase. All required studies and documentation should be completed during EMD or early P&D. In an ideal situation, computation and total provisioning requirements are completed based upon a stable design before the transition to production. Updates to reflect design changes and field experience will be required in all phases.

8.3.4.4 Support Equipment

The support equipment element encompasses all items (mobile or fixed) required to support operation and maintenance of the system. It includes associated multiuse end items, ground handling and maintenance equipment, tools, metrology and calibration equipment, test equipment and automated test equipment.

Support equipment standardization studies are performed starting in the CED phase. Lists of existing equipment employed in the mission area and broader lists of standard support equipment and tools maintained by the Services, the DLA, and the General Services Administration provide input to the standardization studies (see Figure 8-3). Maintainability engineers have a primary responsibility for determining support equipment requirements for maintenance tasks in accordance with MIL-STD-470A, "Reliability Program for Systems and Equipment." Major items of support equipment requiring development should be tentatively identified during CED.

By the beginning of EMD, special and standard support equipment should have been identified through trade-off studies. At this point, detailed task analyses and documentation are performed to identify the specific equipment requirements for every operating and maintenance task. The LSAR reports identified in Figure 8-3 support determination of quantitative requirements for the selected items.

Development and support of Automatic Test Equipment (ATE) has become a major cost area for each of the military services. Substantial progress has been made in recent years in limiting the proliferation of ATE for developmental systems. Each Service has developed standard or preferred ATE or a family of ATE and has established a central office to review requests for waivers. The responsible central activities are PM, Test Measurement and Diagnostic, U.S. Army Communications-Electronics Command; HQ, Air Force Materiel Command; and PM, Consolidated Automated Support System, U.S. Naval Air System Command.

Standardization of the software employed to automate test procedures offers additional opportunities for cost reduction. The OSD, working with the Services and industry, established C-Atlas 716 as the standard programming language for ATE test programs. Each of the Services has established capabilities to manage contractor software development and to update and maintain programs employing this standard language.

8.3.4.5 Technical Data

Technical data encompasses all recorded information of a scientific or technical nature related to a program. Technical data consists of written instructions such as drawings; operating and maintenance manuals; specifications, inspection, test and calibration procedures; and documentation of computer programs.

System functional requirements and design and production documentation provide technical data. Technical manual standards and specifications describe format, content and style requirements. Training activities within the Services identify skills and reading comprehension levels of the target audiences. Technical instructions are developed by performance of logistics support analyses listed in Figure 8-3 and recorded on the data records and table groups identified. The maintenance planning tasks identify preventive and corrective maintenance actions including troubleshooting guidance. Task analyses identify specific procedures and skill requirements. Scheduling the delivery of technical data is a critical PM challenge. Preliminary technical manuals may be required by late DV to support operational test and evaluation and training activities. A formal validation and verification procedure must be scheduled and executed to ensure the quality of technical manuals. This is often conducted as part of the OT&E program and must be included in the Test and Evaluation Master Plan (TEMP).

8.3.4.6 Training and Training Support

This element encompasses all of the processes, procedures, techniques, training devices and equipment used to train personnel to operate and support a system — including individual and crew training; new equipment training; initial, formal and on-the-job training; and logistics support planning for training equipment.

Input to planning for training requirements includes constraints imposed by the present logistics system (Figure 8-3). Compatibility with existing personnel skills, programs of instruction, and training equipment can minimize training costs. Planning and initial resource requirements for training should be established prior to Milestone I. Training items requiring development should be tentatively identified prior to Milestone I. The Services require approval of formal training plans, such as the Navy Training Plan, prior to Milestone II.

The LSA process, through task analysis, serves to identify training and equipment requirements at the task level during DV and EMD. The system developer or Service test organization is responsible for training the operating and maintenance personnel who participate in OT&E during EMD. The initial training procedures and equipment should be representative of those that will be employed during the O&S phase. The output of the LSAR automated system includes LSA-011, which lists requirements for special training equipment and devices, and LSA-014, which details training tasks. These in turn are used to guide budget development and technical and training manual development.

8.3.4.7 Computer Resources Support

Computer resources support is defined as all computer equipment, software, associated documentation, contractual services, personnel and supplies needed to operate and support an embedded computer system.

The increasing complexity, expanding use, and high LCC of embedded computer software demand management attention to configuration control and status accounting of the software. Standardization policies adopted by DoD (e.g., the use of Ada as the standard embedded computer higher order language) help control LCC. Three areas of special concern for the ILS manager are:

- Fault-detection and fault-isolation capabilities of embedded diagnostic systems;

- Ability of maintenance personnel to differentiate between hardware and software deficiencies;

- Management of software maintenance during the O&S phase of the materiel system.

The ILS manager should ensure that diagnostic programs are fully evaluated during OT&E and that deficiencies are corrected before deployment. Support of embedded computers during the O&S phase should be addressed in the Computer Resources

Life-Cycle Management Plan (CRLCMP) and the PPSP.

8.3.4.8 Facilities

Facilities encompass those real property assets required to support the materiel system, and the studies that define types of facilities or facility improvements, locations, space needs, utilities, environmental requirements, real estate requirements and equipment. The objective of ILS facilities planning is to ensure that the required facilities are available to the government test organizations, operating forces and supporting activities at the time they are needed.

Facility planning requires support management attention throughout the acquisition process. A minimum of five years is normally required from initiation of the POM process until the usable facility is in place. In the case of NATO facility acquisition, the lead time can be even greater. Because of the long acquisition cycle, the need for new facilities must be recognized early in the system life cycle. During the CED phase, space and equipment demands are analyzed to determine general facility requirements. Where existing facilities are deemed inadequate, new facility requirements are developed. A particularly difficult scheduling problem is the approval, design, and construction of any new facilities required to support testing activity. These facilities must be defined early in the CED phase if they are to be available when required.

Input to facility requirements planning include data on existing facilities, projected space availability, facility funding constraints and projected operational and maintenance concepts. Existing facility data includes information on other Service depot facilities. The Depot Maintenance Interservicing Program, under the authority of the Joint Logistics Commanders, requires a joint Service review of facility requirements for new systems and major changes to facilities for existing systems. The objective of this review is to determine where support can be provided on a most cost-effective basis, with existing capabilities within any of the Services, with new Service facilities, or by a contractor. (Refer to DoDD 4151.1, "Use of Contractor and DoD Resources for Maintenance of Materiel.") The only justification to reject other Service capabilities is that retention of Service support is absolutely critical to that Services' mission.

The description of and justification for new facilities are summarized in LSA-012, "Requirements for Facility."

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

This element deals with the characteristics, action and requirements necessary to insure the capability to transport, preserve, package, and handle all equipment and support items.

Inputs to the PHS&T planning process are system design, support system transportability constraints, existing packaging standards and containers, and the capability of current handling and storage facilities and equipment. Initial system transportability constraints are specified in the CED phase, in accordance with DoDI 5000.2, Part 6A "Transportability," and are assessed against the capabilities of existing transportation assets. Transportability trade-offs are performed as part of LSA Task 303.2.12 to optimize the transportation concept under the identified constraints. These requirements must be approved by the appropriate military service transportation agents. During DV, specific end item transportability characteristics are identified through transportability analyses conducted as part of LSA Task 401, "Task Analysis."

In the CED phase, packaging and handling standards should be specified. Design constraints should be established to maximize compatibility with the projected support system. Packaging design engineers should be included in the design review and approval cycle for released engineering documents. During DV, component design is reviewed to assure resistance to damage, compatibility with existing packaging assets and to determine unique protection and handling requirements. Dimensional, special handling, storage and shelf life information is recorded in the LSAR. A special handling list can be developed and distributed to facilitate correct handling of special items.

Outputs of the process include LSA-025 "Packaging Requirements Data" and LSA-026 "Packaging Development Data."

8.3.4.10 Design Interface

Design interface is the relationship of logistics-related design parameters, such as R&M, to readiness and logistics support resource requirements. As illustrated in Figure 8-4, this is an two-way, interactive relationship. System readiness objectives and logistics constraints established during CED and DV drive the design. While ILS exerts the greatest influence during this early phase, there are also opportunities in later phases. Application of LSA tasks helps identify design-related shortfalls and targets for subsequent design study. This is achieved through analysis, specific LSA effort and logistics reviews as the materiel system progresses through the acquisition cycle.

The four LSA output reports listed in Figure 8-4 are compiled from LSAR data documented during EMD. The reports identify the need and opportunities for design changes to improve readiness and reduce operation and support costs.

- "Direct Annual Maintenance Manhours" (LSA-001) measures the achievement of a maintenance manhour per operating hour or similar constraint established before program initiation or during the CED phase.

- "Critical Maintenance Task Summary" (LSA-006) lists maintenance tasks that exceed a specified threshold, such as frequency, elapsed time or annual maintenance manhours. This enables a focus on cost drivers.

- "Reliability Summary-Redesign" (LSA-051) is a compilation of problem areas annotated on LSA records during task analyses.

- "Criticality Analysis Summary" (LSA-052) lists failure modes that have the greatest impact upon system reliability and safety.

The constant review of the design interfaces assures the identification of opportunities to reduce logistics support costs and/or enhance readiness. Any design change resulting from this review process must be assessed for impact on logistics support resource requirements. The application of system engineering parameters to the development of logistics support resources is discussed in Chapter 5.

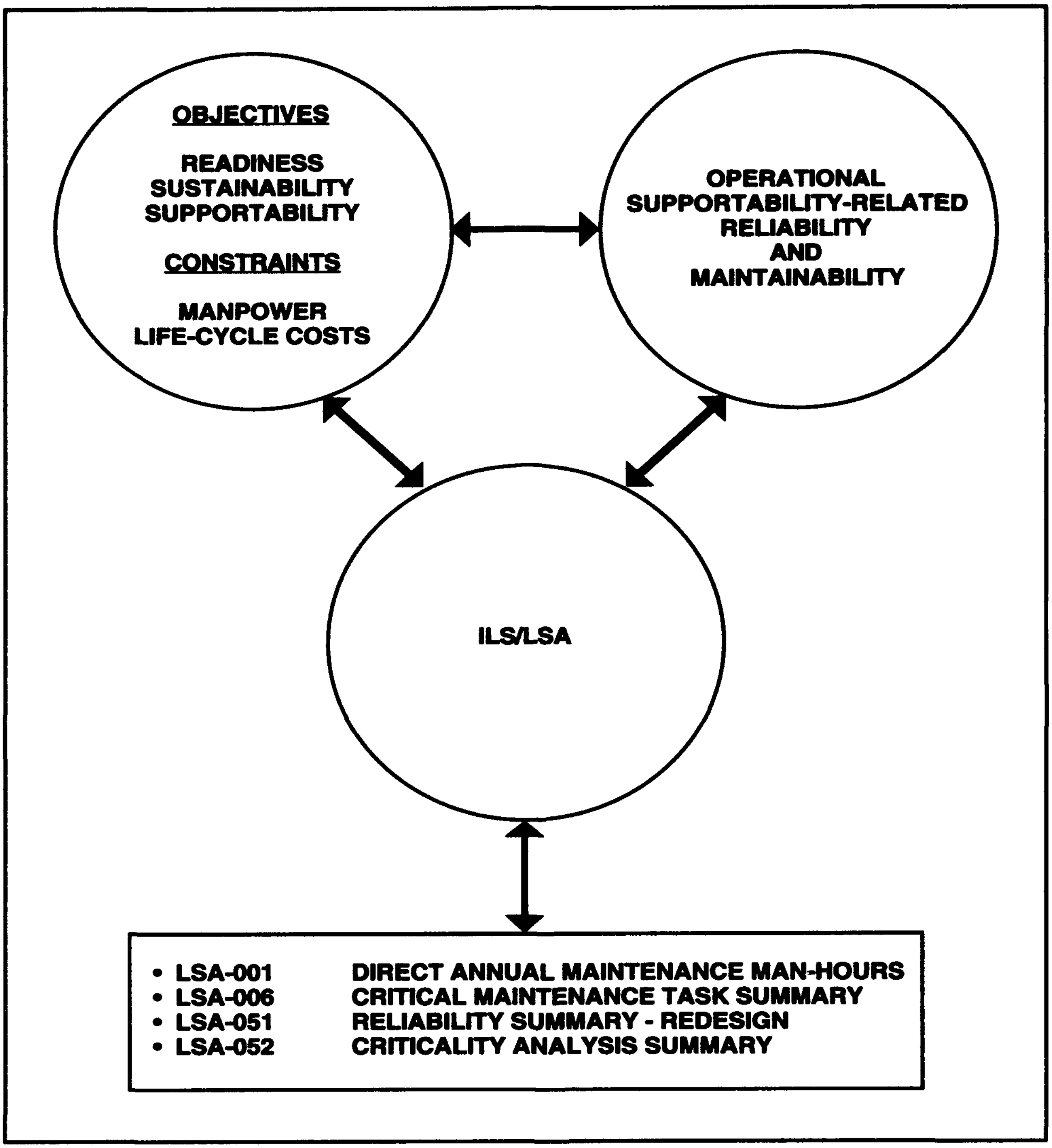


Figure 8-4. ILS System Design Relationship

8.4 RISK MANAGEMENT

8.4.1 Accelerated Programs

8.4.1.1 Risk Area

An accelerated system development program may be required to overcome a critical deficiency in an existing military capability. This streamlining can pose the risk of delaying design maturation with frequent configuration changes occurring in late development; and possibly continuing during initial P&D. The added time required to modify LSA Records and update ILS elements can lead to an initial period of decreased system readiness.

8.4.1.2 Risk Handling

The DoDI 5000.2, Part 7A states ILS policies related to accelerated development programs as follows –

- ILS risks shall be fully considered in reviewing alternate acquisition strategies.

- Accelerated strategies shall place additional emphasis on supportability design requirements (such as R&M) and shall provide additional front-end funding to achieve readiness objectives within the shortened development cycle.

- When deemed necessary, interim contractor support shall be planned to avoid compressing support delivery schedules.

- Transition to organic support will be planned with the schedule based on design stability, demonstration of capability to support the system and availability of support resources for the mature system.

The objective during the initial deployment period is to use contractor resources to replace delayed ILS elements in a manner that attains peacetime and wartime readiness objectives. For many combat-related systems, this requires a combination of full organic military capability within the combat zone and contractor support outside this zone. Life-of-system contractor support is often employed for training devices and administrative vehicles that are not direct participants in combat operations. Planning for contractor support should be performed concurrent with development of an accelerated acquisition strategy and documented in the ILSP.

Reliability Improvement Warranties (RIW) can also be used in combination with contractor repair. The RIW creates a contractor incentive to improve reliability while relieving government activities of the burden of the design changes. This approach was applied successfully during the first three years of production of the T700 turbine engine used in BLACKHAWK helicopters. During this period, all engines removed at unit level were returned to the General Electric Company, which maintained responsibility for configuration control (design improvements) and all repair. After completion of the RIW period, the durability performance of the engine (mean time to overhaul) exceeded the original specification requirement.

8.5 SUMMARY

- System R&S objectives established in CED and DV are the determinants of system R&M and the elements of ILS.

- The LSA and LSAR provide the data required to define and select ILS elements. LSAR automation facilitates compilation of the required data; however, accuracy of the data is totally dependent upon the precision of the input analysis performed by multiple technical and logistics skills.

- Accelerated system development strategies require concurrent logistics planning. Properly designed interim contractor support is an acceptable means of handling the risks of delayed design maturation.

8.6 REFERENCES

1. Blanchard, B. Logistics Engineering and Management. Englewood Cliffs: Prentice Hall, 1986

2. DoDD 4151.1, "Use of Contractor and DoD Resources for Maintenance of Materiel."

3. DoDI 5000.2, Part 7A, "Integrated Logistics Support."

4. DoD 3235.1-H, "Test and Evaluation of System Reliability, Availability, and Maintainability, A Primer."

5. MIL-STD 1561, "Uniform DoD Provisioning Procedures."

9

LOGISTICS TEST AND EVALUATION

9.1 HIGHLIGHTS

- Objectives of ILS-Related Tests and Evaluations

- Requirements for Statistical Validity

- Planning Documentation

- Planning Guidelines for the ILS Manager

9.2 INTRODUCTION

9.2.1 Purpose

To provide an overview of the test and evaluation of a materiel system's operational suitability; and the adequacy of the logistics support developed to attain system readiness objectives.

9.2.2 Objectives

The overall objectives of logistics test and evaluation are:

- To provide assurance of system supportability under anticipated wartime conditions;

- To verify that the logistics support developed for the system is capable of achieving established system readiness levels within the established LCC thresholds; and

- To demonstrate that system readiness objectives are attained at peacetime utilization rates.

9.3 MANAGEMENT ISSUES

9.3.1 Test and Evaluation Programs

Logistics test and evaluation extends over the entire acquisition cycle. The following paragraphs describe ILS-related objectives of Development Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E); as well as the objectives of supportability assessments. The ILS manager must be a participant in the planning of DT&E and OT&E and is directly responsible for the planning of post-deployment supportability assessments.

9.3.1.1 Development Test and Evaluation (DT&E)

The DT&E is part of the engineering design and development process. It verifies the attainment of technical performance specifications and objectives. The tests are generally conducted by the prime contractor and developing agency under conditions not fully representative of field operation. Figure 9-1 identifies the objectives of major interest to the ILS manager.

9.3.1.2 Operational Test and Evaluation (OT&E)

The OT&E is conducted to assess a systems' operational effectiveness and suitability, including the adequacy of the systems' logistics support (see Figure 9-1). The tests are conducted and evaluated by an independent field agency separate from

ACQUISITION PHASE / TEST TYPE	CONCEPT EXPLORATION & DEFINITION	DEMONSTRATION & VALIDATION	ENGINEERING & MANUFACTURING DEVELOPMENT	PRODUCTION & DEVELOPMENT	OPERATION & SUPPORT
DEVELOPMENT T&E	• Select Preferred System and Support Concepts	• Identify Preferred Technical Approach, Logistic Risks, and Preferred Solutions	• Identify Design Problems and Solutions in re: - Survivability - Compatibility - Transportation - R&M - Safety - Human Factors	• Ensure Production Items Meet Design Requirements and Specifications	• Ensure Adequacy of System Design Changes
OPERATIONAL T&E AND SUPPORTABILITY ASSESSMENT	• Assess Operational Impact of Candidate Technical Approaches • Assist in Selecting Preferred System and Support Concepts • Estimate Operational Compatibility and Suitability	• Examine Operational Aspects of Alternative Technical Approaches • Estimate Potential Operational Suitability of Candidate Systems	• Assess Operational Suitability - Operational R&M - Built-In Diagnostic Capability - Transportability • Evaluate Logistics Supportability - Effectiveness of Maintenance Planning - Appropriate Personnel Skills/Grades - Appropriate Spares, Repair Parts, Bulk Supplies - Adequate Support Equipment, Including effective ATE and Software - Accurate and Effective Technical Data; Validation/ Verification of Technical Manuals - Adequate Facilities (Space, Environmental Systems, Storage) - Effective Packaging, Lifting Devices, Tie-Down Points, Transportation Instructions	• Ensure Production Items Meet Operational Suitability Requirements	• Demonstrate Attainment of System Readiness Objectives • Update O&S Cost Estimates • Evaluate Operational Suitability and Supportability of Design Changes • Identify Improvement Required in Supportability Parameters • Provide Data Required to Adjust ILS Elements

Figure 9-1. ILS Objectives in the T&E Program

the developer and user in an environment as operationally realistic as possible. A complete evaluation of the system's supportability design parameters (e.g., operational R&M) and the ILS elements should be conducted during the EMD phase, employing a production representative system. This evaluation may continue into the P&D phase with pilot or full rate production items. All ILS elements should be provided in a condition or configuration that is as close as possible to that which will be provided during the O&S phase. As a minimum, operational test environment should include –

- Representative military operations and maintenance personnel
- Adequately trained personnel using a prototype of the planned formal training program
- Draft technical manuals
- Production representative systems
- Support equipment selected for operational use
- Realistic tactical environment

9.3.1.3 Product Assurance Test and Evaluation (PAT&E)

The PAT&E is conducted on production systems to demonstrate that items procured fulfill the requirements and specifications of the procuring contract or agreements.

9.3.1.4 Supportability Assessment

A supportability assessment (LSA Task 501) is performed in two general stages: (1) assessment as part of the formal DT&E and OT&E programs; and (2) assessment performed after deployment through analysis of operational, maintenance and supply data on the system in its operational environment. The ILS manager participates with the project office test planner in the planning of DT&E and OT&E programs. The manager develops detailed ILS Test and Evaluation (T&E) objectives for each acquisition phase and incorporates these objectives into the formal test programs.

Assessments of some ILS elements may require additional or separate tests. Two common examples are the validation for accuracy of technical manuals and maintainability demonstrations to evaluate maintenance activities. These are generally initiated before the formal test programs, in order to reduce delays during testing. The evaluation of ILS elements is discussed in 9.3.1.5 below. The ILS manager is responsible for the planning of post-deployment supportability assessments (LSA Task 501.2.5). General objectives are listed in Figure 9-1 and summarized below.

- Objectives and specific planned uses of the assessment analyses and reports

- Specific parameters to be estimated (e.g., operational availability, O&S costs, maintenance replacement rates for spares and repair parts and operational R&M)

- Data sources and method of collection

- Statistical validity required

- Duration of data collection

- Data analysis methods and reports

- Planned utilization of the assessment reports (refer to 14.3.2)

9.3.1.5 Evaluation of ILS Elements

Each ILS element should be evaluated to determine its impact on system readiness and system ownership costs. A brief listing of the main evaluation factors for the listed ILS elements is presented below. A check-off list for each element is provided in Department of Army Pamphlet 700-50, "Integrated Logistics Support: Development Supportability Test and Evaluation Guide," from which much of the information in this paragraph has been drawn.

Maintenance Planning is evaluated to verify proper assignment of maintenance tasks to maintenance levels and the appropriate selection of support equipment and personnel to perform maintenance tasks. A structured maintainability demonstration is an effective evaluation mechanism. As a minimum, the demonstration should include all organizational and selected intermediate level tasks.

Manpower and Personnel, Training, and Training Support are tested and evaluated to:

- Ensure that personnel are identified in the numbers and skills necessary to support a system in its operational environment

- Assess the effectiveness of the training program for government personnel as reflected in their ability to operate, support, and maintain the materiel system under test; and

• Ensure that training devices are provided in the proper quantities and functional areas.

Supply Support is evaluated to verify that the quantities and types of items and supplies designed to maintain the system in its prescribed state of operational readiness are adequate.

Support Equipment is evaluated to determine its effectiveness, the validity of the planned requirements and the progress achieved toward meeting those requirements. The T&E should verify that all items specified are required; and that no requirement exists for items not listed.

Technical Data is tested and evaluated to assure it is accurate, understandable, and complete, as well as able to satisfy maintenance requirements at projected skill levels.

Computer Resources Support provides support for both embedded computer systems and automatic test equipment, which will provide support for the end item. In general, this area of support addresses the evaluation of the adequacy of the hardware and of the accuracy, documentation and maintenance of computer software routines. Built-in test routines programmed into the software of a complex device such as a computerized aircraft fire control system, would be covered in this area of the evaluation.

Facilities are evaluated for two conditions:

• Facilities requirements in terms of space, volume, capital equipment and utilities necessary for system operation and maintenance have been defined and satisfied and

• Environmental system requirements (e.g., temperature, humidity and dust control) associated with operations, maintenance and storage facilities have been identified and met.

Packaging, Handling, Storage and Transportability evaluations will determine –

• The adequacy of all transportability instructions provided;

• Whether the system can be handled by conventional types of lifting, loading and handling equipment;

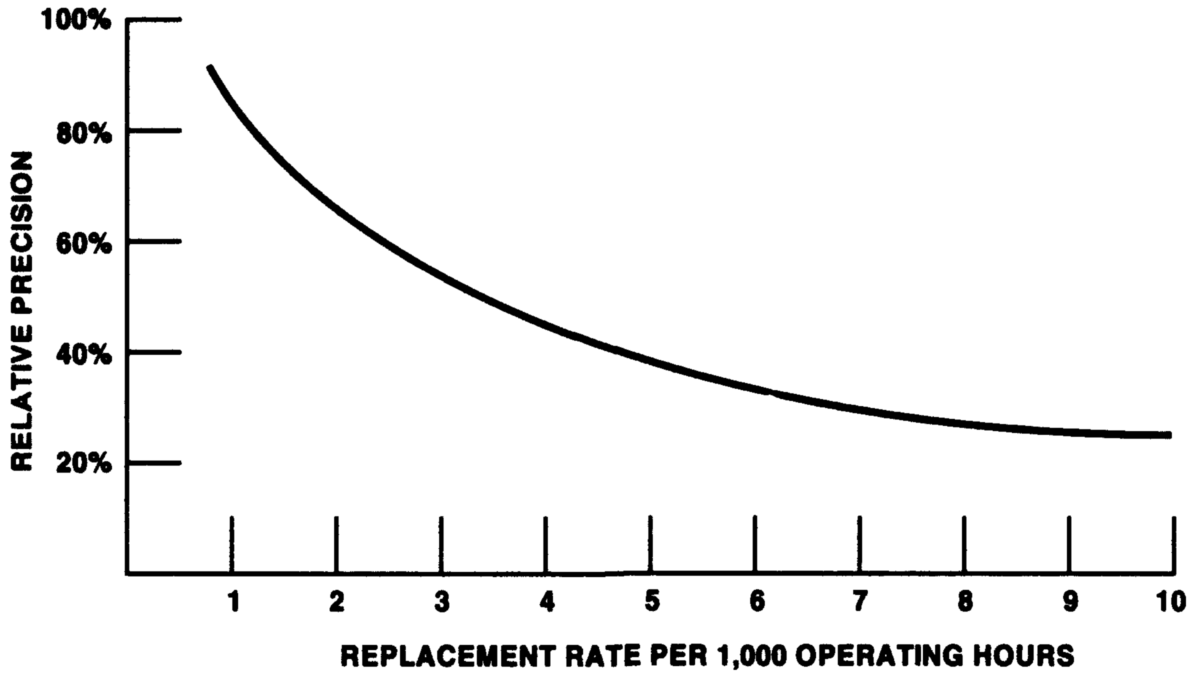
• Whether lifting and tie-down points conform to MIL-STD-209F "Slinging and Tie Down Provisions for Lifting and Tying Down Military Equipment" with regard to size, strength and markings;

• The adaptability of the system to prescribed forms of transport (surface, sea and air as applicable); and

• The ease of moving equipment and personnel from ships to shore assembly points in logistics-over-the-shore operations.

9.3.2 Statistical Validity

There is a trade-off among the numbers of test hours that can be expended, the failure rates experienced during the testing and the degree of precision that statistical analyses permit us to make conclusions from those tests. In practice, test hours are limited by funds available for testing, the numbers of items available for test and by the way in which failures occur. While it may be possible to exercise some control over



EXAMPLE:	**OPERATIONAL TEST AND EVALUATION**
OBJECTIVE:	**TO DETERMINE ESTIMATES OF MAINTENANCE REPLACEMENT RATES FOR COMPONENTS OF SYSTEM DURING A 1,000 HOUR OT&E PROGRAM**
ASSUMPTION:	**EXPONENTIAL FAILURE DISTRIBUTION**
DETERMINE:	**RELATIVE PRECISION OF ESTIMATES AT 60% CONFIDENCE LEVEL**

Figure 9-2. Variation of Relative Precision with Replacement Rate

funding, failure rates and their distribution among the various components and systems are inherent in the system design and use. Careful attention to statistical limitations is important for both development and operational testing of the logistics support of a system.

This relationship is illustrated in Figure 9-2. In this example, the system will be operated a total of 1000 hours. The ILS manager desires to determine the maintenance replacement rate for components of the system. Two statistical terms are used: relative precision and confidence level. To state that an estimate has a relative precision of 30 percent at a 60 percent confidence level means that there is a 60 percent likelihood that the true value lies within plus or minus 30 percent of the estimate. As shown,

REQUIRED SYSTEM OPERATIONAL HOURS (THOUSANDS)

RELATIVE PRECISION RANGE	60%	80%	95%
± 5%	28.2	65.5	154
± 10%	7.1	16.4	38.4
± 20%	1.7	4.1	9.6

CONFIDENCE LEVEL

EXAMPLE: POST-DEPLOYMENT ASSESSMENT

OBJECTIVE: TO DETERMINE A COMPONENT'S MAINTENANCE REPLACEMENT RATE, GIVEN A DESIRED LEVEL OF CONFIDENCE AND PRECISION

PRELIMINARY ESTIMATE: TEN REPLACEMENTS PER 1,000 ANNUAL OPERATING HOURS

ASSUMPTION: EXPONENTIAL FAILURE DISTRIBUTION

PROCEDURE: DETERMINE TOTAL OPERATING HOURS REQUIRED FROM RANDOMLY SELECTED SYSTEMS TO OBTAIN THE SELECTED LEVEL OF CONFIDENCE AND PRECISION

Figure 9-3. Examples of Operating Hours Required to Meet Statistical Objectives

greater precision will be obtained for components that exhibit higher replacement rates. A system test of the limited duration illustrated will generate insufficient data on high cost or high maintenance burden components that are replaced at low to moderate rates. These should be identified as candidates for separate subsystem evaluations, such as, bench tests over a period that substantially exceeds the predicted life of the components.

Post-deployment assessments are not as constrained as development and operational tests; they can extend over a lengthy period of operational use and encompass a large number of operationally deployed systems. Greater relative precision and confidence levels can be obtained by increasing the durations and number of systems monitored and evaluated—normally with corresponding increases in the cost of data collection and analysis. The relationships of relative precision, confidence level and required operating hours (total for all systems) are illustrated in Figure 9-3 using the example of an estimate of a maintenance replacement rate for a single component.

Each military service has qualified test planners to assist in the development of valid and attainable statistical objectives for each assessment.

9.3.3 Technical Performance Measurement (TPM)

The TPM is a design assessment that predicts, through engineering analysis or test measurements, the values of essential system level performance parameters. The ILS manager should participate in the establishment of the TPM program during the DV phase to ensure that critical support and supportability-related design factors are tracked in this formal assessment program. Parameters selected should be directly measurable and follow a predictable time-phased improvement pattern. Appropriate supportability-related parameters may include operational R&M, built-in fault detection and fault isolation capabilities, and measures of readiness (e.g., operational availability). Refer to the DSMC *System Engineering Management Guide* for additional information on this subject.

9.3.4 Planning Documentation

9.3.4.1 The Supportability Assessment Plan

The Supportability Assessment Plan is prepared directly by the ILS manager or by the contractor, and approved by the government. The plan identifies the approach and criteria for achievement of supportability related design requirements and the adequacy of the logistics support resources for a materiel system. The plan documents the ILS managers' input into the TEMP (paragraph 9.3.4.2) and should also be used to plan the assessment of the systems' supportability after deployment in its operational environment. The Supportability Assessment Plan is developed initially during CED and is updated during each succeeding phase to concentrate on plans for testing conducted in the following acquisition phase.

9.3.4.2 Test and Evaluation Master Plan (TEMP)

The TEMP is used in the OSD review and decision process to help assess the appropriateness of the planned tests and evaluations. DoDI 5000.2, Part 8, "Test and Evaluation" establishes the policies and procedures for conducting test and evaluation in support of the DOD acquisition process. The TEMP is prepared initially during CED and is updated as required to support Milestone I through IV decisions and significant program changes.

The PM is responsible for developing the TEMP and assuring proper coordination among the developing activity, the Service's operational test activity and the user or user representative. Approval must also be obtained from the Director of Operational Test and Evaluation (DOTE) and the OSD Director, T&E for major defense and other designated programs.

The format of the TEMP is prescribed in part 7 of DoD 5000.2-M, "Defense Acquisition Management - Documentation and Reports." The TEMP contains a program description, a program summary, outlines of the DT&E and OT&E programs and a summary of resources required. The resource summary identifies the items to be tested, test support equipment, facility requirements and manpower and training requirements.

9.3.5 Planning Guidelines for Logistics Test and Evaluation

- Establish detailed ILS-related objectives for each life-cycle phase.

- Develop a test strategy to implement each objective.

- Employ the ILSMT to assist in developing objectives and strategies (see 2.3.2).

- Coordinate with the test planners to incorporate ILS testing requirements into the DT&E and OT&E program.

- Identify ILS tests and evaluations that will be performed separately from DT&E and OT&E during development and production phases.

- Participate with the test planners to identify all resources required for the formal DT&E and OT&E programs and the separate ILS testing. This will include the identification of all test articles (items to be tested and evaluated) and special support requirements (e.g., facilities, supply support, support equipment and calibration support). Identify the key requirements in the TEMP.

• Participate with the test planners and the Service operational test activity to develop the operational testing "environment." The ILS manager should concentrate on establishing an environment as operationally realistic as possible using the following steps.

1. Select representative personnel with the appropriate skill specialties to operate and maintain the system. Military units supporting the system being replaced (if one exists) are a prime source of representative personnel. If the system requires new skill specialties, select personnel representative of the population that will be trained to operate and maintain the system during its operational phase.

2. Train the selected personnel using prototypes of the training courses and training devices that will be employed in the operational phase.

3. Support test operations with a system support package including; preliminary technical manuals and production representative prototype, or selected items of the support equipment that will be employed in the operational phase.

4. Ensure that OT&E planning will provide sufficient data on "high cost" and "high maintenance burden" items to yield realistic estimates of R&M parameters for these components. Based upon Pareto's principle, focus on the 15-20 percent of the critical spares that generally account for about 80 percent of total spares replacement costs.

5. With the assistance of a qualified test planner or systems analyst, establish appropriate measures of statistical validity for each component and the test parameters required to evaluate these measures.

6. Identify subsystems that require off-system evaluations.

7. Ensure that OT&E planning considers all ILS elements.

8. Establish a methodology to assess the capability of the planned logistics support to attain system readiness objectives. Three examples of logistics/readiness models that have been used for this purpose are the Naval Air Systems Command Comprehensive Aircraft Support Effectiveness Evaluation (CASEE) model; the Army Logistics Analysis Model (LOGAM); and the Air Force/Logistics Management Institute Aircraft Availability model. The methodology should employ operational performance data (e.g., operational R&M) that is validated during OT&E.

9. Determine the adequacy of standard data systems to satisfy the objectives of the post-deployment supportability assessment. If required, develop plans for supplementary data collection during the operational phase.

10. Identify specific uses of post-deployment assessments and ensure that all planned users of the data participate in the development of the Supportability Assessment Plan.

9.4 LOGISTICS EVALUATION AND IMPROVEMENTS

Logistics evaluation and improvements during system development and test are integrated into the acquisition process and are discussed below under functional configuration audits and logistics assessments. Post-deployment assessments and logistics improvements (also discussed below) are performed after Milestone III.

9.4.1 Functional Configuration Audit

Functional Configuration Audits (FCAs) are part of the configuration management program, refer to DoDI 5000.2, Part 9A, "Configuration Management." The FCAs are performed during EMD and they assess items as tested in DT&E and OT&E to ensure that their performance meets requirements in government-approved system and development specifications (refer to 5.3.2.2). The purpose of an FCA is to identify deficiencies and develop appropriate corrective actions. The ILS manager should be an active participant. Logistics issues include reliability, maintainability, readiness and the adequacy of the ILS elements provided and evaluated during T&E.

9.4.2 Logistics Assessments

Logistics assessments are performed by the military services using different titles (e.g., Army ILS Reviews and Navy Logistics Review Groups). Their purpose is to review the adequacy of logistics plans and actions prior to Milestone decisions; and may include assessments prior to initial deployment, initial operational capability and the beginning of the post-production support period.

9.4.3 Post-Deployment Assessments

Logistics evaluations of logistics support continue after deployment. They are based upon data derived from standard data systems such as the Navy's Maintenance and Material Management (3M) and the Air Force's Maintenance Data System, supplemented when needed by special testing and data collection (see 14.3.2).

9.4.4 Logistics Improvements

Logistics improvements are actions planned and executed to correct the deficiencies identified by the assessments. Again, terminology varies among and within the services (refer to 14.3). Improvements that significantly change performance characteristics or maintenance procedures may require additional DT&E and OT&E to evaluate their effectiveness and impact.

9.5 RISK MANAGEMENT

9.5.1 Delayed or Inadequate Logistics T&E Planning

9.5.1.1 Risk Area

The main thrust of the formal DT&E and OT&E programs is to evaluate system level performance. Logistics T&E have an additional focus on component evaluation and on the adequacy of the ILS elements that comprise the logistics support structure. Failure by the ILS manager to participate effectively in the initial development of the TEMP during the CED Phase risks the exclusion of critical logistics T&E and the omission of the ILS test funds required in program and budget documents.

9.5.1.2 Risk Handling

The Supportability Assessment Plan (paragraph 9.3.4.1) should be developed prior to approval of the TEMP. The prior identification of objectives, test articles and resource requirements will enable the ILS manager to participate effectively in developing total T&E planning and total resource requirements.

9.5.2 Poorly Stated ILS Objectives

9.5.2.1 Risk Area

Vaguely or incompletely stated objectives will translate into vague and inadequately defined resource requirements. The ILS manager will be placed in a poor position to justify additional resources for logistics T&E. The wrong data may be collected, thereby wasting test resources, time and funds.

9.5.2.2 Risk Handling

Clearly stated objectives are vital first steps in effective planning. General objectives are listed in Figure 9-1. These must be converted into detailed qualitative and quantitative requirements for each acquisition phase and for each T&E and assessment program. Objectives should be established for all life-cycle phases during initial preparation of the Supportability Assessment Plan (during the CED Phase) and updated during each succeeding phase.

9.5.3 Inadequate Planning for Data Utilization

9.5.3.1 Risk Area

Collecting data without detailed planning for its use can lead to a mismatch of data collection and information requirements; and failure to accomplish the intended purpose of the assessment (such as the update of supply support and manpower requirements and the identification and correction of design deficiencies).

9.5.3.2 Risk Handling

Intended users should be primary participants in the planning of the assessment program, including data collection and analysis. The ILS manager should identify organizational responsibilities, the analyses and follow-up activities to be performed by each organizational element. Organizations and requirements change, and so the ILS manager and all participants should review and update the planning as required throughout the period of implementation.

9.5.4 Incomplete or Delayed Support Package

9.5.4.1 Risk Area

Without an adequate system support package ready on site to support the scheduled test, it may be possible to start testing; however, there is a low probability of maintaining the test on schedule. A support system failure could cause excessive delays and result in a schedule slippage. Test costs would increase because on-site support personnel are idle and facilities are not being efficiently used.

9.5.4.2 Risk Handling

Proper planning, with careful coordination and adequate follow-up, will help ensure that the test system support package is on site and on time, that the personnel required are trained and available, that test facilities are scheduled with enough leeway to compensate for normal delays and that interservice or intraservice support is fully coordinated. To assure adequate planning and follow-up, some type of network schedule (e.g., Program Evaluation Review Technique) should be employed. This schedule identifies critical test parameters and annotates the critical path of resources required to maintain the test schedule and meet objectives.

9.6 SUMMARY

- Preparation of a comprehensive Supportability Assessment Plan during the

CED Phase is an essential initial step in total ILS-related T&E planning.

• Qualitative and quantitative assessment objectives should be established for each acquisition phase.

• Effective OT&E requires establishment of an environment as operationally realistic as possible. The ILS manager should play a major role in the establishment of this environment.

• An adequate system support package should be available at the start of a test effort to enhance the probability that all ILS issues will be fully addressed and that the test will be completed on schedule and within the programmed budget.

• The ability to collect and manage the test data is critical to a successful test.

• The ILSMT should assist in the development of detailed T&E planning.

• The Supportability Assessment Plan should identify the planned utilization of all data collected during the assessments.

9.7 REFERENCES

1. DoDI 5000.2, Part 8, "Test and Evaluation."

2. DoDI 5000.2, Part 6C, "Reliability and Maintainability."

3. DoD 3235.1-H, "Test and Evaluation of System Reliability, Availability and Maintainability, A Primer."

4. System Engineering Management Guide, Defense Systems Management College.

5. Department of the Army Pamphlet 700-50, "Integrated Logistics Support: Developmental Supportability Test and Evaluation Guide."

6. Test and Evaluation Management Guide, Defense Systems Management College.

MODULE

III

Programming, Budgeting and Contracting for ILS

Specific ILS programming and budgeting actions are required to conduct studies and analyses in time to influence the system design, and to design and acquire the required support. The chapters in this Module cover the special skills required by the ILS manager to meet his or her programming, budgeting and contracting options and responsibilities.

10

PROGRAMMING AND BUDGETING

10.1 HIGHLIGHTS

- Visibility of ILS Funds

- Need for Continuing Interface between Program Management and the Logistics Community

- Advance Planning for ILS Program Funding

- ILS Funding in the POM and Budget Estimate Submissions (BES)

- *Minimizing Risk by Realistic Planning and Budgeting*

10.2 INTRODUCTION

10.2.1 Purpose

To address responsibilities of the PM and the ILS manager to program and budget within the PPBS for support essential to the development and acquisition of a materiel system. In addition, to address responsibilities to minimize future O&S costs consistent with operational needs and readiness goals.

10.2.2 Objective

The objective of ILS programming and budgeting is to determine support funding requirements for the materiel system, to work within the PPBS to acquire those funds, and to execute the budget consistent with R&S goals. ILS requirements and funds tracking are to be integrated into the annual POM/budget submission.

10.3 MANAGEMENT ISSUES

10.3.1 Background and Responsibilities

The PM bears overall responsibility for the identification of financial resources for the system's logistics support. This chapter discusses (without being Service-specific) how to achieve this goal. A brief review of the PM's responsibilities to manage support funding is contained in two key DoD documents and was recognized in the Acquisition Improvement Program (AIP) of the early 1980s.

DoDD 5000.1, "Defense Acquisition" establishes an integrated management framework linking requirements generation, acquisition management and PPBS. It states that "the products of PPBS provide the basis for making informed affordability assessments and resource allocation decisions on defense acquisition programs."

DoDI 5000.2, Part 7A, "Integrated Logistics Support" states that "Logistics resource (funding, manpower, facilities, etc.) estimates will be based on the results of a well defined program of analyses/demonstrations, realistic estimates of initial and mature system reliability and maintainability values, and field experience on similar systems (or subsystems). The uncertainty of early planning data will be addressed in developing logistics resource estimates. Resource estimates will be updated as test data and operational experience become available."

The need to focus on logistics resource estimates was stated in an August 1984 memo from Deputy Secretary of Defense, Frank Carlucci, which outlined the AIP as follows:

"A key initiative in our Acquisition Improvement Program (AIP) has been to provide visibility in the PPBS of support funding for new weapons systems (Acquisition Initiative 30, "Management of Initial Support Funding"). Continued progress in this area will enable the DoD to assess the extent to which essential weapon system support needs are met within the Defense program. I regard this initiative as one of the most important advances in our capability to manage the readiness and sustainability of the new systems we are fielding. I would like you to define further steps for improving our corporate ability to validate weapon system support requirements, track the associated funding explicitly in the PPBS, and manage support funding changes with full appreciation of the effects on deployment schedules and readiness objectives."

Four key guidelines of the AIP were to:

- Identify appropriate support resources before program initiation;
- Estimate and budget realistically, and fund adequately;
- Achieve a cost-effective balance among program elements; and
- Address affordability, while understanding that a program normally should not be initiated unless sufficient resources can be programmed for the entire effort.

10.3.2 Planning, Programming and Budgeting System (PPBS)

The PPBS is the framework in which the PM must acquire support resources. DoDD 7045.14, "The Planning, Programming and Budgeting System (PPBS)" and DoDI 7045.7, "Implementation of the Planning, Programming and Budgeting System (PPBS)" describe the policy, procedures, and responsibilities relating to PPBS. The PM and ILS manager should review these documents along with the current Defense Planning Guidance and Service Guidance. In addition, the PM should thoroughly understand the biennial Service programming/budgeting procedures which are likely to include events, dates, level of detail and review group responsibilities essential to structuring the Service POM and later the Service budget. The following provide brief descriptions of PPBS activities. Figures 10-1a and 10-1b depict the key aspects of the biennial programming and budgeting process.

10.3.2.1 Planning

The planning phase results in the development of a broad long-range investment plan that reflects projected major modernization requirements, including acquisition of defense systems. At the beginning of each odd numbered year, the President establishes National Security Objectives. The OSD provides fiscal guidance to the Services which in turn develop Force Posture Statements. The Joint Chiefs of Staff (JCS) prepares a National Military Strategy (NMS) and its related document (NMSD). The Secretary of Defense (SECDEF) submits Strategy/Force Structure recommendations to the President.

The Defense Planning Guidance (DPG), initially issued in draft form, sets forth

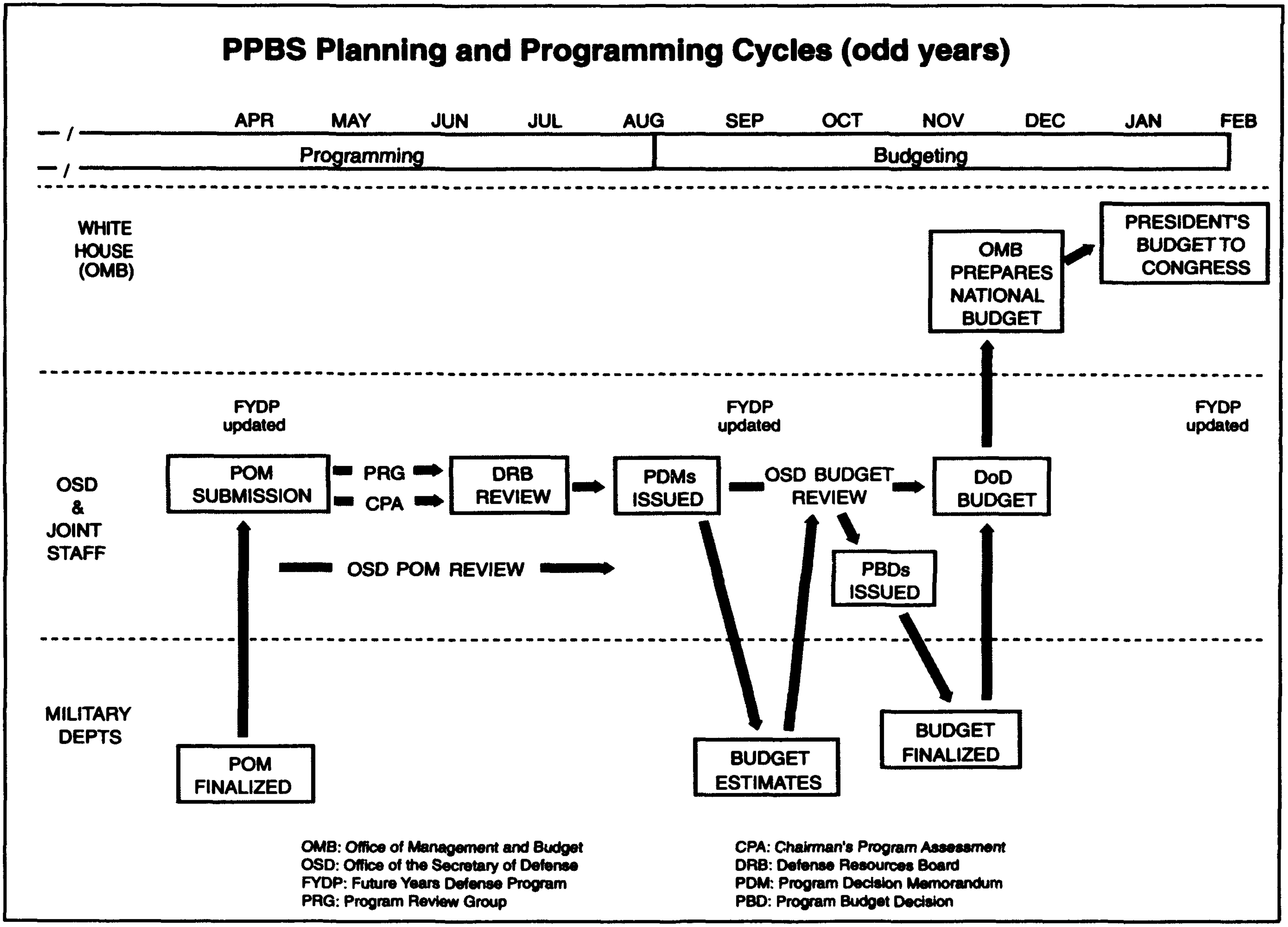


Figure 10-1a. Key Aspects of Biennial Programming and Budgeting Process

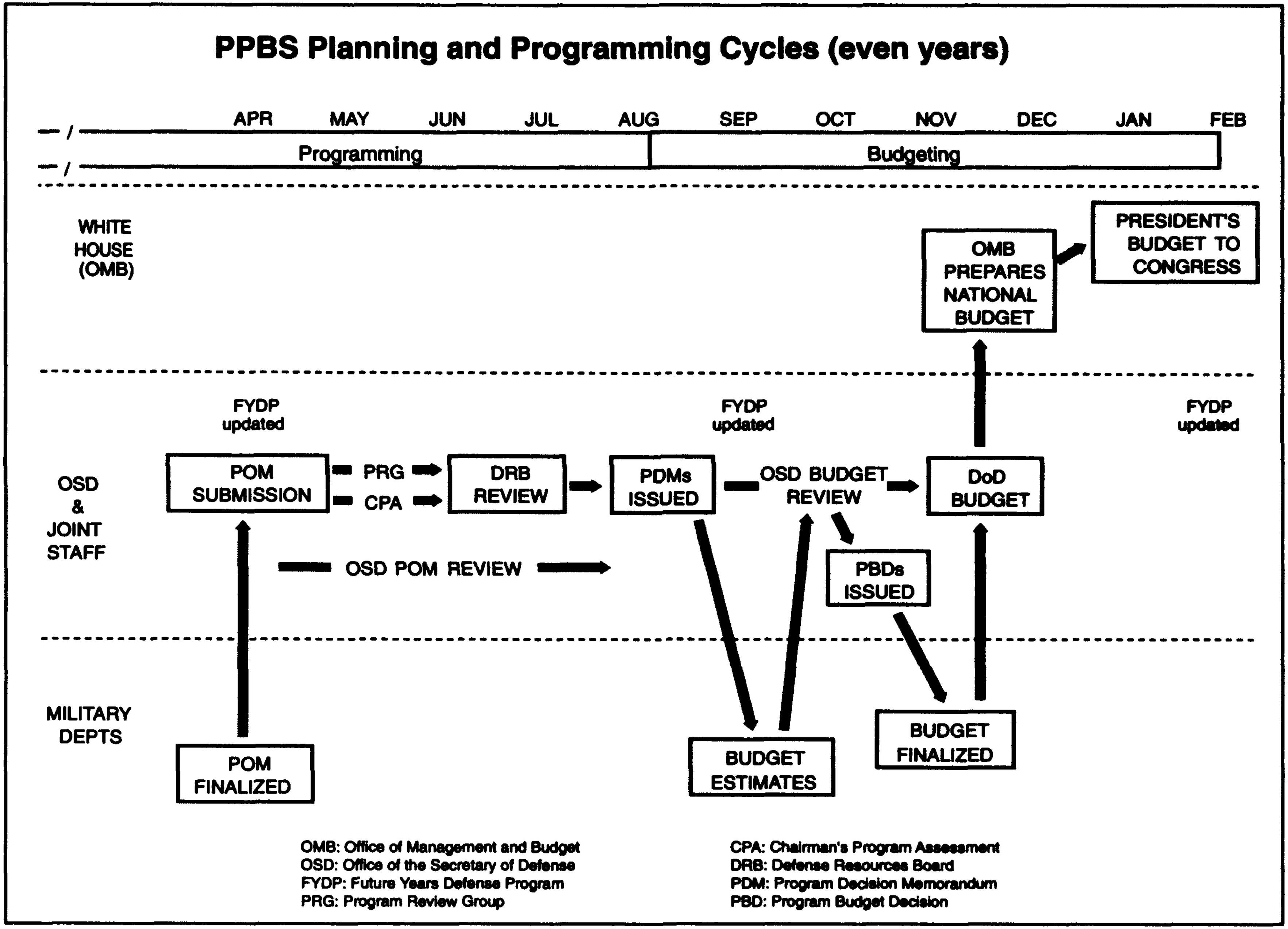


Figure 10-1b. Key Aspects of Biennial Programming and Budgeting Process

broad policy objectives and military strategy. It identifies priority operational capability objectives, the resources to be allocated to achieve these objectives and leads to establishing needs for selected acquisition programs. The Defense Planning and Resources Board (DPRB), chaired by the Deputy Secretary of Defense, reviews the draft DPG and provides recommendations to the Secretary. The Secretary issues the approved DPG incorporating the President's approved Strategy/Force Posture.

10.3.2.2 Programming

The programming phase results in the development of a Future Year Defense Program (FYDP) for each DoD Component (Service and Defense agency) and for the DoD as a whole. The FYDP links national policies, strategy and objectives to specific forces and major programs, including acquisition programs. It is based on the DPG and updated fiscal projections.

The POMs are proposals to establish the next FYDP. The Services begin formulation of draft POM during the latter half of odd numbered years. As shown in Figure 10-1, the Services submit POMs in April of even numbered years. The POMs are reviewed by OSD staff offices, the Commanders in Chief of the unified and specified commands, and the Chairman, JCS. The Chairman's Program Assessment (CPA) is submitted to the DPRB which provides final recommendations to the SECDEF. The SECDEF makes program decisions issued as a Program Decision Memorandum (PDM).

10.3.2.3 Budgeting

The budgeting phase results in the development of SECDEF's recommendations to the President for the Administration's biennial budget request.

As shown in Figures 10-1a and 10-1b, the Services prepare budget estimates based upon the POM as approved/modified by the PDMs. The POM and BES employ different terminology. Programs deal with outputs — that is, what is to be accomplished. Major Force Program categories include strategic forces, general purpose forces, airlift/sealift, central supply and maintenance, training and others. The budget estimates identify the inputs (such as quantities of tanks, aircraft, ships, personnel, facilities, etc.) required to achieve the POM outputs and are grouped into Congressional appropriation categories (e.g., Research, Development, Test and Evaluation; Procurement; Operations and Maintenance; Military Construction; and Military Personnel).

The Services' budget estimates are reviewed by the OSD and the Chairman of the JCS. OSD and the Office of Management and Budget (OMB) analysts conduct hearings to assess program execution and to resolve BES inconsistencies. OSD issues Program Budget Decisions (PBDs) on major budget issues. The Services are given an opportunity to reclama or correct technical error. The SECDEF directs the makeup of the DoD budget. OMB prepares the National budget. When approved by the President, it is submitted to Congress in January as part of the president's budget for the Federal government.

10.3.2.4 Future Years Defense Program (FYDP)

The decisions associated with the three phases of the PPBS are reflected in the FYDP, which is updated three times a year (POM submission or POM update, BES and the President's Budget). At first glance, the PPBS can appear to be difficult to understand and employ, but the following helpful hints will aid the PM and ILS manager in programming and budgeting adequate funds for the logistics elements of their program.

• Work with your Service Headquarters focal point.

• Talk to other PMs about previous year POM/budget activities in your Service.

• Determine those personnel who have leadership and decision making roles in your organization and Service's POM/budget process and understand their impact on the process.

• Understand the content of POM/budget material being prepared by others which may impact your program in any fashion. Review last year's material to identify and explain any changes to correct schedule or technical information.

• Have current knowledge of all dates and formats for the submission of POM/budget data and scrupulously meet these requirements. (See the Budget Guidance Manual for proper formats.)

• Interact with the people mentioned above by discussing your program's requirements. Be continually aware of anything that can directly or indirectly impact program funds. Carefully consider the interrelationship of milestone reviews and decisions identified in the 5000 Series guidance.

10.3.2.5 Funding New Starts

The programming, budgeting and (Congressional) appropriation process takes a long time. A Service POM submitted in April 1994 can be funded by a new Congressional appropriation no earlier than October 1995, 18 months later. The milestone decision authority may elect to identify gap-filling funds from reprogramming, budget amendment actions or existing study funds.

10.3.3 Logistics Activities and Funds

When tailored to the specific needs of a particular program, the many requirements contained in this guide represent the scope of logistics functions to be coordinated and supervised by the PM and ILS manager. Figures 10-2a and 10-2b are an abbreviated listing of those logistics functions. Although Figures 10-2a and 10-2b show where these ILS functions receive emphasis, most functions actually overlap the block in which they have been displayed both in terms of timing and type of activity.

10.3.3.1 Logistics Deliverables

At the risk of oversimplifying, the activities (deliverables) noted in Figures 10-2a and 10-2b can be classified as either materiel or services. A single deliverable often consists of both, for example, the development and manufacturing of support equipment with accompanying user instructions. Taking the definitions of deliverables a step further, materiel deliverables are a combination of raw materials and labor. Services are associated with the expenditure of labor hours and the use of equipment. Labor hours may be used to produce a deliverable engineering study, a cost analysis, a plan, software, etc. The sources of deliverables are primarily government and industry. Therefore, the ILS manager "orders" the items noted in Figures 10-2a and 10-2b through administrative arrangements and task orders (in the case of government agencies) and through contracts (in the case of industry). The timely programming and budgeting of funds provides the means for the ILS manager to acquire the needed logistics materiel and services. In addition to paying for contractual obligations with industry, these funds pay for the travel of government personnel on the project and the labor rates for industrially funded government employees working in support of the ILS manager. The following general rules apply to programming and budgeting based on the category and source of the deliverables.

• Materiel (spares, support equipment, facilities, etc.).

- Government Furnished Equipment (GFE) — may or may not require programming and budgeting by the ILS manager for items used by the materiel system; command and program unique procedures will determine the answer.

- Contractor Furnished Equipment (CFE) — materiel items delivered as part of or in support of the materiel system require programming and budgeting by the ILS manager.

• Services (studies, plans, analyses, cost estimates, etc.).

- Government Sources:

-- Industrially funded activities - services provided by these activities will require programming and budgeting by the ILS manager.

-- Nonindustrially funded activities - labor hours provided by Federal government employees will not usually require programming and budgeting by the ILS manager.

-- Federal Contract Research Centers (Rand, CNA, etc.) - may not require programming and budgeting by the ILS manager.

- Industry Sources:

-- Any nongovernment source services provided by the private sector to the government will require programming and budgeting.

Figures 10-2a and 10-2b also display generic appropriation information applicable to obligations planned for the various phases of a program. The lead time for programming and budgeting these funds and the obligational periods (single or multiyear appropriation) are addressed in OSD and Service guidance.

10.3.4 Documentation and Submission of Logistics Fund Requirements

10.3.4.1 Documentation

The ILS manager is directly responsible for determining the funding needed in all program and appropriation categories to buy logistics materiel and services over the entire life cycle of the supported materiel system. The ILS manager should prepare a logistics fund requirements document that defines and supports these requirements.

The Navy uses the title "Logistics Requirements and Funding Plan." ILS is an integral part of the program WBS (refer to DoDI 5000.2, Part 6B, "Work Breakdown Structure"). An example of the Navy approach is depicted in Figure 10-3. In this example, ILS is divided into ILS planning and the individual ILS elements, which in turn subdivide into a lower level of activi-

SYSTEM ACQUISITION PHASE	PRE-MILESTONE 0	CONCEPT EXPLORATION AND DEFINITION	DEMONSTRATION AND VALIDATION
SUPPORTABILITY DESIGN INFLUENCE ACTIVITIES	• INPUT DATA - THREAT - MISSION - ENVIRONMENT - TECHNOLOGY - OPERATIONAL CONCEPT - SUPPORT CONCEPT - MEASURES OF EFFECTIVENESS • IDENTIFY CONSTRAINTS - TECHNICAL ADVANCEMENTS - OPERATIONAL REQUIREMENTS - EXISTING SUPPORT STRUCTURE • IDENTIFY HISTORICAL LESSONS LEARNED • INCLUDE CONSTRAINTS IN REQUIREMENTS/NEEDS DOCUMENTS • PERFORM INTENDED USE ANALYSIS • ESTABLISH PRELIMINARY SUPPORT CONCEPT • IDENTIFY READINESS AND SUPPORT COST DRIVERS	• DEFINE BASELINE OPERATIONAL SCENARIO • ESTABLISH SYSTEM READINESS/SUPPORTABILITY OBJECTIVES • INTEGRATE PRELIMINARY SUPPORT CONCEPT INTO SYSTEM DESIGN CRITERIA • QUANTIFY RISKS • INITIATE P³I PLANNING • IDENTIFY R&D EFFORTS TO REDUCE SUPPORT DRIVERS • PREPARE AND DOCUMENT COST AND READINESS IMPROVEMENT TARGETS • DESCRIBE STANDARDIZATION APPROACH • IDENTIFY LOGISTICS & R&M PARAMETERS • ESTABLISH BASELINE SUPPORT CONCEPT TO INFLUENCE DETAILED DESIGN	• ESTABLISH FIRM READINESS AND SUPPORT OBJECTIVES • CONDUCT PARALLEL SUBSYSTEM TESTING FOR SUPPORTABILITY • CONDUCT TRADE-OFF ANALYSES OF SYSTEM DESIGN CHARACTERISTICS AND SUPPORT CONCEPTS • ESTABLISH FIRM SYSTEM THRESHOLDS FOR R&M • ESTABLISH MANPOWER AND LOGISTICS DESIGN OBJECTIVES
INTEGRATED LOGISTICS SUPPORT ACQUISITION ACTIVITIES	• IDENTIFY BUDGET CONSTRAINTS • DEVELOP PRELIMINARY LCC ESTIMATES OF SYSTEM ALTERNATIVES	• DEVELOP ACQUISITION LOGISTICS STRATEGY • TAILOR ILS ELEMENTS • IDENTIFY SUPPORT FUNDING REQUIREMENTS • PREPARE AND DOCUMENT PRELIMINARY LCC ESTIMATE • IDENTIFY INTERNATIONAL LOGISTICS CONSIDERATIONS • LSA PLANNING AND TASK IDENTIFICATION • PROGRAM SYSTEM FACILITY REQUIREMENTS • IDENTIFY TEST SUPPORT ITEMS	• UPDATE LCC • VERIFY SUPPORT CONCEPT • COST-EFFECTIVENESS ANALYSIS OF SUPPORT ALTERNATIVES • IDENTIFY GFE ELEMENTS • IDENTIFY INTERIM CONTRACTOR SUPPORT PLANNING • ESTABLISH SPARES PROCUREMENT CONCEPT • IDENTIFY MANPOWER REQUIREMENTS • PROCURE TEST SUPPORT ITEMS • INITIATE FACILITY BUY • CONDUCT REPAIR LEVEL ANALYSIS
TYPES OF FUNDS AND WHEN OBLIGATED			

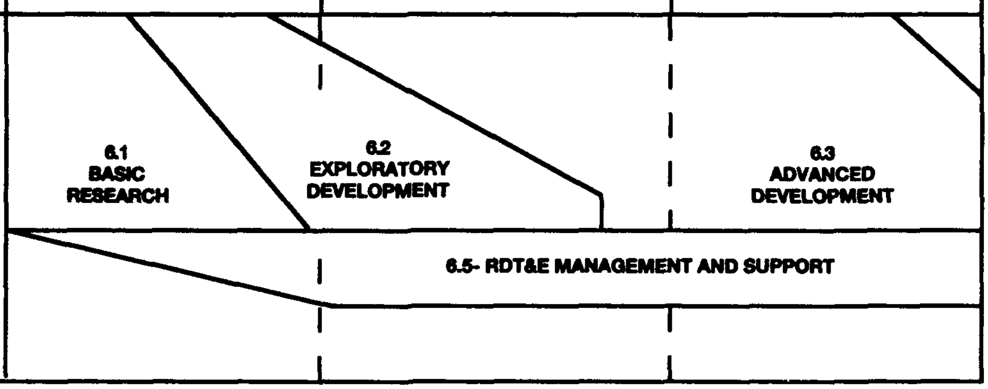


Figure 10-2a. ILS PPBS Activities in the Acquisition Cycle

ENGINEERING AND MANUFACTURING DEVELOPMENT	PRODUCTION AND DEPLOYMENT	OPERATION AND SUPPORT
• CONDUCT SUPPORTABILITY T&E ON ADEQUACY OF ILS PROGRAM TO MEET SYSTEM READINESS OBJECTIVES • ASSESS TEST RESULTS IMPACT ON READINESS AND MANPOWER OBJECTIVES • CONDUCT PARALLEL PRIME SYSTEM SUPPORT TESTING • RESOLVE ILS ELEMENT RISKS AT SUBSYSTEM LEVEL OF DETAIL	• ASSURE PRODUCTION ITEMS MEET DESIGN AND OPERATIONAL SUITABILITY REQUIREMENTS	• CONDUCT POST-DEPLOYMENT SUPPORTABILITY ASSESSMENT • VERIFY ACHIEVEMENT OF READINESS OBJECTIVES • ESTABLISH R&M OBJECTIVES FOR MAJOR SYSTEM CONFIGURATION CHANGES
• IDENTIFY DETAILED ILS ELEMENT REQUIREMENTS • CONDUCT DETAILED ANALYSES AND TRADE-OFFS OF R&M AND LOGISTICS RESOURCES • DEVELOP LCC ESTIMATES OF TRADE-OFF ALTERNATIVES • PLAN FOR POST-PRODUCTION SUPPORT • TEST ADEQUACY OF PLANNED ILS RESOURCES • CONTINUE REPAIR LEVEL ANALYSIS • SATISFY INTERNATIONAL LOGISTICS CONSIDERATIONS	• PRODUCE AND DEPLOY ILS ELEMENTS • IMPLEMENT ILS/ DEVELOPMENT MASTER PLAN • INITIATE WORK AROUNDS FOR IDENTIFIED SHORTFALLS • UPDATE POST-PRODUCTION SUPPORT PLAN • OBTAIN AND ASSESS OPERATIONAL FEEDBACK	• MANAGE POST-PRODUCTION SUPPORT • MANAGE PROGRAM CHANGES - PRIORITIZATION - BLOCK CHANGE CONCEPT - LCC IMPLICATIONS OF PROPOSED CHANGES - IMPLEMENT CORRECTIVE ACTION SYSTEMS (ITEM/ACTIVITY/SYSTEM) • INSTITUTE P^3I

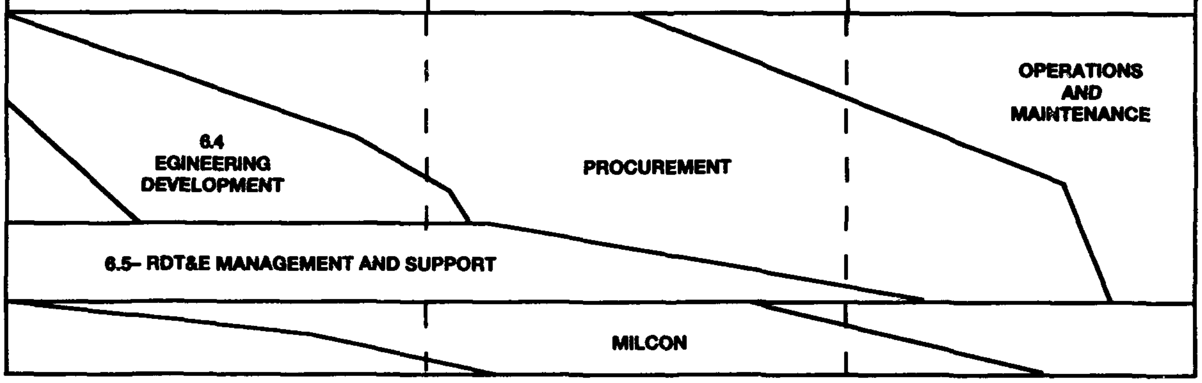


Figure 10-2b. ILS PPBS Activities in the Acquisition Cycle

Source: This figure is based in part on the "Defense System Acquisition Process" prepared by Sanders Associates, Inc., 1984.

ties. This approach offers two major benefits: first, the ILS manager draws upon the specialized expertise of the individual logistics element managers who are assigned to support the program, and second, fund estimates are developed for all activities and sub-activities of the entire ILS program.

Methods used to develop logistics support cost estimates are discussed in paragraph 3.3.3.3, on Comparative Analysis (LSA Task 203), and also in Chapter 6, Life-Cycle Cost and System Readiness.

10.3.4.2 Submission of ILS Funding Requirements

Logistics funding requirements must be provided as inputs to the POM, POM updates, and BES. Figure 10-4 depicts a representative flow for a major defense program. RDT&E and procurement appropriation requirements flow up the PM/PEO chain. The O&M appropriation requirements have historically been submitted through the matrix support organization (i.e., an Air Force systems center, a Navy systems command, an Army commodity command) to the chief of the military service. The POM and BES come together at the Service Secretary/Service Acquisition Executive Level for submission to the DAE and SECDEF. For nonmajor defense programs, logistics fund requirements for all funding flow up the right-hand chain.

10.3.5 Interfacing with PPBS

The acquisition process proceeds in phases, any one of which may require only a part of a budget cycle or may require several full cycles. Gearing the phases to the particular business and technical aspects of the program ensures that adequate in-depth reviews are conducted before there is significant commitment of resources. By contrast, the PPBS runs on a tightly structured schedule (a single cycle from start of programming through Congressional enactment). The start of actual budget execution requires about 21 months, depending on the start of Service programming. PPBS decisions, however, rather than being oriented to the needs of a specific program, are keyed to the more global challenge of balancing all of the programs within an individual service, DoD, OMB and Congressional financial limits established for a particular fiscal year or the FYDP.

Decisions made through the acquisition process need to be reflected in the FYDP and in accompanying Descriptive Summaries or P-forms. This is accomplished either during the POM/Issue Paper/PDM process, or during the budgeting process depending on when the milestone decision is made. The PM must monitor the process closely because the support funding is in jeopardy at each step of the programming/budgeting process. Passing a milestone decision successfully is no guarantee of full funding and in the POM/PDM/budget process, the program's logistics funding may be reduced significantly. This tracking of a program's status is accomplished by the PM maintaining communication with the personnel noted in paragraph 10.3.2.

In the event that a POM or budget submittal to OSD deviates significantly from a previously approved milestone decision, this fact and the cost, schedule and performance impact on the program are to be noted and explained in the POM or budget submittal. This includes O&S costs. For example, if the PM determines that future depot costs are likely to exceed original cost estimates and cause a significant increase in LCC, such information must be included in the next POM and budget. In addition, the PM should communicate these

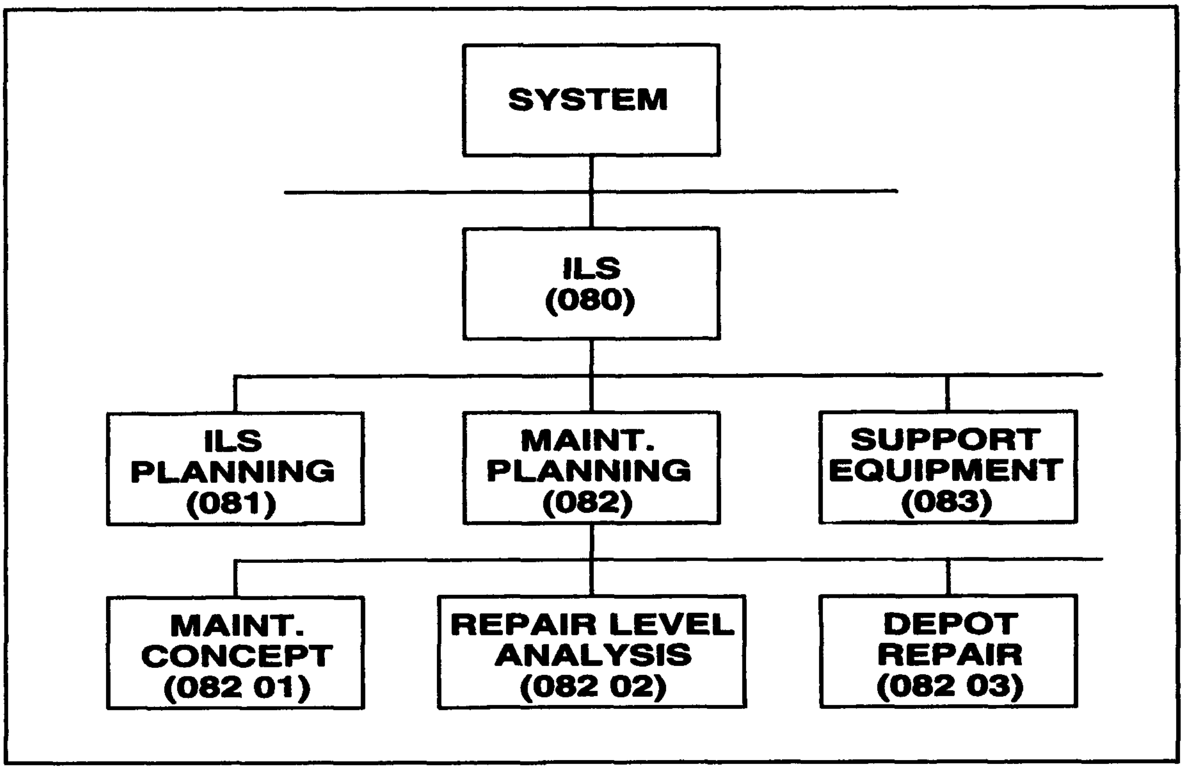


Figure 10-3. Example of ILS Work Breakdown Structure

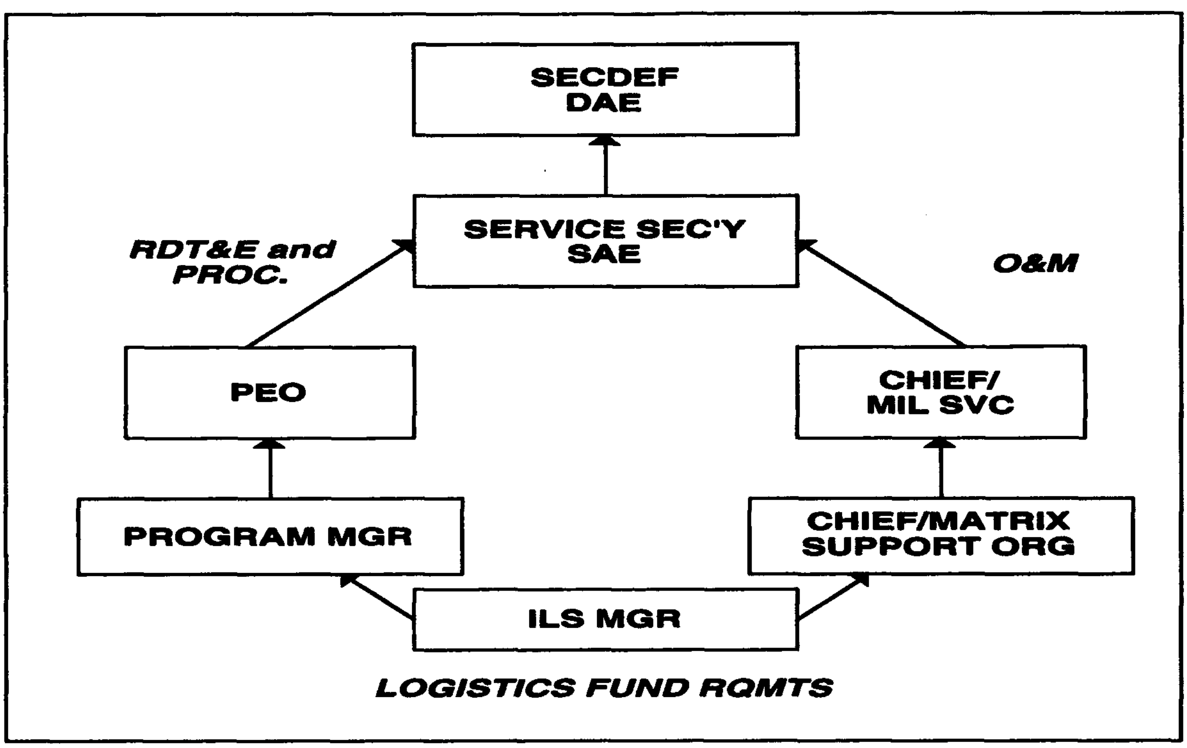


Figure 10-4. POM/Budget Flow for Major Defense Programs

conclusions to his superiors and others as early as possible. This type of problem can be minimized or avoided if the PM insists on and budgets for quality cost analyses and timely comprehensive logistics reviews. His funding documentation must be explicit regarding lead time requirements, location of support, deployment concepts and requirements, and the effects of any shortfalls on support schedules and readiness objectives. The analysis and documentation should support the program through the review chain up to and including Congressional hearings, and should be in sufficient detail that it can be used for decision-making when decrements have been imposed by higher authority.

Many programs compete for limited funds, so the PM must maintain an awareness of the status of the POM and budgeting process. The PM must also be prepared at any time to support the Service sponsor and program coordinator in defense of the project's funding. When responding to questions or writing reclamas, the PM and logistics personnel must work as a unified team. Materiel Command/Logistics Research Organization and contractor support may also be helpful. Sensitivity to the perspective of the questioner is vital.

As the process moves through the POM phase, the PM should anticipate budgeting problems. He or she must know the probable opposition and, with the Service headquarters program coordinator, maintain a dialogue with important constituencies, particularly within the respective comptroller organizations.

10.3.6 The Congressional Budget Process

Former President Reagan instituted biennial programming and budgeting and requested Congress to follow suit by instituting biennial appropriations. Congress declined. The DoD continues to prepare biennial budgets (with off-year updates). The Congress continues to prepare annual Defense Appropriation bills.

Figure 10-5 depicts the Congressional budget process. The President submits his National Budget to Congress in January of each year. The Congressional Budget Office (CBO) prepares evaluations for the Congress. OSD and Service personnel testify to the House and Senate Budget Committees, Armed Services Committees, Defense Appropriation and Military Construction Subcommittees, and others.

The Budget Committees prepare a budget resolution passed by both houses of Congress in the form of a Concurrent Resolution. The Concurrent Resolution is not a public law; it is a guide to Congress's authorization and appropriation committees. The Armed Services Committees prepare DoD Appropriation Authorization Bills. The Defense Appropriation and Military Construction Subcommittees prepare DoD Appropriation and Military Construction Bills, which, when enacted, provide new obligational authority for the fiscal year beginning 1 October. When required by Congressional agreement or, as in recent years, by a joint Presidential/Congressional agreement, the Congress passes a reconciliation bill to reduce appropriations to the agreed levels. Upon enactment, the new obligation authority is apportioned by OMB to DoD and allotted by OSD to the Services. Budget execution by the Services then begins.

10.3.7 Logistics Support Funding Management

The PM's responsibilities include budget execution, the validation of support re-

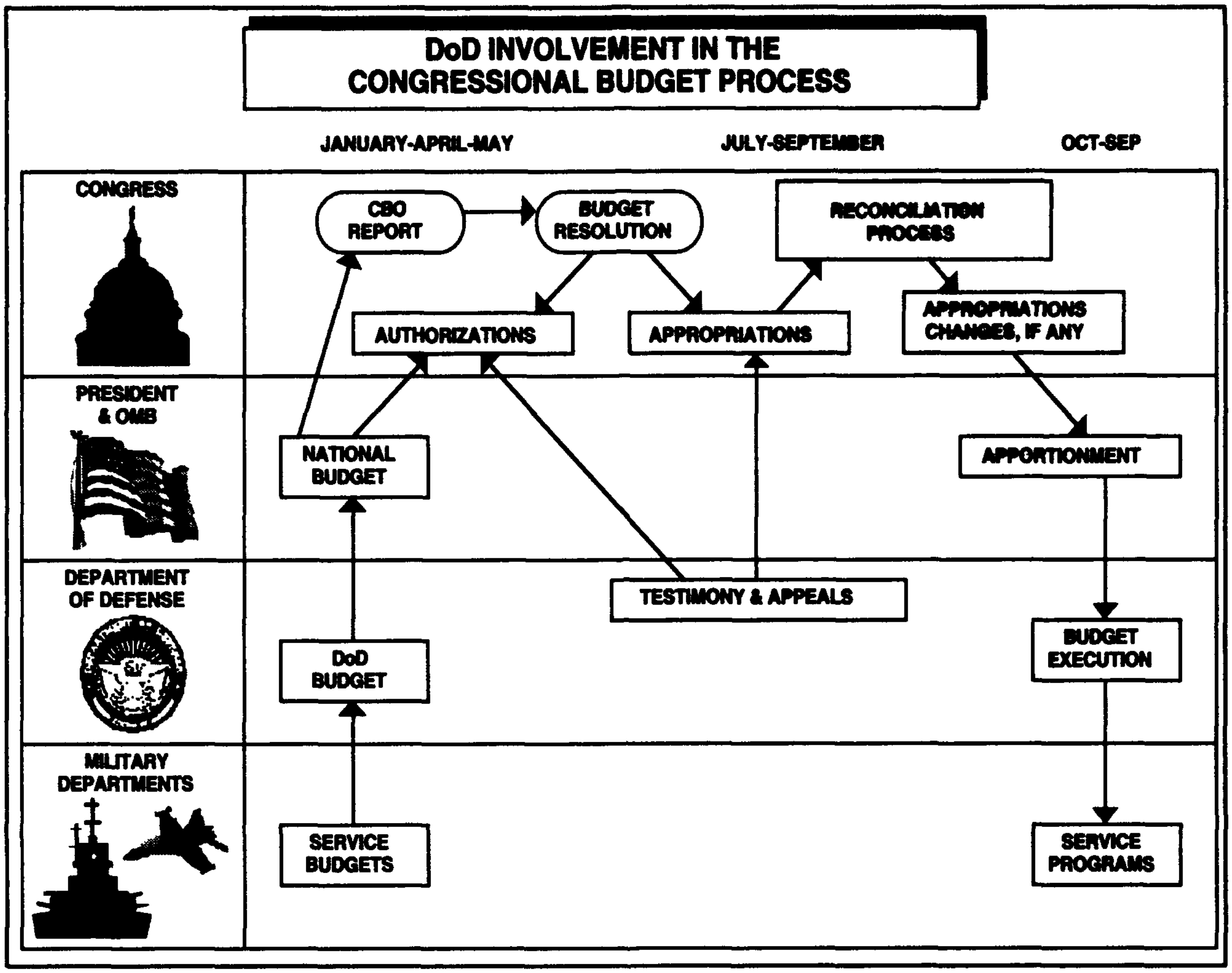


Figure 10-5. Congressional Budget Process

quirements and the tracking of support funding.

10.3.7.1 Budget Execution

The timely and efficient execution of the budget is as important as the planning, programming and budget formulation. Poor execution will result in major adjustments during the Service and OSD Budget review hearings. The PM, in coordination with the ILS manager and each logistics element manager, must ensure that funds are obligated within the authorized time period and that they support the planned logistics goals.

Some form of Contractor Performance Measurement (CPM) is a primary tool in the achievement of these budget execution goals. It can range from monthly one-page status reports of hours and funds planned and expended by a small contractor performing studies, to a highly structured reporting system as outlined in DoDI 5000.2, Part 11B, "Contract Performance Measurement" and be applicable to large contracts. The reports linked to DoDI 5000.2 can be costly to the government and must be tailored to specific needs. Budget execution also requires the PM to be in regular contact with their staff, other government offices, and contractors so that he/she is fully aware of current accomplishments and problems impacting logistics support activities and established program goals. He/she should be aware, well in advance, of any problems that will surface in the next month's CPM report.

Figure 10-6 is a generic display of the financial expenditure process within the Services. The PM enters this process with an approved Purchase Request (PR) which will allow for the assignment of a funding citation. The PM must then monitor the status of a subsequent contract, CPM reports, and the status of obligated and expended funds as reported by vouchers flowing in the system.

10.3.7.2 Logistics Support Requirements Validation and Fund Tracking

The validation of support requirements and the tracking of associated funds through the acquisition process and PPBS events have always been PM responsibilities. This was emphasized in a Deputy SECDEF memo of 28 August, 1984 (Management of Integrated Logistics Support Funding) addressed to the Secretaries of the Military Departments. The memo added renewed emphasis to the ILS validation and tracking responsibilities. The objective and scope of this memo was to:

- Validate support requirements and track support funding for major defense programs using procedures that will make maximum use of existing or modified Service review processes, acquisition documents and information systems;

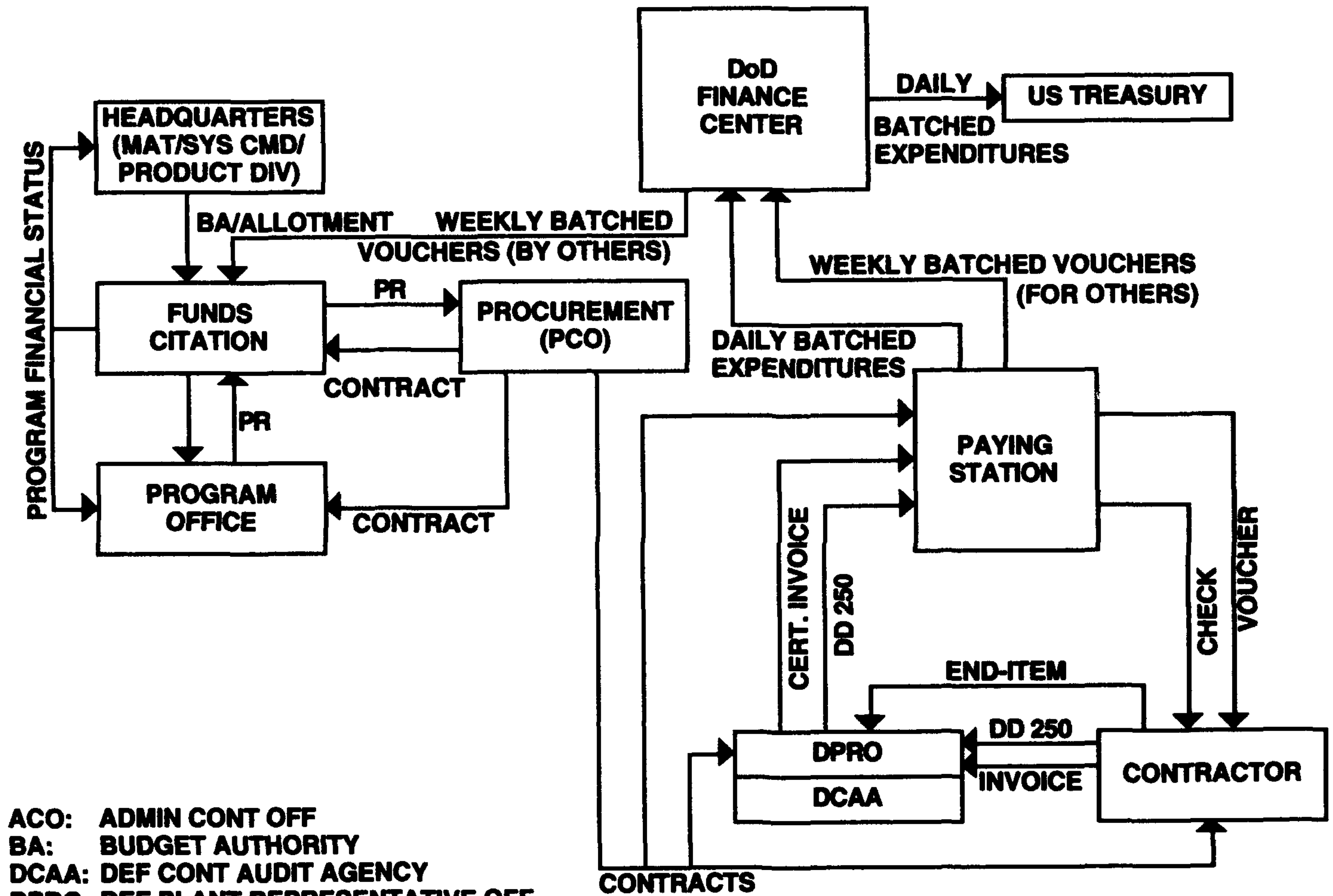
- Cover all major defense programs for which SARs are required; and

- Address seven of the ILS elements defined in DoDI 5000.2 Part 7A, which include the key support investment and recurring support cost elements that affect weapon system deployment schedules and readiness objectives (see list below).

The memo recognized the constraints in then current Service programming and budgeting processes for common support accounts, such as replenishment spares, depot maintenance, and common support equipment. The ability to track all essential funding in these areas by major defense programs has evolved since 1984. The validation and tracking actions apply to POM and budget submissions, plus Milestones II and III decision reviews.

Validation — calls for an independent Service review of the ILS resource requirements. The two essential components of this independent assessment are the validation of the support plans and assumptions and the validation of the estimated cost to carry out the support plans. The PM should use existing or modified Service acquisition document(s) to validate support resource requirements and the key factors that drive them, and should summarize programmed funding in a format directly traceable to that used for reporting weapon support resources in POM and budget submissions, including the budget year and six program years. The methodology used to estimate requirements should be documented in appropriate backup materials.

Tracking — calls for displaying funding requirements in the POM and budget, and using the seven support elements derived from DoDI 5000.2 and listed below. The PM must show that the POM and budget funding requirements are directly traceable to the validated ILS resource requirements document. The POM submittal should assess the impact of any funding shortfalls. Thus, the PM should ensure that his logistics staff efforts always include



ACO: ADMIN CONT OFF
BA: BUDGET AUTHORITY
DCAA: DEF CONT AUDIT AGENCY
DPRO: DEF PLANT REPRESENTATIVE OFF
NRFC: NAVY REGIONAL FIN CTR
PCO: PRINCIPLE CONT OFF
PR: PURCHASE REQUEST

SOURCE: Army Logistics Management Center (Adapted)

Figure 10-6. Financial Expenditures Process sensitivity analyses on the impact of shortfalls and possible alternatives or work-arounds.

The support categories to be considered are:

• Supply Support includes all initial, replenishment and war reserve spares and repair parts (both GFE and CFE) for the weapon system and its associated support equipment and training devices.

• Support Equipment includes development and procurement of peculiar support and test equipment (including test program sets) and major items of common support equipment (automated test stations, handling equipment, etc.) for all echelons of maintenance.

• Training and Training Devices includes development and procurement of both operator and maintainer training courses and materials, simulators and other training devices, and initial factory training.

• Publications/Technical Data includes development and procurement of operator technical manuals, maintenance technical manuals for each echelon of maintenance and other technical data (drawings, engineering and reprocurement data, etc.).

• Maintenance and Maintenance Support includes the recurring cost of organic support at the depot level (labor, material and overhead), contractor support at all levels of maintenance and maintenance support programs (e.g., Contractor Engineering Technical Services).

• Facilities include all MILCON-funded new construction and facilities modifications identified as support requirements for the new system (except production facilities).

• Other System-Peculiar Support Requirements may include ILS management; development and revision of support plans; LSA; analysis of test and early field data; development and procurement of support-related engineering change orders and product improvements; packaging, handling, storage and transportation; and computer resources. Items to be reported will be defined for each individual weapon system, as required.

10.4 RISK MANAGEMENT

10.4.1 Funding Uncertainty

10.4.1.1 Risk Area

This subject has received top level attention and definition within DoD for a number of years. Materiel development and early production programs are subject to uncertainties. PMs who explicitly request funds to address these uncertainties usually find the funds deleted either in the DoD PPBS process, by OMB, or by Congress. When such uncertainties do occur, undesirable funding adjustments are required or the program must be delayed until the formal funding process can respond with additional dollars.

10.4.1.2 Risk Handling

The internal efforts of the Services and OSD to manage the risks can be enhanced by the PM in advance of formal POM and budget submission dates using the following risk-reducing actions.

• Provide organization and structure to program logistics funds by overlaying them with the program WBS. This provides the visibility needed to manage the funding of issues that have a cost, schedule or technical risk impact.

• Ensure all funding requirements are fully justified and that cost sensitivities are understood. Supporting data will flow from logistics studies initiated by the PM plus LSA activity.

• Thoroughly understand the PPBS and rigorously comply with the requirements.

• Stay in regular communication with the appropriate PPBS authorities and administrators within your Service. During critical periods this may mean contact with such personnel several times a day.

• Apply the methods presented in the DSMC Risk Management Handbook.

10.5 SUMMARY

• DoD policy calls for financial resources to be identified before the formal establishment of a program.

• Logistics personnel must be fully informed on the PPBS and actively participate in the process in order to satisfactorily compete for funds.

• Logistics products are either in the form of materiel or services. Logistics personnel must program and budget sufficient funds to acquire deliverables of these items from government and industry in support of system readiness goals.

• Changes in the logistics program that will impact O&S cost must be immediately identified and entered into the next cycle of the PPBS.

• Special DoD procedures have been initiated to cover logistics requirements validation and fund tracking as a part of Service POM and budget submissions.

10.6 REFERENCES

1. DoDD 5000.1, "Defense Acquisition."

2. DoDI 5000.2, "Defense Acquisition Management Policies and Procedures."

3. DoDD 7045.14, "The Planning, Programming, and Budgeting System (PPBS)."

4. DoDI 7045.7, "Implementation of the Planning, Programming, and Budgeting System."

5. AR-1-1, "Planning, Programming, and Budgeting and Execution System."

6. AFM 172-1,"USAF Budget Manual."

11

CONTRACTING FOR SUPPORT

11.1 HIGHLIGHTS

- ILS Manager's Role in Contracting for Support
- Logistics Input to the Procurement Package
- Controlling Deliverable Data
- Contract Types for Logistics Support

11.2 INTRODUCTION

11.2.1 Purpose

To provide a managerial overview of the process and techniques of contracting for logistics support.

11.2.2 Objectives

Contracting for support provides the industry resources needed to implement the government's ILS strategy. Contracting is carried out within the framework of contract laws and regulations and must be in agreement with the acquisition strategy approved by the milestone decision authority (see 11.3.3.1). Contracting may be used to acquire the following logistics deliverables from commercial sources during system acquisition: (1) ILS documentation, such as analyses, plans, design, and reports; (2) support materials, such as spare and repair parts, support equipment and software; and (3) logistics services, such as training, component repair, and turn-key maintenance and supply support of selected equipment (e.g., training simulators) or of the system (see Figure 11-1). Some of these deliverables may be procured under a separate ILS contract; others may be part of an overall program contract. In either case, the government's objectives are to satisfy its logistics support needs at a fair price within legal and regulatory boundaries. Figure 11-2 identifies general government activities in contracting. The contract will provide specific responsibilities for both parties.

11.3 BACKGROUND

11.3.1 Acquisition Policy, Law and Regulations

U.S. government policy calls for heavy reliance on private commercial sources for supplies and services (see OMB Circular No. A-76, "Performance of Commercial Activities"). The Federal Acquisition Regulation (FAR), and other procurement directives, set forth rules and procedures for implementing this policy. These documents reflect basic procurement law, the Armed Services Procurement Act, and revisions enacted during the annual authorization and appropriation process. The DoD implements and expands on the FAR in the Defense Federal Acquisition Regulation Supplement (DFARS) and Service supplements.

11.3.2 Contracting Authority, Responsibility and Participation

Authority and responsibility to contract for authorized supplies and services are

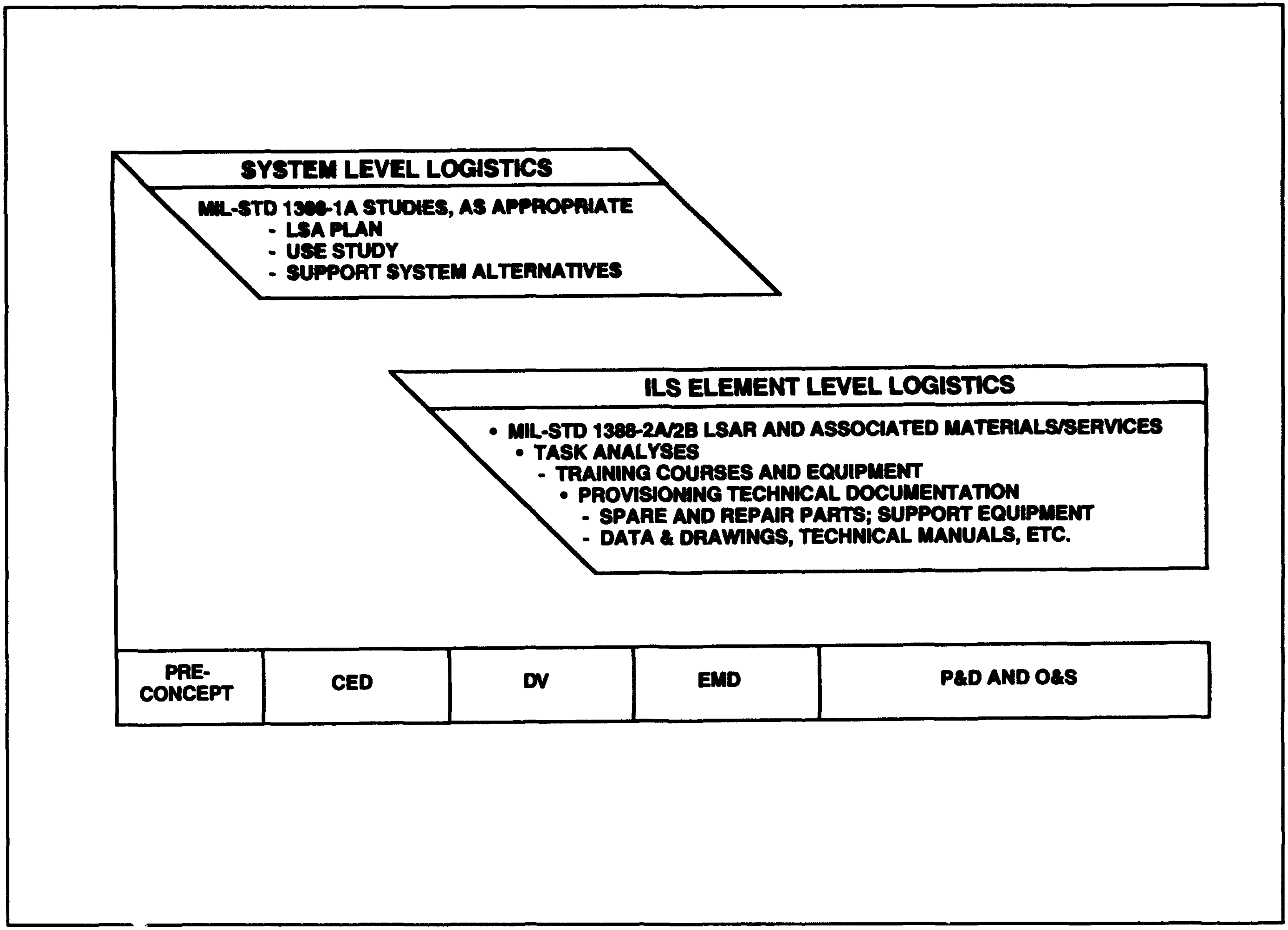


Figure 11-1. Logistics Deliverables During System Acquisition

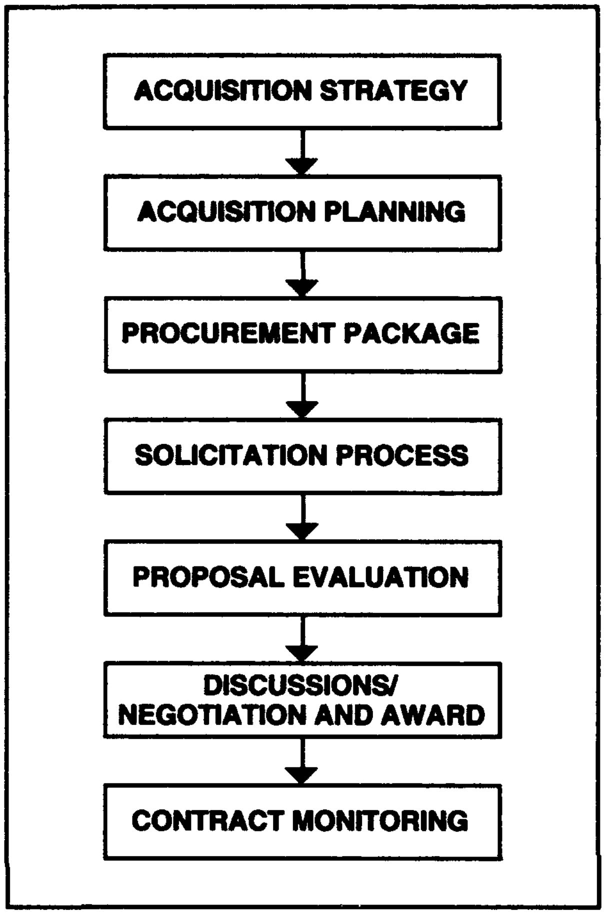


Figure 11-2. Government Contracting Responsibilities

vested in the agency head and delegated to contracting officers. In turn, the contracting officer is responsible for ensuring that all requirements of the law, executive orders, regulations and procedures have been met before exercising this authority. Although contracting officers are allowed wide latitude in exercising business judgement, they must ensure that contractors receive impartial and equitable treatment and they must solicit the advice of specialists in program management, engineering, logistics and other fields as appropriate (FAR 1.602-2). Specialists must be involved in such major contract events as source selection. The ILS manager has some involvement in the entire contracting process from preparation of the procurement package to monitoring contractor performance, but such major contracting activities as developing the acquisition strategy for ILS are primarily his or her responsibility.

11.3.3 The Contract Process

The primary contracting activities that involve the ILS manager are: developing the contracting strategy; planning the acquisition; recommending contract method and type; preparing the procurement package; evaluating proposals and monitoring contract performance. These are discussed in FARs 7, 34, 35, and 37.

The solicitation, negotiation and award processes are the responsibility of the contracting officer, with assistance as required from specialists, such as the ILS manager (Figure 11-2). The ILS manager should become familiar with his responsibilities for these contract events as they relate to contracting for support. Figures 11-3 and 11-4 display a generic chronology of contract events. These time frames are representative contract lead times.

11.3.3.1 Acquisition Strategy

The ILS managers' acquisition strategy should permit competitive contracts where practical. Other strategy considerations include appropriate implementation of warranties, breakout and the consolidation of spare parts requirements (initial, follow-on and replenishment). The ILS contract strategy must be compatible with the overall program acquisition strategy.

11.3.3.2 Acquisition Planning

In planning the acquisition of logistics data, materials or services, the ILS manager should work with (or support) the government team responsible for such significant aspects of the acquisition as con-

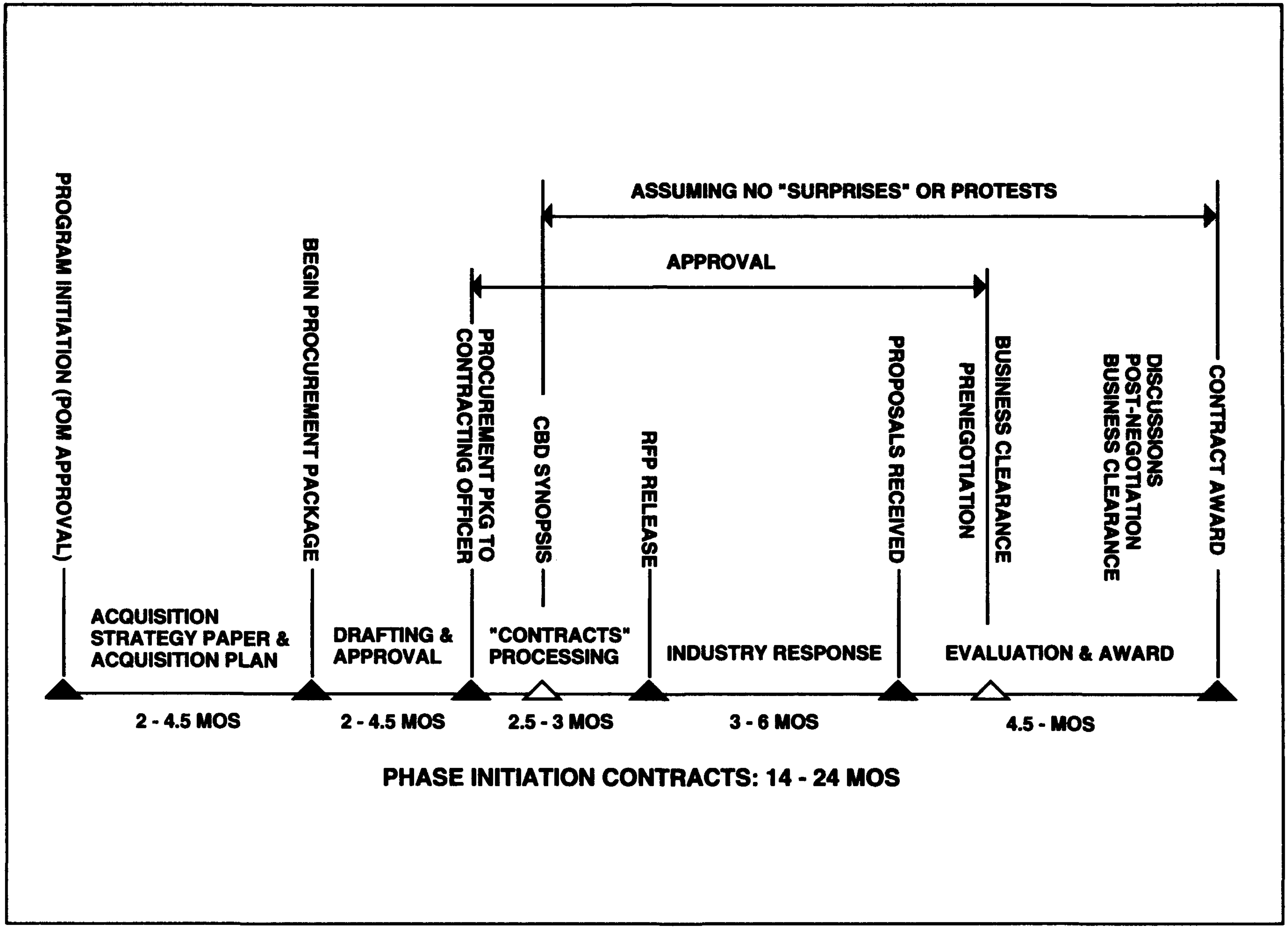


Figure 11-3. Procurement Action Cycles (Full and Open Competition)

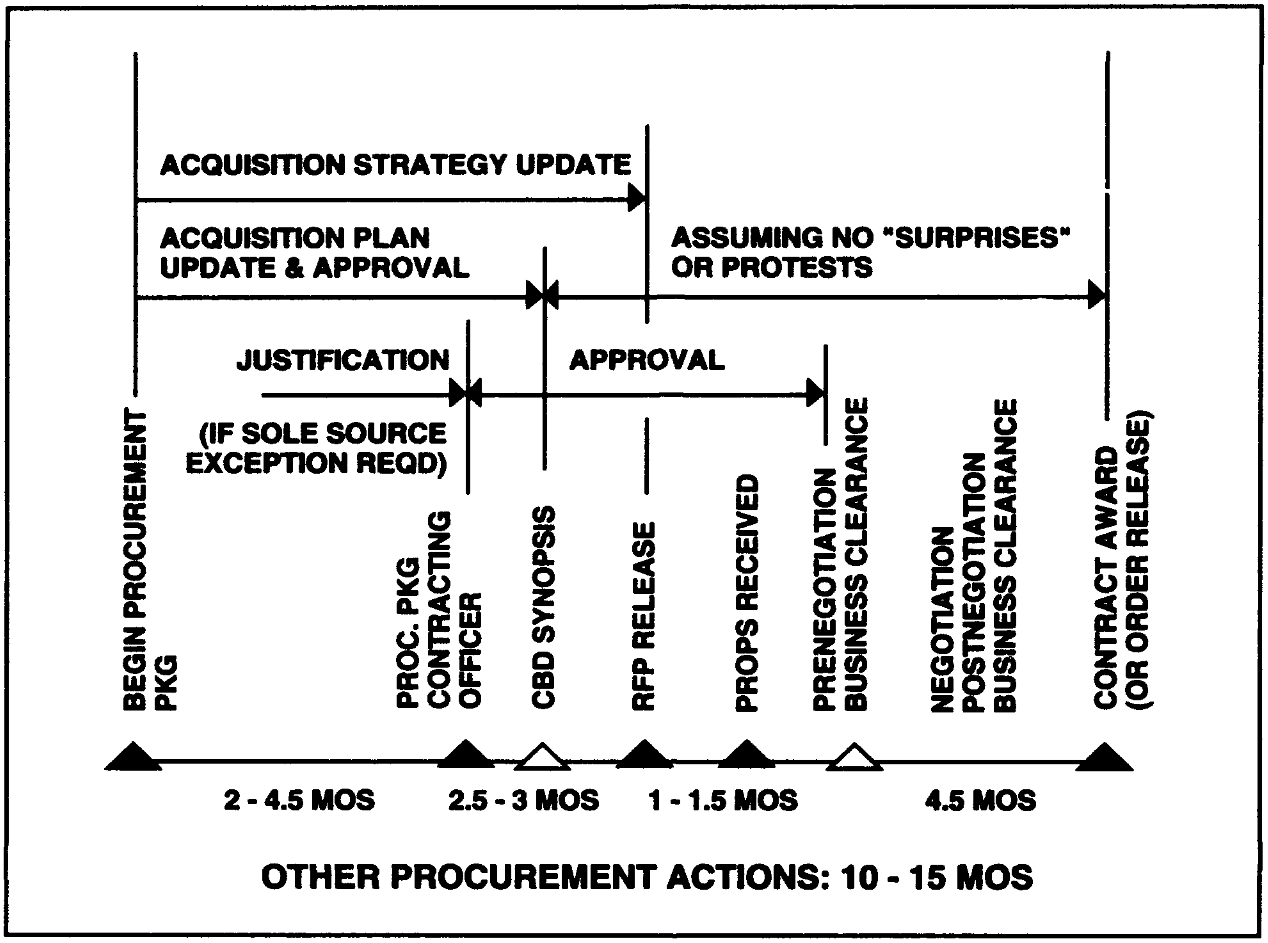


Figure 11-4. Support Contract Cycle (Sole Source)

tracting, financial and technical management in the creation of an acquisition plan (FAR 7.105). A wide selection of contract types is available, providing flexibility in acquiring the needed logistics resources. These contracts vary according to the degree and timing of responsibility (risk) assumed by the contractor for cost and performance, and the amount and nature of profit incentive.

Contract types are grouped into two broad categories: fixed-price contracts and cost-reimbursement contracts. Specific contract types range from firm-fixed-price (where the contractor accepts full risk for performance, cost and profit or loss) to cost-plus-fixed-fee (CPFF, in which the contractor assumes minimal risk for performance and cost but receives a negotiated fee), see FAR 16. In cost-plus-incentive-fee (CPIF) contracts, the government still bears the major risk; however, the contractor's fee (i.e., profit) will vary based upon the achievement of objectives incentivized in the contract. Refer to 11.4.6.

11.3.3.3 The Procurement Package

The Procurement Package encompasses most of the information the contracting officer needs in order to prepare a solicitation as prescribed by Part I - "The Schedule" of the uniform contract format (FAR 14.201-2). It provides technical and management information including the range and depth of data, materials and services to be acquired. Timely and comprehensive statements required for each acquisition involving equipment or processes needing future support materials, services or data.

MIL-HDBK-245B, "Preparation of the Statement of Work" (SOW) provides specific guidance on how to identify and present information on logistics deliverables in a format consistent with life-cycle phase requirements. The ILS manager should be concerned with each part of the Procurement Package because logistics requirements are normally spread throughout the document. Care should be taken in selecting and describing related deliverables.

Plans, drawings, specifications, standards and purchase descriptions should be selectively applied and tailored to the particular application in the SOW. For example, many military standards provide useful guidance and requirements related to logistics. After reviewing the available standards bearing on a given topic, select the fewest number of standards that encompass the desired range and depth of logistics tasking in such areas as planning, supply, manpower, personnel and training. Specific applications should be tailored to meet program needs by selecting or modifying standard DIDs. The majority of data requested will be those defined in MIL-STD-1388-2A or 2B, "DoD Requirements for a Logistics Support Analysis Record" (refer to 7.3.6). The Procurement Package should include:

• Guidance to the contractor about the government's baseline of ILS — objectives, requirements, importance relative to other program objectives, concepts, assumptions, constraints and priorities;

• Specific ILS tasks to be performed by the contractor, such as ILS analyses, logistics alternatives evaluations, preparation of plans and concepts, training courses, spares and repair parts, technical data, etc.; and

• Incentives aimed at achieving the desired balance between ILS and other performance capabilities (refer to 11.4.6).

The terms used must be understandable and consistent with standard contractual clauses. Buzz words, terms with multiple meanings, conflicting or unclear terms and symbols must be avoided.

11.3.3.4 Evaluating Proposals

The ILS manager identifies and defines the logistics considerations to be addressed in the offerer's proposals. He also helps to determine the relative importance (weight) of evaluation factors (e.g., understanding of the problem, technical approach and other technical factors, experience and cost). Other technical factors should provide measurable and meaningful criteria related to the specific logistics support requirements of the proposed system. These logistics considerations are also incorporated in the overall Source Selection Plan (SSP), which contains the evaluation factors and weights for each factor. These must be on record with the contracting officer prior to RFP release and incorporated in the RFP. In preparing for evaluation working group meetings, the ILS manager should evaluate independently all technical proposal items related to logistics in order to contribute meaningful leadership in the discussions leading to source selection.

11.3.3.5 Contract Monitoring

A comprehensive contract file, including all procurement and administrative contract modifications (referred to as "P mods" and "A mods") is a useful management tool. Data in the contract file directly relates actual performance to actual cost and, when automated, does so in a timely manner. During the performance period, this data should be used to rapidly identify, examine and resolve logistics problems.

11.3.4 Contracting Methods

The Competition in Contracting Act of 1984 requires agencies that are conducting procurements for goods and services to obtain "full and open competition" through the maximum use of "competitive procedures." This means that all responsible sources are encouraged to submit sealed bids or competitive proposals, depending on what is required by the solicitation.

There are two primary differences between the competitive procedures known as: (1) sealed bids and (2) competitive proposals. The first difference relates to award factors. When sealed bids are used, the award will be based solely on price and other price-related factors. In contrast, competitive proposals permit consideration of other factors, such as technical merit, that go beyond cost in meeting the government's need.

The second difference involves the permissibility of negotiations to arrive at the business agreement. With sealed bids, discussions, other than for purposes of minor clarifications, are not permitted. Competitive proposals, however, do permit discussions and afford the offerors an opportunity to revise their offers subsequent to discussions. In context, "bargaining" refers to discussion, persuasion and alteration of initial assumptions and positions. The give-and-take may apply to price, schedule, technical requirements and other terms of the proposed contracts. The use of "other than competitive procedures," (sole source negotiations) is only authorized when the circumstances of the acquisition meet the criteria of one of seven identified exceptions (FAR 6).

11.4 MANAGEMENT ISSUES

11.4.1 Data

A major data problem in the past has been the incomplete identification of data requirements and the lack of emphasis on procedures that ensure legible, complete and correct drawing practices. Contract requirements for a technical data package (TDP) must be traceable to the government Configuration Management Plan which, in turn, must implement the acquisition strategy approved by the milestone decision authority. When the approved acquisition strategy specifies competitive reprocurement of systems and/or spares and repair parts, "product drawings and associated lists" in accordance with MIL-T-31000, "General Specifications for Technical Data Packages," must be ordered for delivery prior to the end of the EMD phase. (Also refer to DoDI 5000.2, Part 9B "Technical Data Management.")

It is not easy to verify that the delivered product drawings and associated lists (e.g., specifications; software documentation; preservation, packaging, packing and marking data; test requirements data; quality assurance provisions) will satisfy all needs for competitive procurement. Personnel preparing the data and those reviewing it should be able to determine whether they could manufacture the documented component "without additional design engineering or recourse to the original design activity." One review approach is to award an independent verification contract to a manufacturing or production engineering firm that has relevant hands-on manufacturing experience. The following guidelines are offered for developing technical data packages.

• Determine the level of specificity required for procurement purposes.

• Ensure that the parts descriptions and drawings are available so that other participants in the acquisition understand what is being bought.

• Establish prices and options for data delivery only after the design is stable enough to make it useful.

• Obtain technical data on a phased schedule to permit breakout of vendor components for future competitive acquisitions.

• Inspect and validate the completeness, accuracy and adequacy of data promptly after its receipt.

• Consult with the contracting officer to ensure that the current regulations concerning data rights and data restrictions (FAR 27) are incorporated in the solicitation.

• Technical personnel should review proprietary or other restrictive markings on drawings and, when appropriate, request the contracting officer to obtain a written justification from the contractor for the restrictive marking.

11.4.2 Spares and Breakout

Decisions affecting spares must be made very early in the life cycle of a system. As the program evolves, the ILS manager must issue provisioning technical documentation guidance, including milestones and feedback reporting, via the contract, to ensure that program unique materials are promptly ordered. The ILS manager must also ensure that follow-on spare and repair parts are obtained in a cost-effective manner. Relying on the original prime contractor for follow-on support material entails risks in the areas of cost and availability of needed spare and repair parts, especially during the PPSP (refer to 14.3.3.) The ILS manager should consider obtaining technical data, drawings, tooling, etc., to enable the Services to compete for follow-on logistics support. The cost of obtaining this capability must be weighed against the potential benefits of competition, particularly during an extended post-production period. FAR, Part 7 requires the inclusion of detailed component breakout plans in the acquisition plan. In order to develop and deliver an effective spares procurement package to future users, the ILS manager should do the following.

• Ensure the timely and accurate assignment of procurement source codes (e.g., prime contractor, vendor, field manufacture, etc.) and challenge data rights and restrictive markings.

• Require contractors to identify actual manufacturers.

• Screen contractor-recommended parts lists to make full use of DoD and General Services Administration (GSA) supply systems.

• Make sure parts already available in DoD and GSA supply systems are bought direct.

• Order optimum quantities where significant savings can be obtained.

• Base estimated unit prices on anticipated buy quantities rather than a single item. Provisioning prices (prices established during the provisioning process) should not be used as the basis for determining the reasonableness of the price of future buys and procurement history records should identify provisioning prices as such.

• Consider Spares Acquisition Integrated with Production (SAIP) where the government combines spare parts orders with planned production.

• Encourage multiyear procurement of replenishment spares which are sensitive to quantity and front-end investment costs.

• Ensure that all spare parts requirements (initial or replenishment) are combined to the maximum extent possible to achieve the savings of larger quantities. Buying offices should alert users when frequent purchases of the same part are causing higher costs.

• Ensure realistic breakout and competition goals, taking into consideration savings potential and the availability of procurement specialists to conduct the competitions and breakout actions.

• Be sure that trade-offs are made between inventory carrying costs and marketplace quantity discounts.

11.4.3 Contracts and Pricing

A PM often regards logistics contract considerations, such as identifying logistics deliverables and creating the ILS input to the SOW, as long-term issues that are less important than the immediate problems. As a result, logistics concerns are often deferred for later resolution. A common example is the acquisition of data needed for future logistics support. Understandably, the PM with a funding shortfall is more likely to cut the long-term logistics requirements from the contract than items with immediate impact.

An OMB review found that a large number of unpriced orders are backlogged at many DoD activities. The time required for audit, cost or price analysis and negotiation of a contractor's proposal may relate to the number of cost elements to be negotiated. Solutions have included reducing the number of cost elements to be analyzed, as well as avoiding the use of Basic Ordering Agreements (BOAs) and the ordering (provisioning) clause for the large amounts of data and spares that can be firm-fixed-priced at the time the order is placed. Another solution is using forward pricing arrangements. These provide for advance negotiation of direct and indirect cost factors that can then be used for a mutually agreed upon time. The renegotiated ILS cost factors facilitate efficient pricing of a contractor's proposal by providing more time to analyze direct costs. These factors can be routinely used by less experienced buyers and are easily adapted to a computerized system. Increased emphasis on negotiating forward pricing arrangements should result in a decrease in the number of outstanding unpriced orders. Goals should be set and monitored for the control of unpriced orders.

11.4.4 Government Furnished Property and Other Promises

The government's failure to provide promised Government Furnished Material (GFM) in a timely manner and in suitable condition may create government liability for subsequent cost and schedule increases (FAR 52.245-2). For this reason, the ILS manager should only identify GFM that the government can provide in a timely manner and in a condition suitable for use. If appropriate, the Contracting Office may allow the contractor to utilize MIL-STRIP procedures in obtaining the required GFM (FAR 51).

11.4.5 Unrealistic Delivery or Performance Schedules

The government sometimes creates pressure in negotiated contracts with the result that a contractor may feel obligated to agree to terms that are unachievable and subsequently seek and receive relief from these unreasonable requirements. ILS managers should avoid issuing requirements on an urgent basis or with unrealistic delivery or performance schedules, since doing so generally restricts competition and increases costs.

11.4.6 Incentives

Incentives establish a relationship between the amount of fee payable and the results achieved, and are used in contracts to motivate contractors to exceed predetermined thresholds for performance, delivery and R&M, etc. When predetermined measurable incentives on delivery or technical performance are included, fee increases are provided for achievement that exceeds the targets and fee reductions are made when targets are not met. Incentive contracts are addressed in FAR 16.4 and in a joint DoD/NASA Incentive Contracting Guide. Logistics incentives should be designed to address one or more of the following conditions:

- Designs that tend to reduce logistics costs during the operational phase of the life cycle — increased use of standard components, reduced trouble-shooting time, etc.;
- Accelerated delivery of the logistics system (all elements) commensurate with accelerated program delivery; and
- Exceeding R&M thresholds.

Contractural incentives are established for significant goals that will yield increased combat effectiveness or decreased ownership costs (refer to 6.3.3.4).

11.4.7 Warranties

In 1985, Congress established a requirement for express warranties in production contracts for weapon systems that exceed a unit cost of $100,000 or $10 million total cost. The warranties address conformity to the design and manufacturing requirements; freedom from defects in materials and workmanship at the time of delivery; and conformity to "essential performance requirements" (such as operating capabilities and reliability). In effect, the warranty is an obligation of the contractor to repair or replace equipment found defective or to compensate the government for repair performed by the government during the course of the warranty period.

FAR/DFARS also provide policies and procedures for tailoring the required warranties to the circumstances of a particular procurement and for obtaining waivers when needed. For supplies and services that do not meet the definition of a weapon system (such as spares and data), warranties may be used, provided they meet or exceed the foregoing requirements and are advantageous to the government. A warranty of technical data (extended liability) should normally be included in the solicitation and evaluated on its merits during source selection.

In designing or selecting the contract warranty clause, the ILS manager should consider the following guidelines:

• Establish warranty clauses and procedures that do not adversely impact readiness (like excessive downtime while waiting for contractor replacement or repair of the warranted components).

• Provide a mechanism for administering the warranty that imposes limited or no special reporting requirements on user personnel, particularly at the organizational level.

• Maximize the government's ability to use the warranty. Be sure to consider transportation and storage factors.

11.5 RISK MANAGEMENT

11.5.1 Improper Contracting for Support

11.5.1.1 Risk Area

The major risk area in ILS contracting, in terms of impact and the probability of its occurrence, is the failure to properly contract for data, materials and services. Included are failures involving contractual promises by the government to furnish material and services and the imposition of unrealistic delivery or performance schedules. Impacts may include degraded support and readiness, cost growth, and loss of the taxpayers' good will and confidence. Contracting for support entails many areas of risk which the PM must control. Permanent solutions to these problems are elusive unless management attention is sustained at all levels. Without such attention, we will only repeat the mistakes of the past — a flurry of activity, amounting to overkill, dying out without producing meaningful or lasting improvements.

11.5.1.2 Risk Handling

The Office of Federal Procurement Policy issued a report that offers more than 100 recommendations and suggestions aimed at avoiding well known risk areas (Reference 2) and aimed at improving logistics procurement practices. The recommendations most applicable to executive and working level ILS managers are included in the guidance given in paragraph 11.4, Management Issues. They may be used as a checklist either to guide hands-on managerial efforts, or to review the work of matrix personnel to ensure the price-consciousness of their efforts.

11.6 SUMMARY

• Participation in the contracting process is part of the ILS manager's job.

• Contract knowledge, initiative and determination are essential in managing ILS programs.

• ILS program success is a direct reflection of contract success.

11.7 REFERENCES

1. The Federal Acquisition Regulations (FAR).

2. Office of Federal Procurement Policy, "Review of the Spare Parts Procurement Practices of the Department of Defense," June 1984.

3. MIL-HDBK-245, "Preparation of Statement of Work (SOW)."

4. Defense Federal Acquisition Regulations Supplement (DFARS).

MODULE

IV

Providing the Support

The ILS manager's goal is the successful deployment of a materiel system, its support, and the achievement of readiness, supportability and LCC objectives. This Module focuses on the ILS role in planning for and accomplishing production and operational and post-production support.

12

SUPPORTABILITY ISSUES IN TRANSITION FROM DEVELOPMENT TO PRODUCTION

12.1 HIGHLIGHTS

- Validation of R&M Goals With Early Production Hardware During the Transition to Production

- Interrelationship of Production and Supportability

- Template Discipline of DoD 4245.7-M

12.2 INTRODUCTION

12.2.1 Purpose

To provide a managerial overview of the key activities required to achieve an effective transition from development to production in terms of supportability.

12.2.2 Objective

The ILS objectives during the transition to production are to ensure that approved supportability design requirements (such as R&M) are achieved in the early production articles; and that planned logistics support resources are defined and adequately funded to achieve the system readiness objectives. The ILS manager should insist on evidence of demonstrated R&M, a producible design, proven repeatability of manufacturing procedures and processes, and logistics support verified in operational testing.

12.3 MANAGEMENT ISSUES

12.3.1 General

Program transition from EMD into production is an extremely challenging period. The transition is not a discrete event in time; it occurs over months or even years. Some programs may not succeed in production in spite of having passed the required milestone design reviews. Reliability and support characteristics that are not "designed-in" cannot be "tested-in" or "produced-in". There may be unexpected failures during the test program that require design changes. The introduction of these changes can impact quality, producibility, supportability, and can result in program schedule slippages. The ILS manager must exercise strong change management discipline during this transition period to ensure that the changes incorporated in the system are properly reflected in the support system deliverables.

The transition process is impacted by:

- Design maturity — a qualitative assessment of the implementation of concurrent and effective design policy.

- Test stability — the absence or near absence of anomalies in the failure data from development testing.

- Certification of the manufacturing processes — includes both design for production and proof of process; proof of process occurs during pilot production, low-rate initial production or other "proof of concept" methods used prior to rate buildup.

12.3.2 Variability-Reduction Process

Variability Reduction Process (VRP) is a disciplined design and manufacturing approach aimed at meeting customer expectations and improving the development, manufacturing and repair processes while minimizing time and cost. The traditional approach to improving a product is tightening tolerances and increasing inspections. The alternative VRP approach seeks to reduce causes of harmful variation in the production process and to minimize the effects of the variation on reliability and repeatability of the system.

12.3.3 Support Readiness Reviews

The PM or ILS manager should initiate support readiness reviews to address all ILS elements. The number of reviews and the topic sequence depend on the nature of the program. Depending on the system under consideration and the phase of the program, some elements will be more critical than others during particular reviews. The emphasis on key program issues will have to be tailored accordingly.

Early support readiness reviews should be incorporated in Preliminary Design Reviews (PDRs) and Critical Design Reviews (CDRs), where the ILS manager has an active role in establishing system (type A) and development (type B) specifications (refer to 5.3.2.2 and Figure 5.3). Logistics risk areas revealed during the PDR and CDR should be prime considerations during later support readiness reviews. The ILSMT discussed in 2.3.2 should participate in these reviews.

12.3.4 Tasks, Activities and Deliverables

The quality and validity of many of the products of the LSA process are put to the test in the transition to production. Earlier validation of LSA output provides confidence in the quality of the analytical side of the process. As the program makes the transition to production, a lengthy list of problems, requiring resolution by the ILS manager, may surface (e.g., inadequate support equipment; late ordering of spares; inadequate training; documentation that is not to the latest configuration; unproven facilities; one set of check out equipment needed simultaneously for production testing, quality assurance standards and deployment).

12.3.4.1 Support Requirements Review During The Transition Phase

The ILS manager should take stock of the lessons learned from the results of the EMD phase by conducting a support requirements review before recommending that the program proceed to the production phase. Some questions to ask are:

- Have critical supportability design deficiencies identified during DT&E and OT&E been corrected, or have solutions been identified that can be applied before deployment?

- Have ILS elements (support equipment, technical manuals, etc.) been fully evaluated in a representative operational environment?

- Have deficiencies been corrected or can they be corrected before deployment?

• Have quantitative requirements for ILS elements (e.g., maintenance manpower and initial provisioning) been determined?

• Is sufficient funding included in the POM?

• Can the manpower required to support the system be satisfied by the Services manpower projections?

• Will production leadtimes for the ILS elements support the planned production and deployment schedules?

• Have tests and simulations confirmed the attainability of system readiness thresholds within the target levels for O&S costs?

• Have plans for interim contractor support, if applicable, and transition to organic support been prepared?

If these issues have not been resolved, the ILS manager should develop a recovery plan and/or recommend further system development.

12.3.4.2 ILS Manager's Priority Tasks During The Transition Phase

The primary purpose of the acquisition process is to deploy systems that not only perform their intended functions but are ready to perform these functions repeatedly without burdensome maintenance and logistics efforts. The successful deployment of a reliable and supportable system requires that the ILS manager provide strict watchdog management during the transition phase, to ensure that adequate technical engineering, manufacturing disciplines and management systems are applied to the ILS elements and supportability features of the system. Transition phase ILS priority items include:

• Providing timely and adequate funding for all ILS elements;

• Involving ILS specialists in the preparation of comprehensive hardware and software design specifications;

• Continuing an active LSA process;

• Ensuring ILS input to configuration control and the comprehensive assessment of the impact of changes on all support elements; and

• Establishing a technical management system for tracking support equipment reliability, configuration control and compatibility with end item hardware/firmware/software.

12.3.5 The Transition Plan

Transition plans provide a detailed accounting of the items and issues for "readiness" reviews. They are primarily a management tool for ensuring that adequate risk handling measures have been taken. Figure 12-1 provides a list of contents for a transition plan and production readiness review. They must be initiated and tailored to the need of the program, by the program and ILS managers.

12.3.6 DoD 4245.7-M, "Transition From Development to Production"

This document is an aid in structuring technically sound programs during the transition from development to production. The manual includes a series of risk management templates keyed to specific technical issues. The templates, in turn, provide a program relationship, identify the potential risks and outline risk avoidance techniques. Figure 12-2 illustrates the level of detail of risk management provided. Other

TRANSITION PLAN OUTLINE	PRODUCTION READINESS REVIEW
- Purpose of the Transition Plan	- Production Management
- Manufacturing Organization	- Engineering Design
- Program Schedules	- Production Design
- Make or Buy Decisions	- Production Engineering
- Producibility Engineering	- Industrial Resources
- Role & Responsibilities	- Materials and Purchased Parts
- Facility Required	- Make or Buy
- Manufacturing Technology	- Subcontract Management
- Material Procurement	- Manufacturing Planning
- Assembly Planning	- Quality Assurance
- Methods	- Cost
- Processing Engineering	- Risk
- Assembly Tooling	- Logistics
- Packaging Engineering	- Contract Administration
- Fabrication	
- Production Engineering	
- Production Control	
- Manpower Plan	
- Manufacturing Financial Plan	
- Product Assurance Plan	

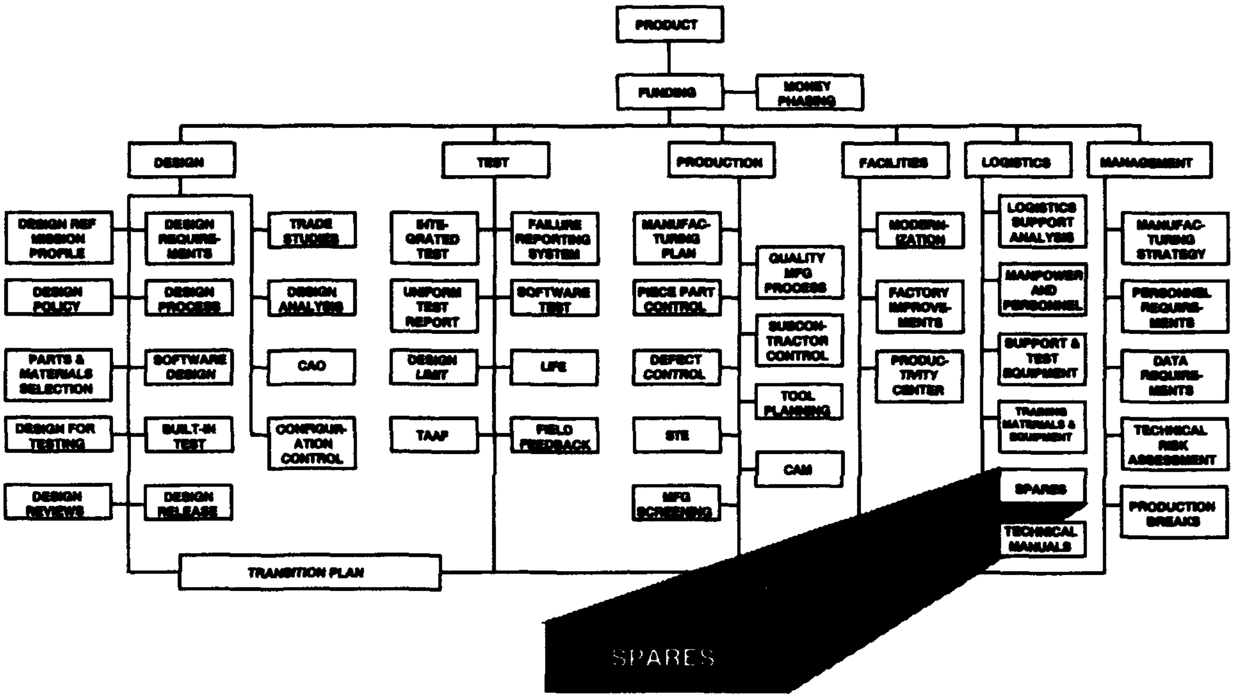
Figure 12-1. Sample Transition Plan and Production Readiness Review Contents

templates related to logistics support are included for LSA; manpower and personnel; training; packaging, handling, storage, and transportation; support equipment and support facilities.

12.3.7 Management of Changes

Even with a good configuration management system, the impact of DT&E/OT&E changes can overwhelm the best logistics support planning in the transition to production. Unless the guidance and intent of DoD 4245.7-M on disciplining the engineering process have been employed; an effective government, contractor and subcontractor team is implemented to handle the changes on a total system basis; and the PM is prepared to respond with funding and direction to other activities whose support tasks on the program are affected by the changes.

TEMPLATE



AREA OF RISK

Spares are a troublesome area in the production and deployment of weapon systems. Spares and repair parts often do not meet the same quality and reliability levels as the prime hardware. Full spares provisioning too early in the development cycle, when there are large uncertainties in the predicted failure rates and design stability, results in the procurement of unneeded or unusable spares. Inadequate technical and reprocurement data frequently limits competition, acquisition flexibility and spares manufacturing throughout the life cycle of the prime systems. Spares thus present a major risk of increased acquisition and support costs, and reduced readiness of fielded systems.

OUTLINE FOR REDUCING RISK

- **A spares acquisition strategy is developed early in EMD to identify least cost options, including combining spares procurement with production. The strategy addresses spares requirements to meet EMD as well as production and deployment.**
- **The same quality manufacturing standards and risk-reduction techniques used for the prime hardware are used in the spares manufacturing and repair process.**
- **Transition from contractor to government spares support is planned on a phased subsystem-by-subsystem basis.**
- **Initial spares demand factors are based on conservative engineering reliability estimates of failure rates (derived from comparability analysis), and sparing to availability analytical models. These factors are checked for reasonableness at the system or major subsystem level against laboratory and field test results and documented in the logistics support analysis database.**

SOURCE: DoD 4245.7-M

Figure 12-2. Sample Logistics Template

Figure 12-3 diagrams the traditional approach to ILS management and review. The reality of professional specialization and organizational compartmentalization in both government and industry means that each support discipline is considered a specialty in itself and is often isolated at the expense of coordination and integration. For example, spares were dealt with in isolation between industry and government provisioning specialists. Experience has amply demonstrated that the traditional approach results in less than optimum field support following delivery of a system. Properly implemented, the systems engineering process, including LSA, provides integration between design engineering and logistics elements.

The support integration review team concept (illustrated in Figure 12-4) is an example of an effective contractor team, which reduces the isolation of specialties and facilitates in-house coordination. The team satisfies the intent of DoDI 5000.2, Part 7A "Integrated Logistics Support" and related directives in the integration of ILS with the design effort.

12.3.7.1 Integration Team Actions

Before the contractor begins to make production parts, program-peculiar issues should have been identified and appropriate risk management and risk hedges applied to ensure design maturity, the repeatability of test results and certification of the manufacturing processes.

This will minimize the quantity and scope of follow-on changes required to correct or improve the production of end items. When changes do occur, the ILS manager's task becomes vital to the eventual success of the program. Changes to the system will generally require changes in most or all of the logistics support resources.

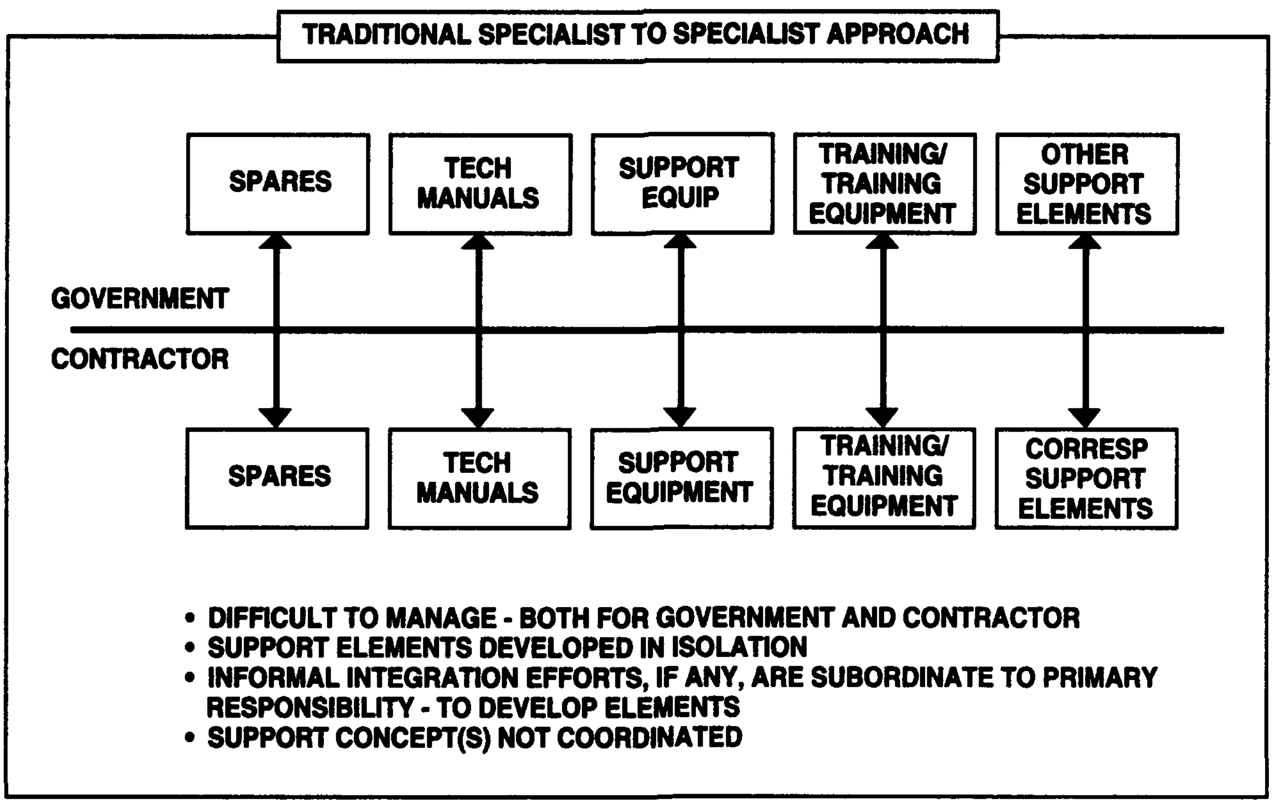


Figure 12-3. Traditional ILS Management and Review Approach

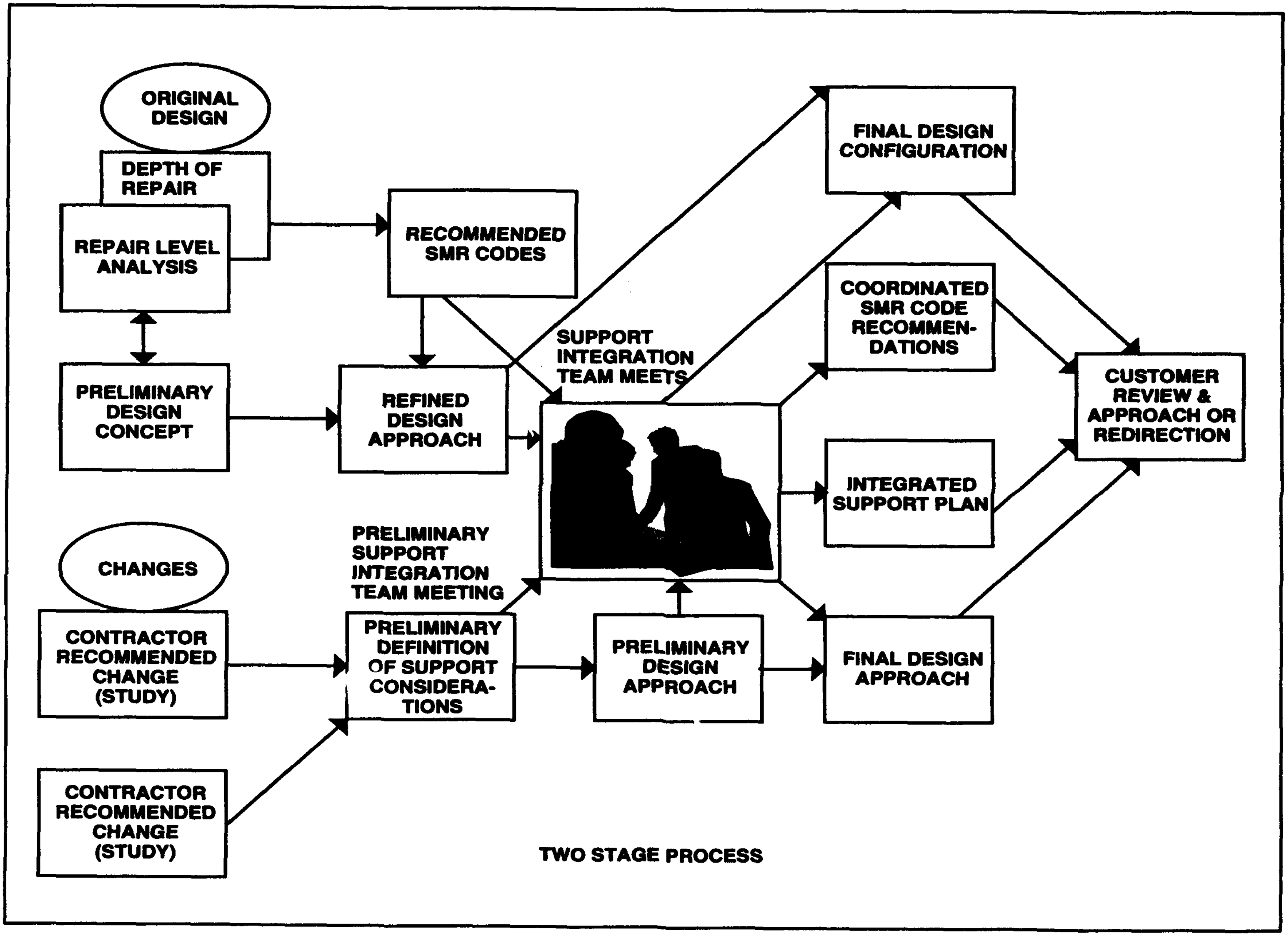


Figure 12-4. Flow of Contractor Support Integration Team Actions

12.3.7.2 Change Proposal Preparation

The starting point in change preparation is recognition of a deficiency and a decision to employ a design solution. As shown in Figure 12-5, the request to change production, and possibly retrofit fielded equipment, may be originated by the government or the contractor. The top half of Figure 12-5 illustrates one approach for contractor preparation of an Engineering Change Proposal (ECP).

The contractor ILS manager must be actively involved in:

- Determining the impact of the ECP on affected ILS elements;

- Developing requirements and schedules for required changes to affected ILS elements; and

- Participating in engineering review board and change review board meetings.

The government ILS manager must be involved in the government review and approval process to ensure that:

- The impact on ILS elements has been fully evaluated;

- ECPs for associated changes to support equipment and training devices are available for concurrent review and approval;

- Lead times for changes to ILS elements are compatible with the planned implementation of the ECP on the production line; and

- Changes to ILS elements are funded.

12.3.7.3 Change Implementation

After government approval, the contractor initiates action to finalize the change for production and/or retrofit concurrently to modify the affected ILS elements (bottom half of Figure 12-5). The government accepts the modified systems. The government ILS manager is normally responsible for the application of retrofit kits and must assure that the required changes to logistics support of fielded systems are applied or are available concurrent with the application of retrofit kits to the systems. This latter requirement can be facilitated by grouping retrofit kits into block modifications and applying them to complete production lots.

12.3.8 The Support Management Information System

A support management information system is an essential component of configuration status accounting. It is employed to manage changes of logistics resources and to maintain concurrent compatibility with changes to the system.

12.4 RISK MANAGEMENT

12.4.1 Risk Areas

Before entering the EMD phase, the ILS manager should identify unique system or equipment risk areas which might impact a smooth transition from EMD to production, and highlight the techniques that might avoid these risks as tasks to be performed during EMD. Some examples of risk areas to be considered are identified in Figure 12-6.

12.4.2 Risk Handling

The risk areas identified in Figure 12-6 can all be minimized by following the guide-

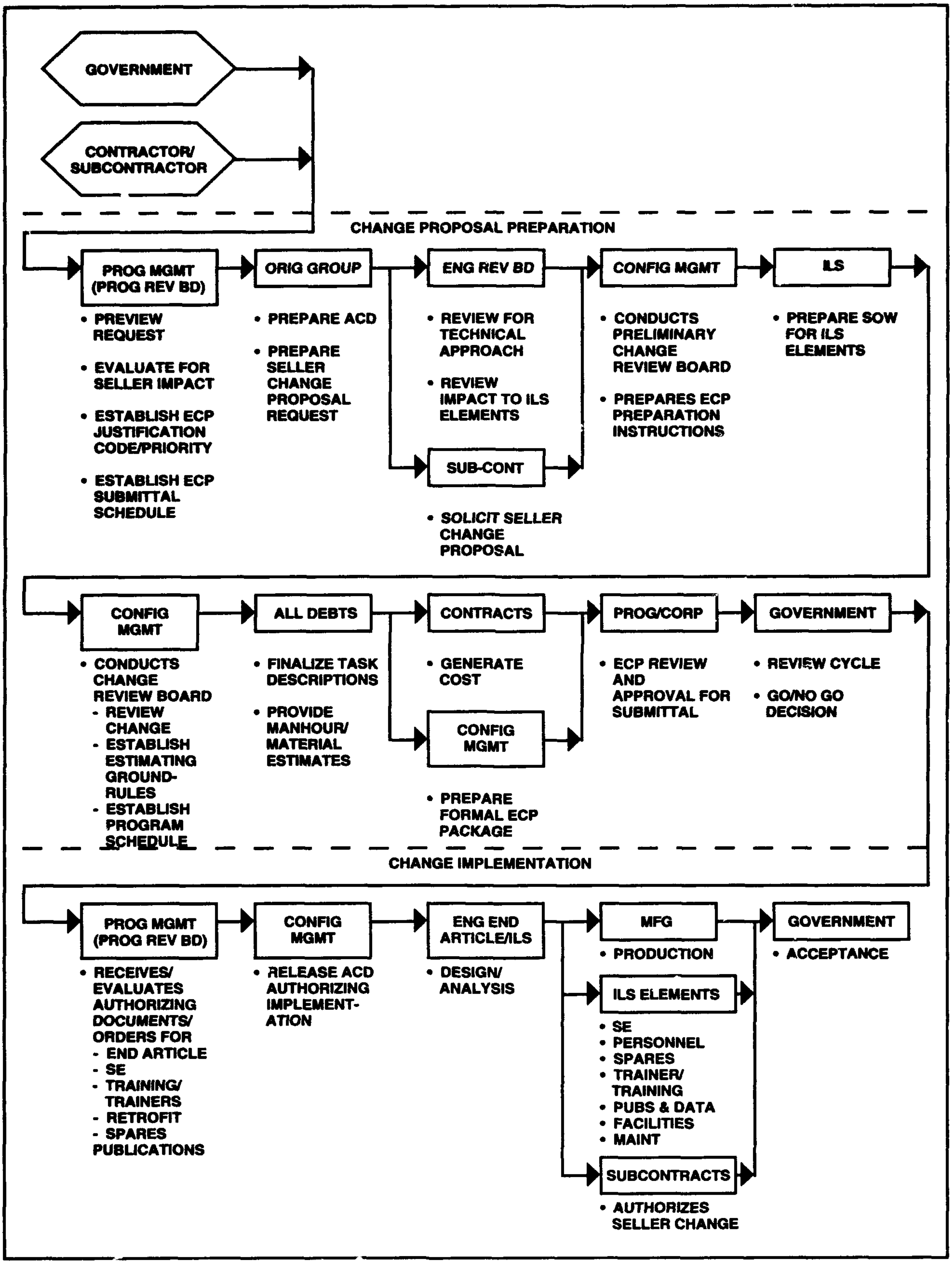


Figure 12-5. One Variation of ECP Preparation and Implementation by a System Contractor

Risk Area	Impact
• Inadequate transition planning	• EMD phase does not effectively validate support item risk areas; increase in production change traffic; extended contractor support period.
• Extensive engineering change traffic	• O&S cost thresholds exceeded; configuration of deployed support systems not compatible with fielded systems.
• Organic support implementation delayed	• O&S cost thresholds may be exceeded; this could stem from contractor support tasks being priced in a noncompetitive environment.
• Delayed completion of DT&E and OT&E effort	• Changing product baseline with expensive post-delivery retrofit in lieu of production incorporation.
• Product not adequately engineered for producibility	• High unit manufacturing cost; producibility improvement changes; configuration management problems with delivered support items.

Figure 12-6. Transition Risk Areas

Technique	Risk-Handling Techniques
• Assessing transition planning	• The transition from EMD to production should be documented with a transition plan that includes as a milestone the validation of a system support package covering and integrating all support elements. • This plan should be available prior to the start of EMD, updated and ratified early in the EMD phase.
• Timely and cost-effective planning of contractor and affected government agency support tasks	• The program and ILS managers must actively coordinate the development of the transition plan with contractor and other government agencies and use MIL-STD-973, "Configuration Management" as an effective ILS change management tool.
• Timely inclusion of government organic support considerations in planning	• Include user and depot representation in the planning process.

Figure 12-7. Transition Risk Handling

lines for the LSA process discussed in Chapter 7, and the planning, management visibility and control techniques discussed as part of the ILSP in Chapter 2. Some specific techniques applicable to the example risk areas are discussed in Figure 12-7.

12.5 SUMMARY

• Major ILS management risks in the transition to the production process are:

- Inadequate planning
- Extensive changes
- Delayed organic support
- Delayed completion of testing phase
- Inadequate producibility in design

• Major support problems may become evident when the system is transitioned to production.

• Transition planning should be completed before entering the initial production phase, so that the system support package can be validated before the production decision.

• Intensive ILS management is required to ensure that support items remain compatible with late changes to the materiel system.

12.6 REFERENCES

1. DoD 4245.7M, "Transition From Development to Production Manual."

2. DoDI 5000.2, Part 6, Section O, "Design for Manufacturing and Production."

3. MIL-STD-973, "Configuration Management."

4. Defense Manufacturing Management Guide, Defense Systems Management College.

13

DEPLOYMENT

13.1 HIGHLIGHTS

- Deployment Planning Requirements and Schedules

- Deployment Coordination and Negotiation Requirements

- The Deployment Plan, Agreement and Certification

- Managing the Deployment Process

13.2 INTRODUCTION

13.2.1 Purpose

To provide a managerial overview of the actions required to successfully deploy a new or modified materiel system.

The term "deployment" includes fielding, turnover, hand-off, fleet-introduction and other terms used by the Services. Included are deployment planning, execution and follow-up requirements covering the period from CED until the last unit is operational.

13.2.2 Objective

The deployment process is designed to turn over newly acquired or modified systems to users who have been trained and equipped to operate and maintain the equipment. All elements of ILS must be in place at deployment with the exception of those for which interim contractor support is available. Although it may seem a straightforward process, deployment is complex and can be costly if not properly managed. When properly planned and executed, deployments result in high unit readiness, reduced cost, less logistics turmoil and help establish a favorable reputation for the new system.

13.3 MANAGEMENT ISSUES

13.3.1 Scope

Deployment challenges the Service logistics organization with providing adequate support to a materiel system when custody of that system shifts to a user or operating command. At that point, the Service logistics capability may be augmented for various periods by a range of contractor provided services. First unit Initial Operational Capability (IOC) 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 deployment program may range from introduction of thousands of combat vehicles over a ten-year period to the staged transition 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 containing realistic lead times, supported by adequate funds and staff, and having the potential for rigorous execution. Applicable elements among those identified in

Figure 13-1 must be available on schedule or the system will not be operational.

Although a deployment schedule may be established at Milestone I, subsequent adjustments are possible and should be considered, particularly in the early stages of a program when a greater range of flexibility exists. In later stages of the acquisition process, the failure to meet a logistics milestone can translate either into a costly deployment delay or deployment of a system that cannot meet readiness goals. Either one will result in reduced capability.

13.3.2. Planning

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; and identification of funds. Planning for deployment begins in the CED phase. By Milestone I, the draft ILSP must be prepared to address the long-term deployment considerations. Deployment planning intensifies through the DV phase so that by EMD, a detailed plan for deployment can be prepared. This plan must be updated and coordinated on an ongoing basis to reflect program changes.

Dissemination of information to all participants is very important; each change must be passed on to every organization involved in the deployment process. 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 13-2 shows the relationship between deployment activities and major ILS activities. Figure 13-3 provides suggested topics for inclusion in the plan. The ILSMT must be actively involved in deployment planning. See Chapter 2 for additional material on planning.

13.3.2.1 Test and Evaluation

Supportability of a system should be demonstrated before deployment. The ILS manager must ensure that the TEMP includes supportability objectives, issues and criteria. Development and operational testing during EMD provides information for the Milestone III production approval decision, and provides input to follow-on testing requirements. These tests should provide assurance that the proposed logistics concepts and planned resources will be sufficient to support the system once deployed. This testing may also suggest changes to planned deployment actions. In addition, the Follow-On Test and Evaluation (FOT&E) may use the first unit equipped as the test unit; FOT&E planning must, therefore, be closely coordinated with deployment planning.

13.3.2.2 Logistics Support Analysis (LSA)

LSA task results have a significant impact on deployment planning and execution. Early Fielding Analysis (LSA Task 402) should be conducted during EMD. This task should be repeated as input data changes. Typical input data changes result from Evaluation of Alternatives and Tradeoff Analyses (Task 303), changes in deployment quantities and schedules, and changes in manpower and personnel requirements or availability. Early Fielding Analysis assists ILS management by assessing many elements, among them: the impact of the introduction of new systems on existing systems, the identification of sources of personnel to meet the require-

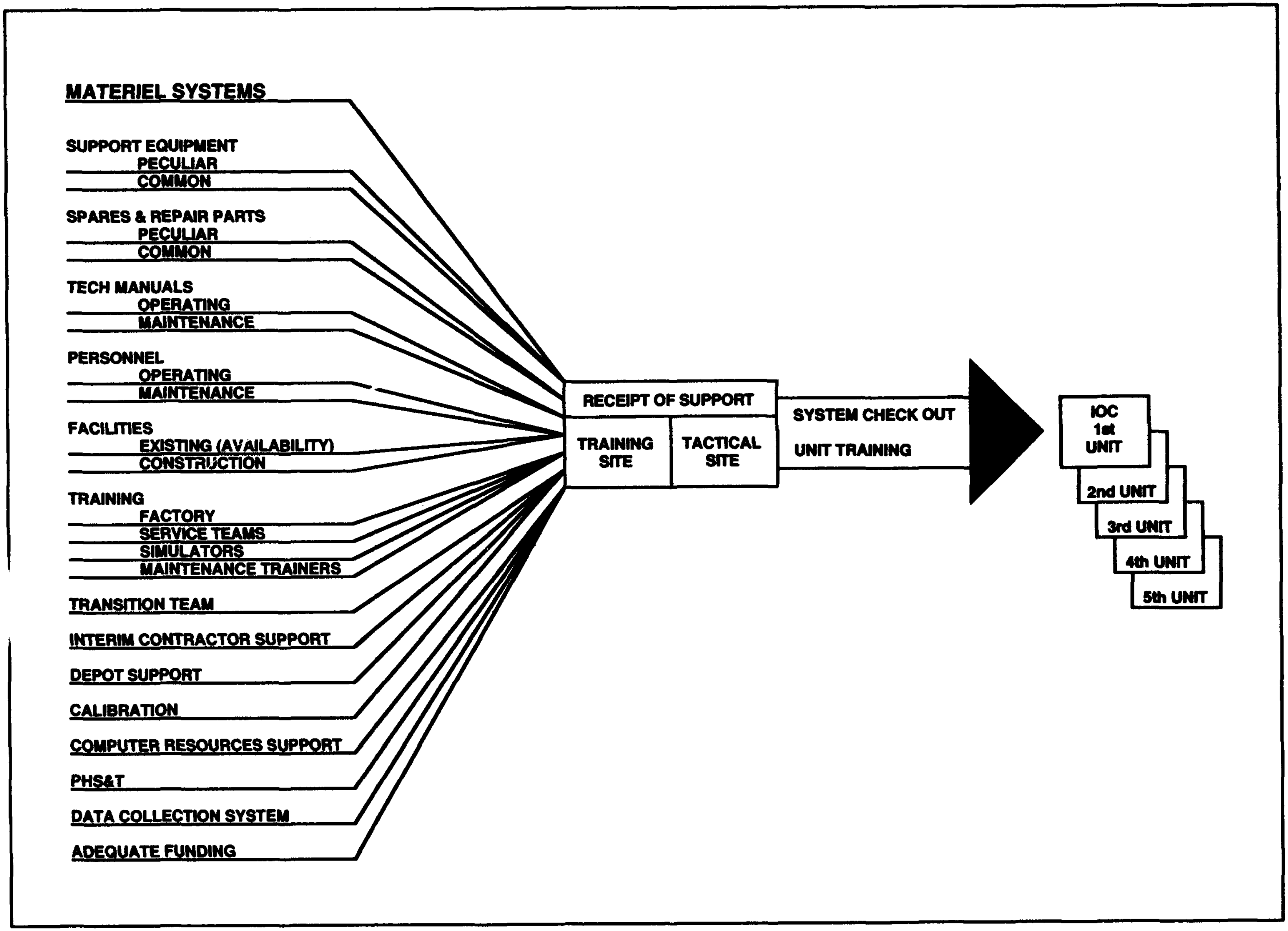


Figure 13-1. Deployment Requirements

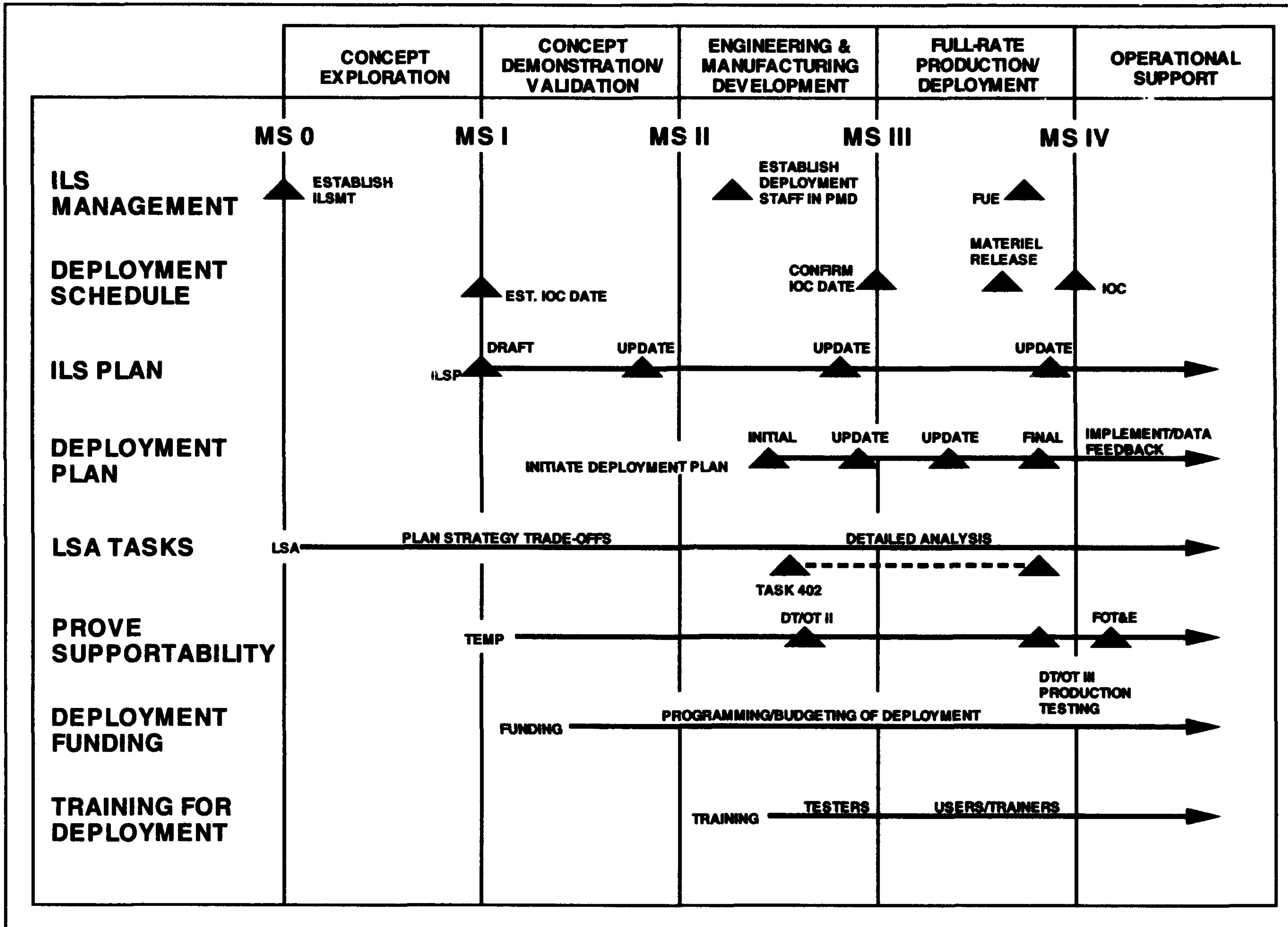


Figure 13-2. ILS Deployment Activities

TYPICAL DEPLOYMENT PLAN

I. INTRODUCTION
   A. Purpose
   B. Limitation of Data
   C. Logistics Support Concept
   D. Deployment Agreement and Certification (LOA, MOU)*

II. SYSTEM/END ITEM DESCRIPTION
   A. Functional Configuration
   B. Organizational and Operational Concepts
   C. Deployment Schedules

III. LOGISTICS SUPPORT AND COMMAND AND CONTROL
   A. Command and Control Procedures
   B. Logistics Assistance
   C. Materiel Defects
   D. Coordination

IV. SYSTEM SUPPORT DETAILS
   (Discuss each ILS Element)

V. THE PROGRAM MANAGERS COMMITMENT

VI. SUPPORT REQUIRED FROM USING COMMAND

VII. SUMMARY

APPENDIX
   A. Key Correspondence
   B. Plans and Agreements
   C. Developers Checklist
   D. User Command Checklist
   E. Classified Information

* Letters of Agreement, Memorandum of Understanding

SOURCE: DARCOM CIR 700-9-4

Figure 13-3. Suggested Contents of a Plan for Deployment

ments of the new systems, the impact of a program's failure to obtain all the logistics support resources and the essential logistics support resource requirements for a combat environment. The last subtask for the Early Fielding Analysis is to develop plans to alleviate potential fielding problems.

13.3.2.3 Funding

ILS funding is discussed in Chapter 10. It is important to reiterate here that specific funding requirements for deployment require early identification in terms of programming and budgeting. Deployment-related funding requirements may include military construction, training, travel, transportation of materiel, contractor support and can involve both PMO and user funds. There has been a continuing trend to give the PM more visibility and control over funds needed for deployment.

13.3.2.4 Warranties

The ILS manager must participate in the selection of "essential performance requirements" to be warranted in the production contract. 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 established warranties that allow Navy personnel to perform needed maintenance and then recover the cost incurred from the contractor.

When a warranty is to be used, the user must be involved in the planning and the warranty's impact must be accommodated in the deployment plan. The deployment plan should state which components are under warranty, by whom and for how long, the performance parameters covered, and the starting date or event of the warranty. It is often necessary to describe warranty provisions by equipment serial numbers. The interface between the user and the contractor should be explained in the plan.

Warranty coverage often begins when the item is accepted by the government and delivered to its first destination. If the first destination is a storage depot and the warranty period is measured in elapsed time, a portion or all of the warranted life may expire before the item is placed into use. Under these circumstances, it is preferable to seek warranty coverage that begins when the item is placed into service, or coverage that is based upon a measure of usage (such as miles driven or elapsed operating time).

13.3.2.5 Management Information System (MIS)

The ILS manager should establish an MIS to assist the deployment planning and implementation processes. The number of logistics elements, the varied disciplines involved in planning for deployment, the numerous funding sources for support and the multitude of interrelated data items make the deployment status difficult to track and update unless it is managed systematically. For example, a slippage in parts delivery for a simulator could mean that more training time is needed on the prime system. This would increase demands on maintenance (during a training period) and increase the demand for replenishment spares. The increased demand for spares could impact the availability of components for the production line or the initial support package for following deployments, causing a slippage in the deployment schedule. Slippage in the deployment schedule would increase the demand for support to the system being phased out — all the result of slippage in parts for the simulator. In addition, failure rates and operating problems could differ significantly from those encountered in the testing environment. These difficulties must be fed back to the ILS manager so that the support deficiencies can be corrected. As a minimum, on-site data collection, reports of trade-off analyses, status of support activities and costs and funding reports should be included in the MIS.

COMMAND/STAFF	RESPONSIBILITIES
PROGRAM MANAGEMENT OFFICE	• Establishes Working Group
	• Develops Supportability Testing Assessment
	• Provides Input to Training Plans
	• Prepares Deployment Plan
	• Coordinates Plan
	• Prepares Deployment Agreement or Certification
	• Negotiates Agreement or Certification with Using Command(s)
USING (OPERATING) COMMANDS	• Prepares Operational Support Plan
	• Provides Input to Deployment Plan
	• Negotiates Agreement or Certification with PMO
TEST AND EVALUATION ORGANIZATION	• Performs OT&E
TRAINING COMMAND	• Provides Input to Deployment Plan
	• Prepares Training Plans and System Training Requirements
SERVICE STAFF	• Provides Deployment Allocations, Manpower Changes, Training Facilities and Logistical Inputs to the Deployment Plan
	• Reviews Plans and Agreements
CONTRACTOR	• Provides Support/Warranty
	• May Provide Plan for Interim or Life-Cycle Maintenance and Supply Support

Figure 13-4. Deployment Planning, Negotiation and Coordination Requirements

13.3.3 Coordination and Negotiation

A deployment working group, which involves the ILSMT, should be established. The group should, at a minimum, have members from the using and supporting commands. Figure 13-4 depicts representative participants and responsibilities.

The major negotiation requirement is on the agreement or certification by the PM to deliver the system and its support; and by the user to prepare for its receipt. The agreement may be an integral part of the plan for deployment, negotiated between the two principals and coordinated among the many other participants. Negotiations should commence before the production decision and should be documented as required by each Service. For example, in the case of the USAF, the Turnover Agreement is documented in the PMP. The coordination may involve on-site meetings to coordinate the details of transfer, site planning and inspection, equipment on-site checkout and similar activities. The initial units to receive a new system frequently compete for replacement spares with the ongoing production line and with the build-up to support subsequent deployments. Depot level component repair may also compete with the production line for resources (test equipment, bits and pieces, skilled manpower, etc.). These problems are compounded when the fielded reliability does not meet the planned reliability. The priorities established for satisfying requirements during this time of support and production build-up should be included in the agreement.

13.3.4 Organization

As the planning for deployment intensifies, the PM should establish an organization within the PMO to assist the user, interact with the working groups and resolve problems that arise during deployment. Deployment personnel should be considered for both PMO and on-site assignments. Teams may be required for briefing and assisting user commanders and their staffs. System deployment teams on site can assist in the checkout of equipment, help perform the hand-off, train unit personnel and assure that support capabilities are in place. The assistance of contractor personnel is often desirable at this time and should be considered in the planning.

13.3.5 Materiel Release Review

The release of the first system to each major user activity follows a period of extensive planning and coordination. The materiel release review is a control mechanism to verify that all materiel and logistics deficiencies identified in OT&E have been corrected and that all logistics resources required to support the initial deployment will be available concurrent with the release of the system (see Figure 13-1). The materiel release is in essence a certification by the developing activity that all conditions required to achieve initial readiness have been met.

13.3.6 Lessons Learned from Previous Deployments

Figure 13-5 summarizes problem areas associated with previous deployments and suggested corrective actions.

13.4 RISK MANAGEMENT

13.4.1 Accelerated Programs

13.4.1.1 Risk Area

Compressed schedules increase the demand for critical assets during the time of normal asset shortages.

13.4.1.2 Risk Handling

Knowing that the acquisition strategy calls for an accelerated schedule, the ILS manager must assess the risks associated with acceleration, identify support concept alternatives that will minimize the risk and develop ILS program guidelines and techniques that will assure its proper execution. Interim contractor support is a feasible alternative that should be considered

COMMON PROBLEM AREAS	CORRECTIVE ACTIONS
Personnel Turnover	Document all plans, agreements and changes.
	Conduct new equipment training close to date unit will be equipped.
Conditional Materiel Release	User must understand and agree to the terms of a conditional materiel release.
Training of Operators and Maintenance Personnel	Software training required before ATE delivery so unit will be better prepared to participate in the acceptance testing.
	New equipment training plans must include provisions for the maintenance of equipment used in training. Contractor personnel may be considered for this task.
	Developer should brief operational commanders and their staffs prior to deployment.
	Developer must ensure all required support equipment is available prior to new equipment training.
	Personnel should be scheduled for new equipment training. They should have the correct skills, sufficient time remaining in the unit and meet all other training prerequisites.
	The use of video tapes and other media should be considered for new equipment training teams.
Establishing a PMO Deployment Team (Field Support)	Need experienced fielding personnel, who are logisticians familiar with the system. Must start looking for these people early.
Warranties	Establish simple procedures for returning failed parts to the manufacturer for analysis.
Deployment Plan for a Non-Logistics Significant Item	Plan may not be necessary, but user must concur with decision to eliminate the plan.
Contractor Involvement in Deployment Planning	Keep contractors informed of requirements so they can assess their tasks.
	Contracts must be negotiated to ensure support items are delivered concurrently with the end item.
Hardware Problems during User Hand-off Period	Establish a staging area (may be at contractor's facility) where maintenance personnel can check out all equipment.

Figure 13-5. Lessons Learned from Previous Deployments

and, if accepted, planning should be initiated as early as possible in the program. The using command and all other participants must be informed and involved in the planning. As stated in DoDI 5000.2, Part 7A, "Integrated Logistics Support," accelerated acquisitions require "adequate front-end funding to achieve established readiness objectives within the shortened development cycle."

13.4.2 Schedule Slippage

13.4.2.1 Risk Area

Failure to understand how a schedule slippage in one functional element impacts the other elements and milestone events.

13.4.2.2 Risk Handling

The PM should employ a network schedule, such as Critical Path Method, which identifies all deployment activities and annotates the critical path of those activities that would delay deployment if not accomplished on schedule.

13.4.3 Delayed Facilities Planning

13.4.3.1 Risk Area

Failure to perform timely facility planning can result in substantial deployment delays.

13.4.3.2 Risk Handling

Facility requirements which are included in the Military Construction Program normally have a planning and funding cycle of five years, and up to seven years, for NATO requirements. Early identification of requirements and coordination with the military construction proponent, therefore, is necessary. A facilities support plan is desirable.

13.4.4 Updating the Deployment Plan

13.4.4.1 Risk Area

Failure to keep the deployment plan updated, complete and coordinated with all concerned can result in deployment delays and problems.

13.4.4.2 Risk Handling

The PM should ensure that fielding personnel in his or her organization recognize the need to promptly update the plan as requirements, schedules and responsibilities change. In addition, he or she must also ensure that the plan and its changes are fully coordinated with the user, and that the ILSMT or working group provides the vehicle for its coordination and distribution. Finally, the user should be required to prepare a plan for the receipt of the new system; and should have established policy and procedures regarding the preparations for receipt of new system by its subordinate units.

13.4.5 Managing Problems in the Deployment Process

13.4.5.1 Risk Area

Unreported and uncorrected deployment problems can seriously disrupt the process.

13.4.5.2 Risk Handling

Problems need to be quickly identified, reported and solved. The deployment plan should provide a process that will lead to the rapid correction of deployment problems and deficiencies. On-site program management and contractor personnel can facilitate the identification and reporting of problems. In addition, for the benefit of future deployments, lessons learned reports based on the problems and their solutions should be submitted to the appropriate Service agency.

13.5 SUMMARY

- Deployment is a key event in the acquisition life cycle. Its success can be evaluated in terms of how quickly and smoothly it is achieved, and how easily the user establishes the ability to meet and sustain the system readiness objective.

- The success of the process is directly related to how well it is planned, coordinated, negotiated and executed. Major points are as follows:

  - Deployment planning starts in the CED phase. It intensifies during EMD, reaching a peak during the P&D phase as the deployment approaches

  - Deployment is characterized by extensive coordination and negotiation. It deals with many long lead time tasks; e.g., facilities, personnel, provisioning, procurement of training devices and spares and repair parts.

13.6 REFERENCES

1. MIL-STD-1388-1A, "Logistics Support Analysis."

2. AR 700-127, "Integrated Logistics Support."

3. AFR 800-8, "Integrated Logistics Support (ILS) Program."

4. AFR 800-19, "System or Equipment Turnover."

5. SECNAVINST 5000.39, "Acquisition and Management of ILS for Systems and Equipment."

14

OPERATIONAL AND POST-PRODUCTION SUPPORT

14.1 HIGHLIGHTS

- Assessing Operational Performance
- Maintaining Readiness
- Planning Post-Production Support
- Funding of Engineering and Publications Support

14.2 INTRODUCTION

14.2.1 Purpose

To provide an overview of ILS planning and management activities associated with operational support and post-production support.

14.2.2 Objective

The overall objective of operational and post-production support (PPS) is to maintain the materiel system in a ready condition throughout its operational phase within the O&S cost levels documented in LCC estimates and acquisition program baselines. System readiness objectives established early in development constitute the baseline for planning operational and PPS, and supportability assessments during the operational phase.

14.3 MANAGEMENT ISSUES

14.3.1 Background

Figure 14-1 is a notional display of system readiness levels across a system's life. Prior to deployment, success in achieving system readiness objectives is evaluated by modeling or other estimation techniques employing input data obtained in development and operational testing. The first opportunity to directly measure readiness occurs when the system is initially deployed in its operational environment with its planned logistics support structure. Operational support planning and PPS planning are performed early in the acquisition cycle and serve a two-fold purpose: to ensure that readiness objectives are met and sustained and to provide advance planning for corrective actions if required.

About 60 percent of the LCC of a system is dedicated to O&S. Logistics support problems increase with the age of the system and the rate of obsolescence of the technology employed in its manufacture. While problems may be encountered in all the support elements (such as the retention of manpower skills and replacement of support equipment), the loss of production sources for spares and repair parts has presented the greatest difficulties. Each materiel system has unique PPS problems, and the success of PPS will depend on the manager's ability to anticipate problems

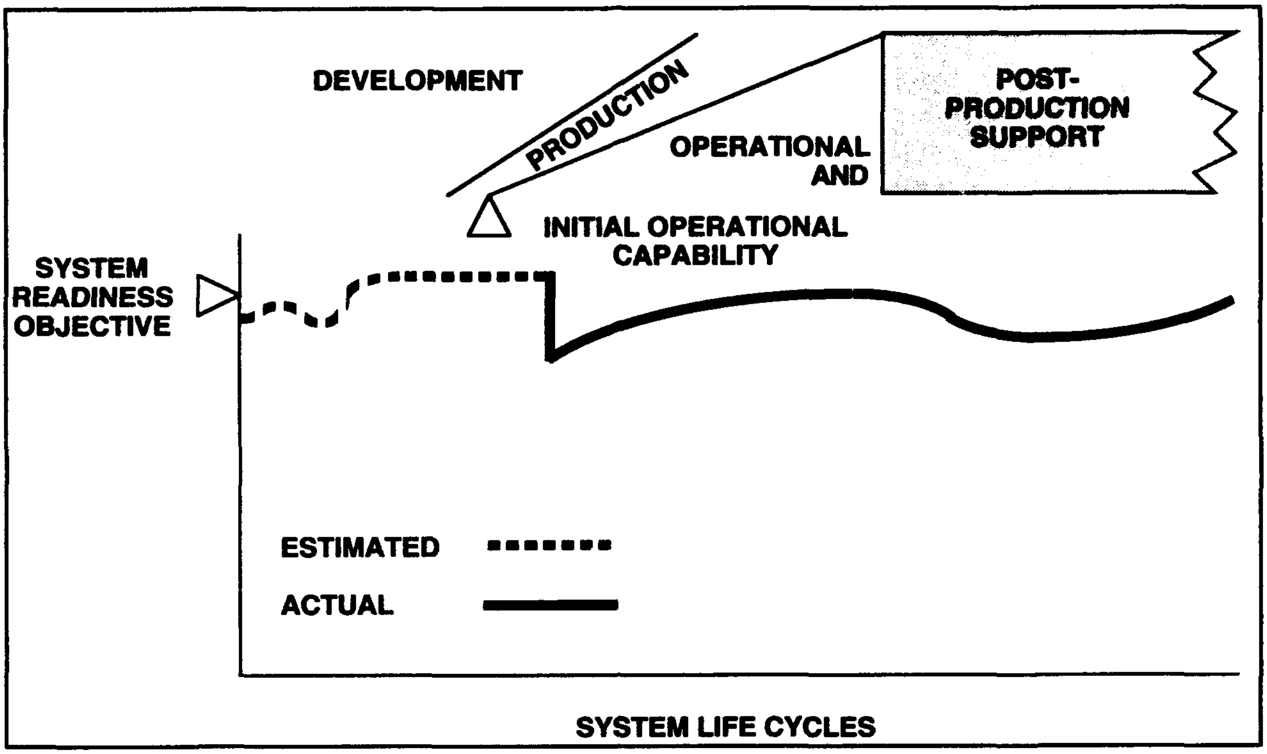


Figure 14-1. Readiness in the Acquisition Process

and find cost-effective solutions before they reduce readiness and/or increase support costs.

14.3.2 Maintaining Readiness

14.3.2.1 Assessing Performance

Although adequate, development testing and operational testing, with their inherent data feedback, are critical to the success of a materiel system, they do not fully measure the experiences that occur once that system has been fielded. Existing data collection systems, such as Visibility and Management of O&S costs (Navy), O&S Cost MIS (Army), Maintenance and Material Management (3M)(Navy), and Maintenance Data Collection (AF), provide coverage for many general applications. Their output may not be sufficiently timely or detailed, however, to support R&M and supportability analysis of deployed systems. Supplemental data collection is often desirable and should be considered to provide timely corrections to design and quality assurance deficiencies evidenced by high failure rates, poor training evidenced by high false removal rate or poor technical data evidenced by high "no defect — item checks good" findings for replaced components. The earlier these problems are detected in the operational environment, the less costly the retrofit and the more effective the operational system will be.

It should be noted that the root causes of system performance problems are often not directly determinable from data reported by the user community. For example, a dramatic increase in reported, compared to, predicted mean-time-to-repair for a specific component could be attributed to any one or a combination of the following factors:

- Wrong skill specialty selected in the maintenance plan;

- Inadequate or improper training;

- Unclear or incorrect maintenance procedures documented in the technical manuals;

- Improper or no tools provided; and

- Design deficiency.

14.3.2.2 Adjusting the Support

The initial corrective reaction to a readiness shortfall is to draw more extensively on existing logistics support resources. Responsive actions might include accelerating delivery of critical parts, increasing stockage levels, modifying training procedures and technical manuals, changing operational or maintenance procedures or concepts and increasing technical assistance to user personnel.

As stated in Chapter 8, initial estimates of requirements for ILS elements (manpower, supply support, etc.) are based on anticipated failure rates, maintenance times and other input factors. Logistics support resources must be recomputed as required, based upon updated values of R&M and other parameters measured during the O&S phase.

14.3.2.3 Correcting The Design and Specifications

There are two basic reasons to modify the manufacturing drawings of an operational system: to correct performance and operational R&M deficiencies, and to improve and maintain the producibility of major components and spares over time. With reference to the first issue, it is important to detect design deficiencies as early as possible while the system is still in production. Procurement and application of field modifications are much more expensive than a production engineering change. Drawing obsolescence, the second issue, occurs primarily in the post-production period and becomes apparent when components can no longer be procured with the outdated drawing. Inability to obtain components incorporated in the original design can also necessitate modifications to the deployed system (e.g., change a bracket to accept a new commercial component).

14.3.2.4 Updating the Software

Embedded computer systems are critical to most modern weapon systems. This criticality has resulted in increased requirements to develop, test and maintain the software used to control the mission and operation of the materiel system, as well as the software employed with related ATE.

Rapid growth and expanding technology have caused two problems. First, software programs exhibit a greater degree of latent defects than hardware design. Software maintenance involves the correction of original deficiencies in requirements specifications, design and coding which may crop up over an extended period of the life cycle. Second, system developers have encountered difficulties developing and maintaining ATE software compatible with system design during EMD and P&D phases.

Responsibility for initial establishment of a complete and tested software capability remains with the system developer. However, it must also be recognized that there will be a continuing need for software maintenance during the deployment and the post-production periods. ILS managers and the Services must establish the funding and the organization required to update the software to correct deficiencies and reflect hardware design changes.

14.3.3 Post-Production Support

PPS is associated with the systems management and support activities necessary to ensure continued attainment of system readiness objectives, with economical logistics support after cessation of production of the end item (major system or equipment) until disposal.

Some sources of post-production problems are displayed in Figure 14-2. Each system will have unique support problems and many of these will be unanticipated. The ILS manager must include PPS as a line item in the budget to accommodate the resultant changes.

14.3.3.1 Providing The Plan

Task 403, PPS Analysis, of MIL-STD-1388-1A, "Logistics Support Analysis," should be performed during EMD. The PPSP should be a joint government-contractor effort. It should be completed before Milestone III and updated with the ILSP. The PPSP should be maintained current as long as the system is in the active inventory and should focus on such issues as:

- System and subsystem readiness objectives in the post-production time frame;

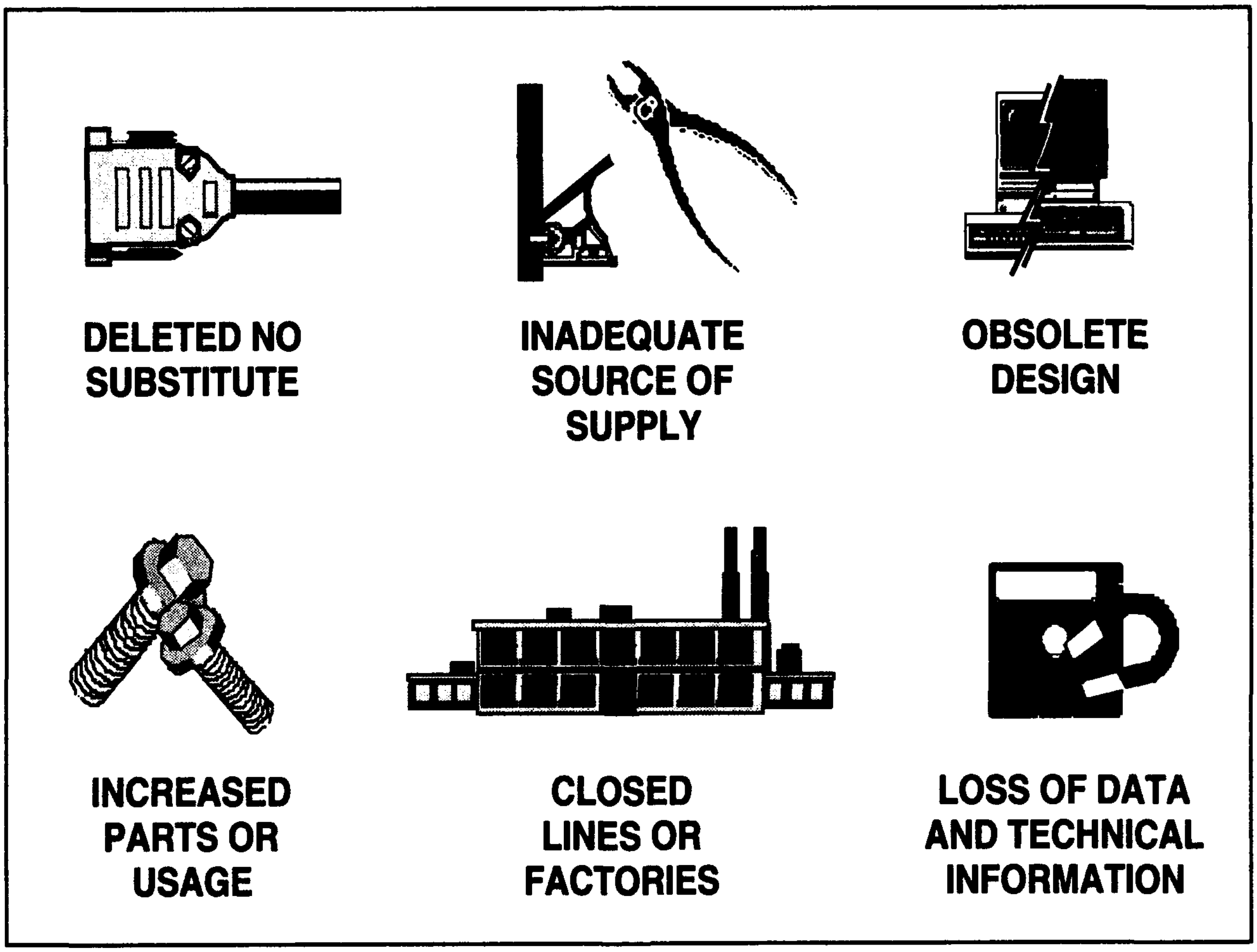


Figure 14-2. Problems of Post-Production Support

- Organizational structures and responsibilities in the post-production time frame;

- Modifications to the ILSP to accommodate the needs of PPS planning;

- Resources and management actions required to meet PPS objectives;

- Assessment of the impact of technological change and obsolescence;

- Evaluation of alternative PPS strategies to accommodate production phase-out (e.g., second sourcing, standardization with existing hardware, engineering level of effort contracts in the post-production time frame, life-of-type buys, contract logistics support vs. organic support, maintenance concept change, suitable substitute, redesign and flexible computer integrated manufacturing);

- Consideration of support if the life of the system is extended past the original forecast date;

- Data collection efforts in the early deployment phase to provide the feedback necessary to update logistics and support concepts;

- Potential for Foreign Military Sales and its impact on the production run; and

- Provisions for the use, disposition and storage of government tools and contractor-developed factory test equipment, tools and dies.

The PPS Checklist (Figures 14-3, 14-3a and 14-3b) provides additional issues to be addressed in PPS planning.

14.3.3.2 Establishing a Competitive Environment

Relying on a single industrial source for critical support may increase risk in the cost and availability of spares and repair parts during the operational phase; and particularly after termination of end item production. The ILS manager should consider obtaining technical data, drawings, tooling, and so forth, to enable the Service to complete follow-on logistics support. The cost of obtaining this information and capability should be weighed against the potential benefits of competition, particularly during an extended post-production period. The FAR, Part 7 requires the inclusion of detailed component breakout plans in the acquisition strategy initially prepared during the CED phase. (Note that historically, the government has done a poor job in keeping good configuration control after the loss of production experience, equipment, and drawings; and has purchased inadequate technical documentation to enable the breakout and competition of equipment, spares and repair parts. Good documentation and configuration control are essential if the government is to successfully compete follow-on support. It may be advisable to have the major manufacturer continue a level of effort in documentation after the production line closes.)

14.3.3.3 PPS Decision Meeting

The PM should conduct a PPS decision meeting before the final production order to avoid major nonrecurring charges if follow-on production is later required, and to update the PPSP based upon the latest data available. The meeting should also explore the advisability of purchasing items from the manufacturer — for example, manufacturing structures, forgings and castings, insurance items to cover crash/battle damage or fatigue, production sources for

Post-Production Support Checklist

1. Supply Support

a. Continued producibility and availability of Components and Parts. (Peculiar items within the system should be reviewed down to the subcomponent level and national stock number.)

(1) Is technical data available at a reasonable cost?

(2) Is stability of design a concern?

(3) Is competitive procurement appropriate?

(4) Is the production base adequate?

(5) What proprietary rights, if any, have been declared by the prime or subconcontractors?

(6) Are rights in data procurable at a reasonable cost?

(7) What is life-of-type buy potential?

(8) Are repair facilities available?

(9) Is the component critical to system performance?

(10) What is the expected life of the system/subsystem?

(11) Is there FMS support potential?

(12) Are workaround alternatives available?

(13) Are quality assurance requirements unique or difficult to duplicate?

(14) Is contract logistics support feasible?

(15) Will failure rates be high enough to sustain organic capability?

(16) Technology obsolescence. Is the system or part replaceable with new technology?

(17) Will potential design changes eliminate the need for the part?

(18) Is an engineering level-of-effort contract appropriate to ensure continued supportability?

b. What support equipment is required?

c. Will support of support equipment be available at a reasonable cost?

d. Is there an adequate organization to focus on and resolve post-production problems?

2. Engineering

a. Who has been designated to perform acceptance inspection QA on tech data?

b. Will there be adequate field engineering support, configuration management and ECP support? Will there be adequate support to update:

Figure 14-3. PPS Checklist

(1) Technical manuals;

(2) Production drawings;

(3) Technical reports;

(4) Logistics support data;

(5) Operational and maintenance data;

(6) User's manuals; and

(7) Data requirements.

c. Will operational experience be considered in changes to the materiel system?

3. Competitive Procurement

a. Is production rate tooling complex/cost significant? Is it readily available or long lead to procure?

b. Have all cost factors associated with a breakout/competitive procurement decision been considered? Cost elements should encompass added tooling, special test equipment, qualification testing, quality control considerations, rights in data procurement, etc. If performance specifications are applicable, the following additional costs pertain: cataloging, bin opening, item management, technical data, production and distribution variables, configuration control and engineering requirement costs, etc.

c. Are all potential customers included in the production requirements computations?

4. ATE Support

a. Hardware

(1) Will hardware be supportable?

(2) Will mission, ECP changes be compatible?

(3) Will modifications be possible, supportable?

(4) Is system expandable?

b. Software

(1) Will diagnostic software changes be possible?

(2) Will the organizational structure allow for continuing software update?

(3) Will software changes caused by ECP/mission changes be incorporated?

5. Storage and Handling

a. Will shelf life items be replaceable when they expire?

b. Will special shipping containers be replaceable/repairable?

c. Will peculiar manufacturing tools and dies be procured and stored?

Figure 14-3a. PPS Checklist (Continued)

6. Technical Data

a. Will manufacturing shop standards and procedures be retained?

b. Will all changes that occur during the production phase be incorporated in the manufacturing shop drawings?

7. Training

a. Will simulators and maintenance trainers be supportable in the out years?

b. Will follow-on factory training be required?

8. Maintenance

a. Will depot overhaul be required in the out-years? Organic or Contract?

b. Will provisions be made in the front end to accommodate a service life extension program if required? (Most recent materiel systems have been extended well past their original forecasted disposal date.)

c. Will components be available to support the depot overhaul program in the out-years?

d. Is it realistic to co-mingle manufacturing with repair on a single production line?

Figure 14-3b. PPS Checklist (Continued)

SPARE AND REPAIR PARTS ACTIONS

INCREASE SUPPLY	DECREASE DEMAND
• Develop a reprocurement technical data package and alternate production sources. • Withdraw from disposal. • Procure Life-of-Ty:›e Buy. • Seek substitute (interchangeable) parts. • Redesign system to accept standard component, if not interchangeable. • Purchase plant equipment; establish an organic depot capability. • Subsidize continuing manufacture. • Draw (cannibalize) from marginal, low priority systems.	• Restrict the issue to critical applications in support of combat essential items. • Phase out less essential systems employing the same parts. • Restrict issue to system applications where no substitute is available. • Accelerate replacement of the system.

Figure 14-4. Logistics Actions to Reduce Impact of Loss of Parts

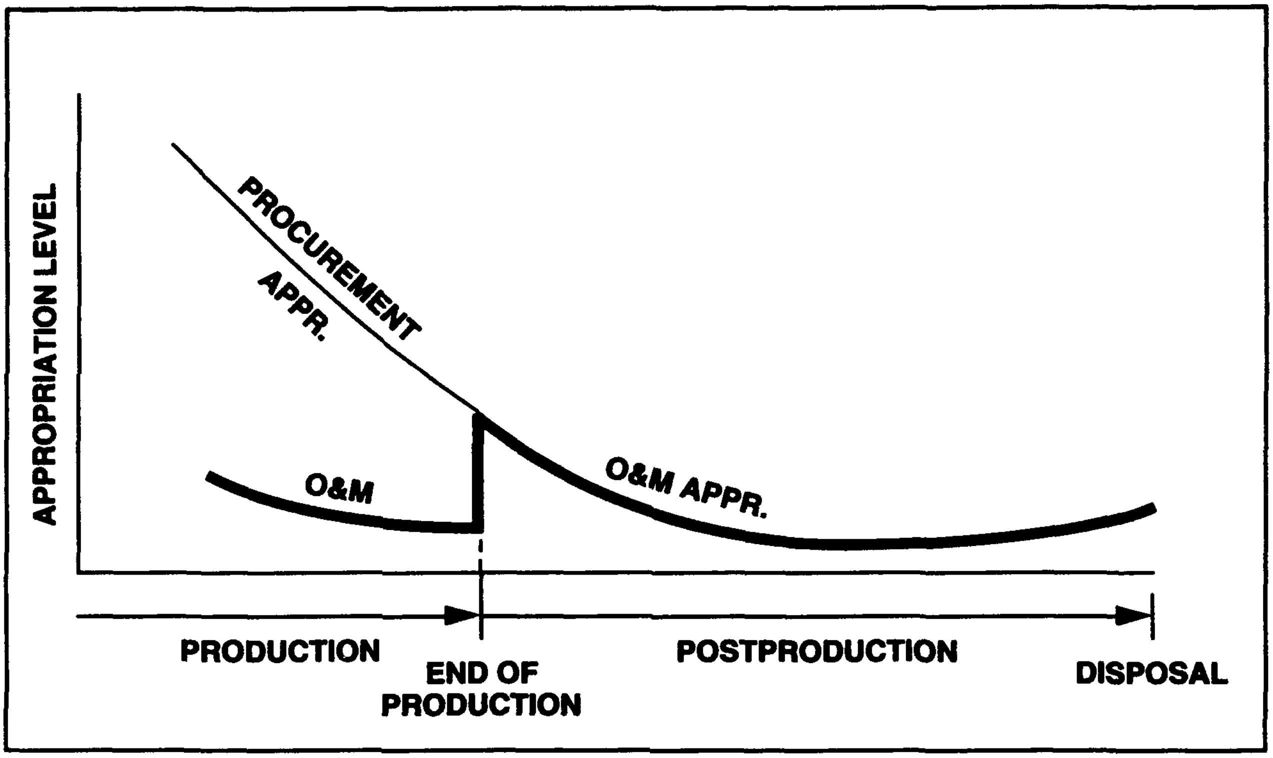


Figure 14-5. Sources of Engineering and Publication Funding

unique spares and repair parts. There are two basic options available to logistics managers: to increase the supply or decrease the demand. A combination of actions listed in Figure 14-4 is often the most practical approach. These remedies are generally less effective and more costly than effective actions taken earlier in the production cycle.

14.3.4 Funding of Engineering and Publications Support

As stated in 14.3.2.3 and 14.3.2.4, there is generally a continuing need to correct hardware design, specifications and software after the completion of system development. Changes to technical manuals are also needed to reflect the system and software changes; and to correct other deficiencies reported by operator and maintenance personnel. While the materiel system (end item) is still in production, the procurement appropriation bears the major burden of these costs. However, an abrupt change in funding responsibility occurs at the beginning of the first post-production fiscal year.

Figure 14-5 is a notional display of the continued funding requirement for the above costs extending into the O&S phase. While the total requirement for engineering and publication support should decrease as initial problems are detected and corrected, the total burden for such costs shifts to the O&M appropriation after the termination of system production. Early recognition of the need for PPS and the programming and budgeting of O&M funds are required to maintain a continuity of effort. The increase in fund requirements shown in the late post-production phase is attributed to growing design obsolescence and wearout. The ILS manager should work directly with his supporting O&M appropriation manager to develop valid requirement estimates (usually derived from experience with similar systems) and program and budget accordingly.

14.4 RISK MANAGEMENT

14.4.1 Delayed PPS Planning

14.4.1.1 Risk Area

Continued support of the materiel system by the industrial base existing in the post-production time frame may not be economically feasible.

14.4.1.2 Risk Handling

PPS planning must be performed when acquisition strategy, design and documentation options are still available for incorporation into an effective PPSP. This includes both engineering and financial issues. The PPSP must be maintained and tied to each ILSP update. While the ILSP is essential to establishing the R&S of the materiel system, the PPSP is crucial to maintaining that R&S throughout the system's life. A deficiency in either will adversely impact system effectiveness and mission readiness.

14.5 SUMMARY

- The first empirical measure of system readiness occurs when the system is deployed in the operational phase.

- Readiness and R&M experience during the operational phase is employed to adjust the support resources that were programmed during the EMD and P&D phases.

- Performance and R&M deficiencies must be detected and corrected as early as possible in the O&S phase of the system.

- The objective of the planning performed during system development is to ensure that readiness objectives are met and sustained through the O&S phase, including the post-production period. Planning deferred until the problems are encountered will not be as effective.

14.6 REFERENCES

1. DoDD 4151.1, "Use of Contractor and DoD Resources for Maintenance of Materiel."

2. DoDI 5000.2, Part 7A, "Integrated Logistics Support."

3. MIL-STD-1388-1A, "Logistics Support Analysis."

MODULE

V

International, Nonmajor and Joint Programs

All programs require an ILS effort. This module presents the differences in ILS management for international, nonmajor and joint-Service programs.

15

INTERNATIONAL PROGRAMS

15.1 HIGHLIGHTS

- Security Assistance Program Management Structure
- ILS Issues for Security Assistance Programs
- ILSPs for Security Assistance Programs
- Cooperative Logistics
- ILS Issues for Cooperative Programs

15.2 INTRODUCTION

15.2.1 Purpose

To provide a managerial overview of ILS issues unique to international programs, with a focus on security assistance and coproduction programs.

15.2.2 Objectives

15.2.2.1 Security Assistance

Support objectives in a security assistance program are to assist non-U.S. users of U.S. equipment to achieve readiness objectives and to increase standardization and interoperability in a combined military structure (e.g., NATO).

15.2.2.2 Coproduction

The support objectives in a coproduction program are to increase standardization and interoperability in a combined military structure, increase production and repair sources, and provide for the interchangeability of spares and repair parts on components manufactured by both co-producing countries.

15.3 MANAGEMENT ISSUES

15.3.1 Background

International logistics is the negotiation; planning and implementation of supporting logistics arrangements among nations, their forces, and agencies. It also relates to the coordination of U.S. logistics systems or procedures with those of foreign countries, and the provisioning and receipt of logistics support among friendly governments (JCS Pub. 1, "Dictionary of Military and Associated Terms"). Security assistance and coproduction — two aspects of international logistics — are the subject of this chapter.

15.3.1.1 Security Assistance

Security assistance concerns the transfer of military and economic assistance through sale, grant, lease or loan to friendly foreign governments. The two major laws that apply to Security Assistance programs are the Foreign Assistance Act (FAA) of 1961, as amended, and the Arms Export Control Act (AECA) of 1976, as amended.

Security assistance consists of the following major programs administered by the Department of State.

- Economic Support Fund

- Peacekeeping Operations

- Commercial Export Sales Licensed Under the Arms Export Control Act.

The following programs are administered by the DoD.

- The International Military Education and Training Program (IMETP);

- Foreign Military Sales (FMS) Financing;

- Foreign Military Financing Program (FMFP).

The State Department has overall responsibility for continuous supervision and general direction of the Security Assistance Program because it is part of the U.S. foreign policy. Direction includes determining whether there will be a program for a particular country or activity and, if so, its size and scope. It also includes the determination of whether a particular sale will be made and when.

DoD administers and manages all transactions that involve the transfer of defense materiel, services and the provision of military training for international students. To the extent practical, security assistance requirements are integrated with other DoD requirements and implemented through the same DoD systems, facilities and procedures.

The Defense Security Assistance Agency (DSAA) is the DoD focal point for tracking arms transfers; and budgetary, legislative and other security assistance matters. The focal point for training in Security Assistance is the Defense Institute of Security Assistance Management (DISAM) at Wright Patterson Air Force Base, Ohio.

The military department logistics organizations manage security assistance as an integral part of their overall mission. They procure and provide Defense articles, services and training to meet security assistance requirements. They are also responsible for providing information necessary to ensure that proper security assistance planning can be accomplished. In general, Security Assistance procurements are conducted in accordance with the existing FAR. Additional information on Security Assistance responsibilities is contained in DoD 5105.38-M, "Security Assistance Management Manual."

Security assistance programs have a unique financial management system. DSAA established policy and procedures are contained in DoD 7290.3-M, "FMS Financial Management Manual." A basic principle of FMS financial management required by the AECA is that the FMS program will result in no cost or profit to the U.S. government.

The Security Assistance Accounting Center (SAAC) performs FMS accounting and billing, collections, trust fund management, and administrative fee accounting for all security assistance programs. Each department interfaces with the DSAA financial system through an International Logistics Control Office (ILCO). Procedures for interface between SAAC and each Service are different and require a variety of planning, obligating and expending procedures that are delineated in Service directives.

A FMS case manager is designated within a DoD component: and is responsible for performing case planning and for implementing the sales and lease agreements that are documented in the Letter of Offer and Acceptance (LOA), DD-1513. The case manager ensures the case objectives are established between the foreign country and the U.S. government. Objectives are achieved within applicable laws and regulations to maintain the case on schedule, accomplish the case within cost constraints and close the case as planned. In some FMS cases, there may be a separate ILS manager designated to support the case manager. For the program managed system, this responsibility should be with the ILS manager of the program office. Specific responsibilities for a case manager can be found in DoD 5105.38-M, "Security Assistance Management Manual."

15.3.1.2 Coproduction

Coproduction of systems, subsystems and components is the sharing of product manufacture and assembly among the U.S. and foreign producers. ILS issues for the U.S. program office result from foreign production of components for use in U.S. military systems.

A coproduction project may be limited to the assembly of a few end items with a small input of local country parts, or it may extend to a major manufacturing effort requiring the buildup of capital industries. Coproduction programs are defined in DoDD 2000.9, "International Coproduction Projects and Agreements Between the United States and Other Countries or International Organizations."

From a political and military viewpoint, the programs strengthen alliances with other nations through standardization and interoperability of military hardware. From an industrial viewpoint, an ally's industrial technological capability is upgraded and high technology employment is created.

Coproduction is implemented either by a government-to-government arrangement, normally called a Memorandum of Agreement (MOA), or through specific licensing arrangements by designated commercial firms. Coproduction enables an eligible foreign government, international organization, or designated foreign commercial producer to acquire the know-how to manufacture or assemble, repair, maintain and operate a specific defense item or support system. Coproduction programs are normally initiated by a properly authorized DoD component and by authorized representatives of foreign governments and international organizations.

Offset arrangements are often requested as a condition of sale (DoDD 2000.9). Offset arrangements provide procedures for the coproducing country to balance trade and expenditures through the seller's agreeing to make offsetting purchases from the country. The U.S. government will not guarantee offset arrangements. DoD policy does not require U.S. contractors to place subcontracts in foreign countries as a condition for the sale of U.S. defense articles to those countries.

There is no counterpart to DSAA for coproduction programs. Since coproduction involves acquisition programs, the training focal point for coproduction and other cooperative programs is DSMC.

15.3.2 Integrated Logistics Support Issues in Security Assistance Programs

When a foreign country decides to procure a U.S. system, there are a variety of ways in which the U.S. and the customer can interact to support the system over its life cycle.

Effective and efficient integration of a materiel system into a foreign government's military structure may include developing the foreign country's logistics support requirements, processes and procedures for the new system. U.S. support for the system will vary depending upon the nature of the sale (commercial or FMS) and the existing logistics capabilities of the foreign country. A detailed discussion of logistics in Security Assistance programs, and other international logistics issues, is contained in the DSMC "Guide for the Management of Multinational Programs."

Detailed ILS planning must be performed to develop tailored or modified support for the system when requested by the purchasing country. In this instance, it is also appropriate to document ILS planning in a special ILS Plan. Joint ILS planning conferences or in-country site surveys, or both may be used to develop the plan.

15.3.2.1 ILS Planning Conference/ In-Country Site Survey

When considering the choice of the ILS planning conference or the in-country site survey method, the PM decides which process will provide adequate information to effectively plan logistics. The choice is influenced by a number of factors:

- The attitude of the foreign country toward a U.S. team evaluating their capabilities;
- The technological and logistical competence of the foreign country;
- The experience of the foreign country in introducing similar systems; and
- The availability of data at various locations.

If the in-country survey is desired, representatives of the foreign country and a team of U.S. personnel work together to conduct the survey. The specific goals of the site survey team generally are to provide the customer country with an assessment of support requirements; to assist the country identify required levels of support and to assess their capabilities to provide the support; and to develop and document a plan for introducing and supporting the system.

Careful planning and preparation are necessary for a successful site survey. As part of the planning process, a pre-site survey may be required to collect preliminary data. The pre-site survey team generally consists of a small group of highly trained experts who lay the groundwork for the full site survey and prepare an administrative plan and an implementation plan. The administrative plan provides information for the site survey team to assist them with in-country living logistics — air fares, hotel accommodations, passport/visa data, and so on. The implementation plan spells out specific duties of the site survey team working groups and the data they will provide for the Program and Support Plan (P&SP). This document should include a plan of action and milestones for the formal site survey.

A logistics planning conference is usually chosen when the foreign country has an existing logistics system that can support the equipment without a survey. If the planning conference option is chosen, the foreign country participants should include representatives of the relevant logistics specialties. They should have the necessary information to complete the planning exercises described in the following paragraphs. Consultation between the countries prior to the actual convening of the meeting is helpful to ensure that the required information is available.

A detailed understanding of how the U.S. FMS system works and an appreciation for how their own requirements relate to U.S. requirements will help the foreign country make decisions on items they wish to procure via FMS. The item delivery lead time and FMS processing time will have to be considered when defining system requirements and item need dates. Planning schedules will indicate when FMS customers should submit Letters of Request (LORs) for an LOA to activate the U.S. procurement system. The agreement should address the extent of logistics support the U.S. will provide after the system is no longer in the active U.S. inventory.

The basic structure for an ILS Plan for a U.S. system is described in Chapter 2 and can be used as a baseline for the special P&SP. The structure for this P&SP can be tailored to the needs of the foreign country. The schedule and the logistics element sections especially will require modification to reflect support of the foreign country's logistics system.

15.3.2.2 Logistics Support Analysis (LSA)

The LSA performed to support U.S. forces is based upon the U.S. operational role, utilization rates and support concepts. However, there is a core of data within the LSA and LSA records prepared for U.S. forces that is independent of the role, utilization rates and support concepts. This core can be used to derive LSA and LSAR information needed to compute the foreign country's requirements for logistics support resources (maintenance manpower, supply support, provisioning quantities, etc.). If the foreign country desires, the U.S. military service can assist with or perform the analysis, documentation and resource computations.

15.3.2.3 Maintenance Planning

Maintenance planning may require an in-depth study of the foreign customers' ability to support the system. The results of the examination will help in tailoring maintenance recommendations to correspond to the customers' current maintenance philosophy and practices. Logistics support will be analyzed and unique requirements identified. The analysis should result in recommendations on how best to use the country's maintenance capabilities, and how DoD can interface and assist in executing the overall maintenance program.

15.3.2.4. Facilities

The country's existing facilities should be analyzed for adequacy of structures, property and permanently installed support equipment; to determine their capability to support operation and maintenance of the new system. The analysis should result in recommendations on cost-effective methods to adapt existing facilities to support requirements of the new system.

15.3.2.5 Supply Support

The country's supply system should be analyzed to determine how best to integrate supply support of the new system; how the foreign customer's supply system works, ADP interfaces and required new methods to support the system should be thoroughly analyzed. A Repair of Repairables (ROR) program can be designed and offered using either foreign customer or U.S. sources for repair of repairable items. A working knowledge of the country's industrial capabilities is necessary to properly address ROR programs. If the decision is made to use U.S. maintenance facilities to support ROR, an FMS case will be established. Because separate organizations are responsible for providing supply support, this FMS case is separate from the case that covered the sale of the system.

15.3.2.6 Support Equipment

An analysis should be performed of the country's ability to satisfy requirements for support equipment with their existing equipment or support equipment producible by the foreign country. The analysis should identify requirements to procure support equipment from the U.S. government or industry where applicable.

15.3.2.7 Training and Training Support

Operational and maintenance training requirements are normally established by the U.S. and will be the baseline for a foreign training program. The analysis can assess existing training facilities, level of English language proficiency, level of core technical training, level of operational proficiency and the foreign skill specialty structure. Once an assessment is made in these areas, recommendations on training devices, training courses, required software, and operator and maintenance training requirements can be incorporated into a training plan. The training plan will identify sources for accomplishing the training and purchasing the training devices, available contractor support and applicable software. The U.S. military service generally supplies a majority of the initial support in this area.

15.3.2.8 Technical Data

The analysis should establish requirements for the country's technical data, including publications and documentation library, to support the purchased system. The applicable U.S. service will have established the documentation required to support U.S. forces and the analysis can compare the customers documentation needs with this U.S. documentation. As a follow-on, an information exchange agreement between the purchasing country and the U.S. is desirable in order to transfer data efficiently in a mutually agreeable and timely way. Another customer requirement is to establish a separate FMS case to provide automatic updates and revisions of publications and documentation.

15.3.2.9 Configuration Management

Consideration should be given to a method to share the costs of the continuing engineer support. Continued adherence to the U.S. configuration has many advantages, particularly if the customer is going to rely on the U.S. supply system and technical documentation program. If the customer's configuration differs from the U.S. configuration, then supply support, software development and support equipment development will be costly and may adversely affect interoperability and standardization objectives.

15.3.2.10 Contractor Engineering and Technical Services (CETS)

CETS can be a vital element in any foreign acquisition of a U.S. system. The technical expertise available to the customer in all phases of the program can assist the customer in performing maintenance, conducting training, purchasing support equipment, test and evaluation, follow-on provisioning, inspections and other aspects of the program. The customer country can contract through the U.S. military services using the primary FMS case or a separate FMS case or may contract directly with a commercial firm for CETS. The requirements for CETS will depend largely on the ability of the foreign country to attain full organic operation and maintenance capability.

15.3.2.11 Safety

The analysis will identify potential safety hazards resulting from unique operations and maintenance procedures used by the foreign country. U.S. military instructions, guidance and reporting procedures are normally used as a basis for this evaluation. If safety hazards do exist, the analysis should result in recommendations for engineering change proposals, revised operation and maintenance procedures and other corrective actions.

15.3.3 Integrated Logistics Support Issues in Coproduction Programs

This section addresses ILS issues related to coproduction of a U.S. developed system with logistics support provided to U.S. forces by the coproducing nation. The major issues that must be addressed in the ILS planning.

- Foreign Industrial Base Survey
- Offset Agreements
- Configuration Management

15.3.3.1 Foreign Industrial Base Survey

An industrial base survey must be conducted by the U.S. military service, prime contractor and their foreign counterparts to ensure; the foreign production facilities satisfy U.S. military specifications and quality assurance acceptance standards are on an achievable schedule with a reasonable cost. In particular, the existing tooling must be evaluated and any deficiencies corrected. Foreign capacity to produce spares on a surge basis in peacetime and wartime must be addressed because of its readiness implications. To ensure that these logistics requirements are met, a pilot preproduction or low rate initial production program should be undertaken before the final production program commitments are made.

15.3.3.2 Offset Agreements

The PM must also require that logistics support offset agreements be analyzed carefully to ensure that logistics support provided by the foreign country contributes to system readiness and is cost-effective. An offset agreement should address several issues: willingness to provide the support on a continuing basis; the ability to substitute other equipment or services for those in the agreement because of inability to provide a previously agreed equipment or service; and inclusion of depot maintenance. The cost analysis must seek to define a set of hardware or services to satisfy the offset commitment, which has a reasonably competitive cost compared to domestic production and is feasible for the foreign country to produce. Offset agreements providing for equipment maintenance can have a positive readiness impact by providing facilities at locations closer to the operating sites.

15.3.3.3 Configuration Management

Manufacture of any item by a second source generally requires changes to manufacturing drawings to enable production by that source. The process to develop and approve engineering change proposals will be more critical when the second source is in a foreign nation and uses different manufacturing processes. Configuration control should be exercised by the U.S. configuration manager. The objectives of this control are to retain interchangeability of line replaceable units with no impact on maintenance procedures performed at the organizational level and minimal impact on maintenance performed at the intermediate and depot levels.

15.4 SUMMARY

- Security assistance and coproduction programs are two major approaches to international logistics.

- The DSAA is the DoD focal point for security assistance. DISAM is the DoD focal point for security assistance training.

- Depending on the logistics capabilities of the foreign country, an in-country site survey or a conference should be conducted to plan logistics for the Security Assistance Program.

- Logistics support analyses for the Security Assistance Program should result in recommendations tailored in the areas of: maintenance planning, facilities, supply support, support equipment, training and training support, data, configuration management, contractor engineering and technical services and safety.

- Planning of coproduction programs should address the qualitative and quantitative adequacy of all logistics support to be provided by the foreign country to U.S. forces.

- Effective configuration management is needed to enable common support of each nation's equipment.

15.5 REFERENCES

1. DoDD 2000.8, "Cooperative Logistics Supply Support Arrangements."

2. DoDD 2000.9, "International Co-Production Projects and Agreements Between the U.S. and other Countries or International Organizations."

3. DoDD 2010.4, "U.S. Participation in Certain NATO Groups Relating to Research, Development, Production and Logistics Support of Military Equipment."

4. DoDD 2010.6, "Standardization and Interoperability of Weapon Systems and Equipment within the North Atlantic Treaty Organization."

5. DoDD 2010.8, "Department of Defense Policy for NATO Logistics."

6. DODI 2010.9, "Mutual Logistics Support between the U.S., Governments of Eligible Countries and NATO Subsidiary Bodies."

7. DoDD 2040.2, "International Transfers of Technology, Goods, Services and Munitions."

8. DoD 5105.38M, "Security Assistance Management Manual."

9. DoD 5220.22R, "Industrial Security Regulations."

10. The Management of Security Assistance, Defense Institute of Security Assistance Management.

11. Guide for the Management of Multinational Programs, Defense Systems Management College.

12. The Federal Acquisition Regulations (FARs).

13. Public Law 90-629, "Arms Export Control Act," as amended.

14. "Report of the Defense Science Board Task Force on Industry to Industry International Armaments Cooperation," June 1983, Under Secretary of Defense (Research and Engineering).

16

NONMAJOR DEFENSE ACQUISITION PROGRAMS

16.1 HIGHLIGHTS

- Management of Nonmajor Programs by the Military Services
- Integrated Logistics Support of Nonmajor Programs
- ILS Risk Considerations in Nonmajor Program Acquisition

16.2 INTRODUCTION

16.2.1 Purpose

To provide an overview of the management of ILS for nonmajor programs by the military Services.

16.2.2 Objective

The objectives of the ILS activities for nonmajor programs are identical to those applicable to major programs, that is, deployment of ready and sustainable materiel systems within cost and schedule targets.

16.3 MANAGEMENT ISSUES

16.3.1 Background

DoDD 5000.1, "Defense Acquisition" and DoDI 5000.2, "Defense Acquisition Management Policies and Procedures" establishes policies and procedures for nonmajor programs managed by the Services, as well as, for major programs that come under the overall control of the DAE.

Defense Program Acquisition Categories (ACATs), funding criteria, milestone decision authority and examples are identified in Figure 16-1. Major programs designated ACAT ID are managed by the DAE. The ACAT IC designates major programs selected for component (e.g., military service) management or transitioned to component management. The ACATs II, III, and IV designate nonmajor component-managed programs of progressively decreasing size or military role.

The ACAT II programs meet the Congressionally established funding criteria for "major systems." DoD components will establish criteria for ACAT III and IV designation and will delegate milestone decision authority to the lowest level deemed appropriate.

16.3.2 Acquisition and Management of Nonmajor Programs

Nonmajor programs may not have the intense management and detailed reviews experienced by major programs. Managers and their staffs may be assigned several nonmajor programs and may handle a variety of actions covering a wide spectrum of acquisition functions. Less supervision and the requirement to deal with many

ACQUISITION CATEGORY (ACAT)	TYPE OF PROGRAM	FUNDING CRITERIA RDT&E/PROC. (FY 1980 $)	MILESTONE DECISION AUTHORITY	EXAMPLE
ID	MAJOR DEFENSE ACQUISITION PROGRAM	$200 MILLION/ $1 BILLION	UNDER SECRETARY OF DEFENSE (A&T) (DAE)	USAF ADVANCED TACTICAL FIGHTER (F22)
IC	MAJOR DEFENSE ACQUISITION PROGRAM	$200 MILLION/ $1 BILLION	COMPONENT HEAD OR ACQUISITION EXECUTIVE	USA BRADLEY FIGHTING VEHICLE SYSTEM
II	MAJOR SYSTEM (NONMAJOR PROGRAM)	$75 MILLION/ $300 MILLION	COMPONENT HEAD OR ACQUISITION EXECUTIVE	USA 155 MM HOWITZER IMPROVEMENT PROGRAM (PALADIN)
III	NONMAJOR PROGRAM	COMPONENT OPTION	COMPONENT OPTION	USN CLOSE-IN WEAPON SYSTEM (CIWS)
IV	NONMAJOR PROGRAM	COMPONENT OPTION	COMPONENT OPTION	USN DIVER ACTIVE THERMAL PROTECTION SYSTEM

Figure 16-1. Acquisition Categories

areas can result in some actions being overlooked. Logistics personnel must ensure that ILS receives the resources and attention required. Small programs may have a small logistics burden individually; however, they have a large aggregate impact. It is important that ILS planning be applied as necessary and tailored to each nonmajor program.

16.3.2.1 Developmental Systems

Specific ILS procedures for influencing the design and for defining and acquiring the support parallel those for major programs but are generally characterized by a reduced scope, fewer iterations, fewer personnel and smaller budgets. The LSA requirements for nonmajor programs, particularly those requiring only minor development, are often significantly reduced by tailoring.

16.3.2.2 Nondevelopmental Items (NDI)

DoDI 5000.2 Part 6L, "Nondevelopmental Items" defines NDI as any item (system or component) that is:

- Available in the commercial marketplace;

- Previously developed by a Federal, State, or local agency of the U.S. or a foreign government with which the U.S. has a mutual defense cooperation agreement;

- As described above that requires only minor modification to meet the requirements of the procuring agency; and

- As described above that is currently being produced but is not yet in use.

DoDI 5000.2, Part 6L states that materiel requirements shall be satisfied to the maximum practicable extent through the use of NDI when such products will meet the user's needs and are cost-effective over the entire life cycle. Market research and analysis should be conducted to determine the suitability and availability of NDI before initiating any developmental effort. Purchase of NDI offers the benefits of shortened acquisition time and reduced ownership cost.

It should be noted that NDI may include major programs as well as nonmajor programs. The KC-10A "Extender" cargo-tanker aircraft is a production variant of the DC-10A commercial aircraft.

The logistics support challenges of purchasing nondevelopmental items include:

- Design Influence — Design influence is generally limited to the selection process. Source selection criteria, therefore, should include the following.

  - Similarity of current and intended use;

  - Supportability-related design factors, e.g., R&M;

  - Compatibility with common or available multiuse support equip ment;

  - Utility of available operator and maintenance manuals; and

  - Availability of supportability data and experience.

- ILS Resources — Funds must be programmed and budgeted for the performance of ILS tests and analyses normally conducted during development, and for acquiring the ILS elements (see Chapter 10).

• ILS Planning — The planning requirements described in Chapter 2 are also applicable to NDI. ILS plans may be prepared to cover individual items or categories of items (e.g., commercial test equipment). In either case, the contractor's data and field experience will be helpful in structuring the plans.

• Maintenance Planning — The choice between contractor and organic support is based on operational constraints, schedules, resources, and the mission of the user. When the NDI is "off-the-shelf" and commercial/contractor support is chosen, minimal LSA and documentation is required. In fact, use of the contractor's support philosophy and support structure (e.g., skills, facilities, equipment, technical documentation and training) may be a feasible and preferred alternative. If not, the support should be tailored to the user's requirements. When organic support is preferred but lead times are insufficient, interim contractor support may be necessary during the period required to establish an organic support capability.

• Supply Support — NDI procurement poses the problem of securing long term sources of spares and repair parts. Several alternatives are available. They include procuring a life-time supply before terminating the contract with the source, or giving selection preference to the commercial product having the greatest likelihood of having a long-term supply. A requirement for provisioning technical documentation in accordance with MIL-STD-1388-2A or 1388-2B should be considered in the solicitation.

• Test and Evaluation — An evaluation of the military suitability and supportability of NDI is required if marketplace testing or other developmental data is inadequate or fails to address the intended military environment.

• Technical Data — Commercial manuals should be used if feasible and if they satisfy the requirements of the intended user. The alternative is the commitment of considerable time and money to convert the manuals to military specifications. The decision to use contractor support facilitates the use of commercial manuals.

16.4 RISK MANAGEMENT

16.4.1 Accelerated Acquisitions

16.4.1.1 Risk Area

Lead times for delivery of NDI can be extremely short, particularly for in-stock commercial items. This poses a substantial risk of deployment with incomplete or inadequate logistics support and attendant degraded readiness.

16.4.1.2 Risk Handling

Applicable management approaches include:

• Performing detailed logistics planning concurrently with development of the acquisition strategy;

• Determining the need and extent of contractor support required, including appropriate logistics support requirements in the solicitation;

• Employing existing commercial or other developmental data to compute supply support stockage levels;

• Considering use of reliability improvement warranties to enhance reliability; and

• Planning and budgeting for a supportability evaluation.

16.4.2 Configuration Control of Commercial Items

16.4.2.1 Risk Area

The government does not control the configuration of items procured from the commercial marketplace. This presents two potential risks. First, that subsequent competitive reprocurement of the end item may lead to a totally different internal configuration with different support requirements. And second that there is no automatic guarantee that original commercial suppliers will continue to manufacture spares and repair parts to fit the government's configuration.

16.4.2.2 Risk Handling

These configuration risks may be reduced by the following:

• PPSP should be performed to determine such viable alternatives as buyouts, modifications and government manufacture (refer to Chapter 14 for additional information) or

• Multiyear procurement from the same source should be considered in order to decrease the impact of configuration changes in follow-on procurement.

Pre-solicitation market surveys should be performed to determine the probable availability of a civilian after-market that will supply components for an extended period. For example, when the Army procured commercial 1 1/4-ton trucks in 1975, surveys indicated that major components would remain available through the useful life projected at that time.

16.5 SUMMARY

• The military Services employ decentralized acquisition and ILS management procedures for nonmajor programs.

• Procurement of NDI may offer substantial reductions in total program cost and acquisition time; however, the reduction in time requires that logistics planning be performed concurrent with development of the acquisition strategy.

• Acquisition in nonmajor programs poses special considerations because of the more general management and review procedures employed by the Services. Logistics personnel have less program supervision and broader responsibilities for each system.

• Viable mechanisms are available to attain readiness objectives for NDI. These include incorporation of supportability issues in the source selection process and use of existing LSA documentation.

16.6 REFERENCES

1. DoDI 5000.2, Part 6L, "Nondevelopmental Items."

2. AR 70-1, "Army Acquisition Policy."

3. AR 700-127, "Integrated Logistics Support."

4. AFR 800-2, "Acquisition Program Management."

5. AFR 800-8, "Integrated Logistics Support (ILS) Program."

6. NDI Acquisition - An Alternative to "Business as Usual," Defense Systems Management College.

17

JOINT SERVICE PROGRAMS

17.1 HIGHLIGHTS

- Roles of Lead and Participating Services
- ILS Funding for Joint Programs
- Performance of Joint ILS Activities
- Inter-Service Coordination and Communication

17.2 INTRODUCTION

17.2.1 Purpose

To present an overview of ILS planning and management responsibilities for joint programs.

17.2.2 Objective

Logistics management objectives of joint programs are to realize economies by joint performance of ILS planning, analysis and documentation; satisfy essential logistics support needs of each Service; and attain established R&S objectives.

17.3 MANAGEMENT ISSUES

17.3.1 Background

The OSD and Congress encourage joint programs because such programs provide opportunities to reduce acquisition and logistics support costs and to improve interoperability of equipment in joint operations.

The ILS management of joint programs is similar to that of single Service programs, with one major exception — joint program management requires the accommodation of each participating Service's unique requirements resulting from differences in equipment deployment, mode of employment and support concepts.

17.3.2 Policies

Key policies prescribed in DoDI 5000.2, Part 12B, "Joint Programs" are as follows:

- Mission needs, operational requirements and program plans will be structured to encourage and provide an opportunity for multi-Service participation;
- The milestone decision authority will approve joint program designation as early in the acquisition process as possible and will appoint the lead Service; and
- Inter-Service logistics support will be used to the maximum extent possible commensurate with effective support to operational forces and efficient utilization of DoD resources.

The following additional policy guidance is provided in AR 700-129/OPNAVINST 4105.2A/AFR 800-43/MCO4110.2, "Management and Execution of Integrated Logistics Support for Multiservice Acquisition":

• The executive (lead) service will make every effort to accommodate the unique ILS requirements of participating Services; and

• All involved Services will standardize ILS requirements and data products as much as possible.

17.3.3 Joint Management Structure

Although there is no overall single structure for the management of joint programs, the OSD and the Joint Logistics Commanders have identified required management relationships. The military services must build a structure that responds rapidly to decisions of the lead military service PM and ILS manager, and provides a direct information path conveying the requirements of each Service to the PM. Figure 17-1 identifies the required joint program staff relationships. Typical staffing of a joint program office includes the considerations illustrated in Figure 17-1.

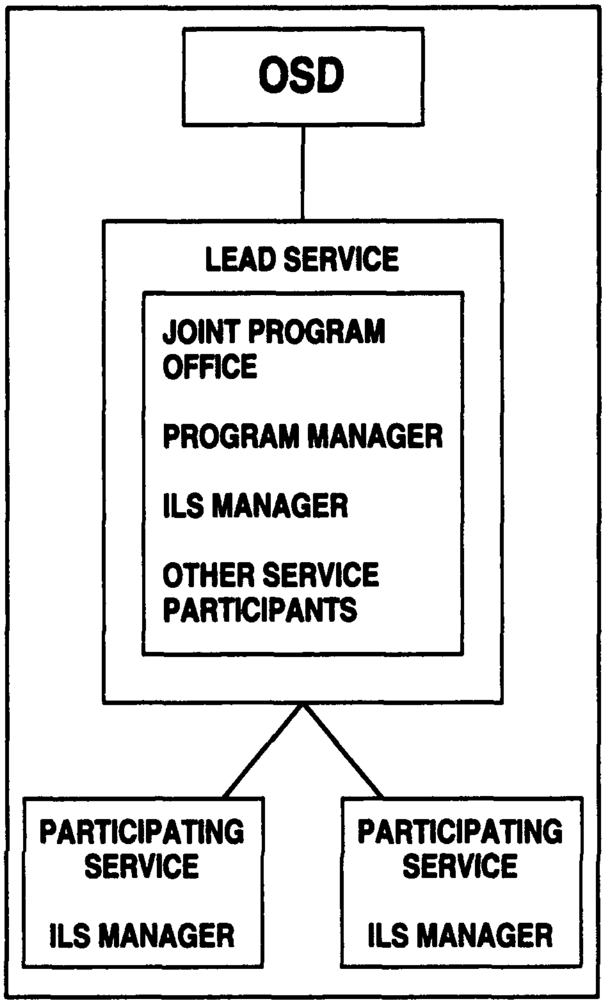


Figure 17-1. Joint Program Chain of Command

• The lead service establishes a manning document for the program office, with positions to be filled by representatives of the participating Services. The manning document also designates key positions for the senior representative of each participating Service.

• The participating services assign personnel to fill identified positions in the jointly staffed program office. The senior representative assigned to the program office reports directly to, or has direct access to, the PM and functions as the participating Service's representative on all issues pertaining to that Service.

• The lead Service ILS manager establishes an ILSMT with members from the lead and participating Services to support accomplishment of all ILS functions including the performance of all logistics support analysis for the joint program.

• Each participating Service designates an ILS manager to support the lead Service ILS manager.

17.3.4 Documentation of Joint Programs

Initial program documentation, beginning with the MNS, will be prepared by the Service first identifying a mission deficiency that cannot be satisfied by a nonmaterial solution. The MNS, which is prepared prior to establishment of a program, is forwarded for validation of the need and consideration of joint potential to the Service's operational validation authority or, for programs with potential to become major defense programs, to the Joint Requirements Oversight Council (JROC). Joint potential should be considered during MNS development, to include identification of needs which may cross Service boundaries and coordination with the Services affected concerning the potential for a joint program.

The MNS will be further considered by the milestone decision authority at milestone 0 to determine if it justifies further effort. If so, a study phase will be initiated to identify and evaluate alternatives to meet the deficiency. Normally, an acquisition program, per se, will not yet exist, and the Service initiating the MNS will bear the responsibility of developing documentation for the program initiation decision review at Milestone I with some level of support from the other Services, if the program has been identified as one with joint potential. Full consideration of other Service requirements, operational concepts and logistics support systems is crucial during this study phase, in recognition of the fact that many of the basic ILS system design decisions are made here.

Once a joint program is formally established at Milestone I, a lead Service (normally, but not always, the Service that initiated the MNS) will be designated. From that point forward, the lead Service has primary responsibility for all program documentation. Generally, joint program milestone documents will be single documents with separate appendices, when required, to support Service-peculiar requirements.

The Joint Integrated Logistics Support Plans (JILSP) parallels the content and purpose of ILSPs of single-service programs. (Refer to 2.3.4.) AR 700-129/OPNAVINST 4105.2A/AFR 800-3/MCO 4110.2 provides guidance for preparation of JILSPs.

17.3.5 ILS Funding for Joint Programs

Funding responsibilities of the lead and participating Services are prescribed in DoDI 5000.2, Part 12B and summarized below. The milestone decision authority may agree to or direct alternative arrangements.

- Research, Development, Test and Evaluation (RDT&E) funding of requirements common to all participants is provided by the lead Service. Each Service funds its own unique ILS activities.

- Procurement is funded by each Service for ILS assets (support equipment, training equipment, etc.) to support its deployed systems.

- Operation and Maintenance funds for operation and maintenance requirements to support its deployed systems are provided by each Service.

- Military Construction, new or modified facilities may be required to support development testing and operational deployment. Funds for common facilities required during development are programmed by the lead Service. Funds for operational facilities are provided by each Service to support individual requirements.

Each participating Service uses its own Service channels to identify program requirements to OSD. However, the joint PM maintains overall responsibility for identification of total funding requirements and their inclusion in a joint program Funding Plan. The joint PM also consolidates contracting requirements and contract award for the entire development and production program. The participating Services transfer the required obligational authority to the Joint Program Office or that office's supporting command for this purpose.

17.3.6 Unique ILS Requirements

Given identical systems (which is not always the case) the military services will often operate the systems with differing operations, supply and maintenance support concepts and with unique support equipment. Techniques to accommodate essential Service-unique requirements within the framework of common approaches are discussed below.

17.3.6.1 Logistics Support Analyses

MIL-STD-1388-1A, "Logistics Support Analysis" provides a common structure, recommended timetable and objectives for a large body of analyses; however, many of the detailed procedures to perform the tasks are Service-unique. For example, the Services employ different models for RLA, RCM, and supply stockage computations. ILS managers of a Joint Service Program should endeavor to reach agreement on common models for each analytic technique applied to the joint system. Use of common models will reduce the total analytical effort and also reduce differences in the results obtained. Some differences will remain as a result of Service variations in logistics parameters (order and ship time, for example) and maintenance concepts.

17.3.6.2 Logistics Support Analysis Record (LSAR)

The developers of MIL-STD-1388-2A and 2B, "DoD Requirements for a Logistics Support Analysis Record" have incorporated mechanisms to accommodate Service variations in configuration, supply and maintenance concepts and operational roles. As an example, Service variations in maintenance task levels and replacement rates for the same component can be entered with alternate LSA records at the component level of detail. Separate LSA output reports may then be produced for each Service; for example, separate Service summaries of direct annual maintenance manhours for the total system.

17.3.6.3 Technical Publications

The Services have different requirements for technical manuals or orders. In addition to the variations in support concept, operational role and configuration mentioned in the previous paragraph, there can also be differences in the reading comprehension levels of the target audience. The Services generally have been successful in accommodating those differences in joint-use technical orders and technical manuals, especially when the joint approach begins at program initiation. Reading comprehension levels occupy a range rather than a precise point value; the Services seek a single target level that satisfies the needs of each Service. Other differences are covered in the body of the specific publication or in Service supplements.

17.3.6.4 Training

Training requirements vary. The Services employ different skill specialty code systems as well as different maintenance concepts. Single location training for a jointly used system can still be cost-effective and should be considered early in the planning cycle. As one example, Air Force and Army personnel receive common maintenance training on the TSC 94 and TSC 100 satellite terminals at the Army's Ft. Gordon training facility.

17.3.6.5 Depot Maintenance Inter-Servicing (DMI)

DMI studies seek to avoid unnecessary duplication of facilities and equipment among the Services. The studies have been performed effectively for both single-Service and multi-Service new starts. Inter-Servicing plans for joint programs should be addressed in the JILSP. This approach has been applied very effectively on joint programs. The TRI-TAC Program develops tactical communications systems used by the Army, Navy, Air Force and Marine Corps. The PM has identified TRI-TAC items to be managed by individual Services. The designated Service then provides depot support for all users of that system.

DoDI 5000.2, Part 12B places strong emphasis on depot maintenance inter-Servicing. An inter-Service logistics support agreement is required for joint Service programs before Milestone III. A program review will be held by the logistics head of the lead Service, if needed, to remove impediments to inter-Service logistics support. Additional guidance is provided in AMCR 750-10, OPNAVINST 4790.14, MCOP 4790.10A, AFLCR/AFSCR 800-30, "Logistics Depot Maintenance Interservice."

Depot maintenance consolidation studies will likely have significant impact on depot maintenance inter-Servicing.

17.4 RISK MANAGEMENT

17.4.1 Inadequate Coordination

17.4.1.1 Risk Area

Logistics planning tasks for joint programs require more coordination than for single-Service programs; no other aspect of joint program management will present the manager with as many inter-Service differences, which can occur in all of the ILS elements. The lack of extensive coordination can lead to:

- Incomplete or inadequate logistics support at the time of initial deployment;

- A decision by one or more Services to go it alone with ILS planning and development of Service-unique logistics support; and

- Loss of the economies that can be gained by joint ILS performance.

17.4.1.2 Risk Handling

Success in joint program management comes from facilitating and expediting the required coordination, not from eliminating coordination and fragmenting the program. Methods that have been employed include:

- Early Recognition of Joint Requirements — A vital first step is early recognition during mission area analyses that a joint program is needed. The joint MNS may be initiated by OSD, JCS, or two or more Services in unison. When this occurs, a joint program structure is recommended in the MNS, funding requirements for each Service are identified in each Service's initial POM, and common and unique requirements of the Services are documented in the initial JILSP prepared during CED.

- Staffing of the Joint Program Office — Senior representatives and other participating Service personnel serve two vital functions. First, they work as part of a team committed to objectives of the joint program. Second, they are conduits for rapid two-way communications and decisions on methods to implement joint planning and satisfy unique needs of each Service.

• Effective Communication — Implementation of joint ILS planning by the Services requires participation by their subordinate activities. Effective communications must be carried out among the provisioners, maintenance engineers, publications managers, trainers and other logisticians who support the program within the Services. The lead ILS manager must ensure that key logistics personnel from each Service are identified and jointly participate in planning and establishing the program. A hierarchy consisting of a high level review team, a joint ILS committee and functional working groups may be established to provide oversight and rapid decisions that meet each Service's needs. Refer to the Joint Logistics Commanders' Guide for the Management of Joint Service Programs for additional information.

17.5 SUMMARY

• Joint implementation of ILS planning, analyses and documentation can reduce total logistics support costs and meet essential needs of each Service.

• As with single-Service programs, effective joint ILS programs require early planning starting prior to Milestone 0 and continuing during CED and beyond.

• Joint ILS planning and implementation are facilitated by DoD military standards on logistics support analysis and continuing development of other joint-use standards and specifications.

• Jointly staffed program offices and effective inter-Service communication have been major contributors to joint program management.

17.6 REFERENCES

1. DoDI 5000.2, "Defense Acquisition Management Policies and Procedures."

2. MIL-STD-1388-1A, "Logistics Support Analysis."

3. MIL-STD-1388-2A and 2B, "DoD Requirements for Logistics Support Analysis Records."

4. AMCR 750-10/OPNAVINST 4790.14/MCOP 4790.10A/AFMCR 800-30, "Logistics Depot Maintenance Inter-Service."

5. AR700-129/OPNAVINST4105.2A/AFR 8OO-43/MCO4110.2, "Management and Execution of Integrated Logistics Support for Multiservice Acquisition."

6. Joint Logistics Commander's Guide for the Management of Joint Service Programs, Defense Systems Management College.

APPENDIX A
GLOSSARY

ACQUISITION CATEGORIES — Categories established to facilitate decentralized decision-making and execution, and compliance with statutorily imposed requirements. The categories determine the level of review, decision authority and applicable procedures (DoDI 5000.2).

ACQUISITION DECISION MEMORANDUM (ADM) — A memorandum, signed by the milestone decision authority, that documents decisions made and the exit criteria established as the result of a milestone decision review or in-process review (DoDI 5000.2).

ACQUISITION PLAN (AP) — A formal, written document reflecting the specific actions necessary to execute the approach established in the approved acquisition strategy and guiding contractual implementation (DoDI 5000.2).

ACQUISITION STRATEGY REPORT (ASR) — Describes the acquisition approach to include streamlining, sources, competition, and contract types from the beginning of Phase 1, DV, through the end of production (DoDI 5000.2).

AFFORDABILITY — A determination that the LCC of an acquisition program is in consonance with the long-range investment and force structure plans of the DoD or individual DoD Components (DoDI 5000.2).

ALLOCATED BASELINE — Development specifications (type B) that define the performance requirements for each configuration item of the system (DSMC).

AVAILABILITY — A measure of the degree to which an item is in an operable and committable state at the start of a mission, when the mission is called for at an unknown (random) time (DoDI 5000.2).

BASELINE COMPARISON SYSTEM (BCS) — A current operational system, or a composite of current operational subsystems, which most closely represents the design, operational and support characteristics of the new system under development (MIL-STD-1388-1A).

COMPARABILITY ANALYSIS — An examination of two or more systems and their relationships to discover resemblances or differences (MIL-STD-1388-1A).

COMPUTER RESOURCES SUPPORT — The facilities, hardware, software, documentation, manpower and personnel needed to operate and support embedded computer systems (DoDD 5000.39) one of the principal ILS elements.

CONFIGURATION ITEM (CI) — An aggregation of hardware, firmware and computer software or any of its discrete portions, which satisfies an end item use function and is designated by the government for separate configuration (DoDI 5000.2).

CONFIGURATION MANAGEMENT (CM) — The technical and administrative direction and surveillance actions taken to identify and document the functional and physical characteristics of an item, to control changes to a configuration item and its characteristics and to record and report change processing and implementation status (DoDI 5000.2).

CONSTRAINTS — Restrictions or boundary conditions that impact overall capability, priority and resources in system acquisition (MIL-STD-1388-1A).

CONTINUOUS ACQUISITION AND LIFE-CYCLE SUPPORT (CALS) — (Formerly Computer-Aided Acquisition and Logistics Support.) A DoD and industry strategy intended to enable more effective generation, exchange, management, and use of digital data supporting defense systems (MIL-HDBK-59B).

CONTRACT DATA REQUIREMENTS LIST (CDRL) — A list of data requirements authorized for a specific acquisition and made a part of the contract (DoDI 5000.2).

COPRODUCTION (INTERNATIONAL) — The method by which items intended for military application are produced and/or assembled under the provisions of a cooperative agreement that requires the transfer of technical information and know-how from one nation to another (DoD-5105.38M).

CORRECTIVE MAINTENANCE — All actions performed, as a result of failure, to restore an item to a specified condition. Corrective maintenance can include any or all of the following steps: Localization, Isolation, Disassembly, Interchange, Reassembly, Alignment and Checkout (MIL-STD-1388-1A).

COST-ESTIMATING RELATIONSHIP (CER) — A statistically derived equation which relates LLC or some portions thereof directly to parameters that describe the performance, operating or logistics environment of system (MIL-STD-1388-1A).

CRITICAL DESIGN REVIEW (CDR) — A review conducted to determine that the detail design satisfies the performance and engineering requirements of the development specification; to establish the detailed design compatibility among the item and other items of equipment, facilities, computer programs and personnel; to assess producibility and risk areas; and to review the preliminary product specifications (DoDI 5000.2).

DATA ITEM DESCRIPTION (DID), DD FORM 1664 — A form used to define and describe the data required to be furnished by the contractor. Completed forms are provided to contractors in support of, and for identification of, each data item listed on the CDRL (MIL-STD-1388-1A).

DEFENSE ACQUISITION BOARD — The senior DoD acquisition review board chaired by the Under Secretary of Defense for Acquisition and Technology. The Vice Chairman of the Joint Chiefs of Staff is the Vice-Chair (DoDI 5000.2).

DEFENSE PLANNING AND RESOURCES BOARD — A board, chaired by the Deputy Secretary of Defense, established to facilitate decision making during all phases of the planning, programming and budgeting system process (DoDI 5000.2).

DEPLOYMENT — The process of planning, coordinating and executing the deployment of a materiel system and its support (AR 700-127).

DEPLOYMENT PLAN — The plan to ensure smooth transition of the system from the developer to the user (DSMC).

DESIGN INTERFACE — The relationship of logistics-related design parameters to R&S resource requirements. These logistics-related design parameters are expressed in operational terms, rather than as inherent values, and specifically relate to system readiness objectives and support costs of the system (DoDI 5000.2).

DESIGN PARAMETERS — Qualitative, quantitative, physical and functional value characteristics that are inputs to the design process; for use in design trade-offs, risk analyses and development of a system that is responsive to system requirements (MIL-STD-1388-1A).

DEVELOPMENT TEST AND EVALUATION (DT&E) — Test and Evaluation conducted to verify the status of engineering and manufacturing development progress; verify that design risks have been minimized; and substantiate achievement of contract technical performance requirements (extracted from DoD 5000.2-M).

END ITEM — A final combination of end products, component parts and/or materials which is ready for its intended use; e.g., ship, tank, mobile machine shop, aircraft (MIL-STD-1388-1A).

FACILITIES — The permanent, semi-permanent or temporary real property assets required to support the system, including conducting studies to define facilities or facility improvements, locations, space needs, utilities, environmental requirements, real estate requirements, and equipment (DoDI 5000.2).

FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS (FMECA) — An analysis to identify potential design weaknesses through systematic, documented consideration of the following: all likely ways in which a component or equipment can fail; causes for each mode; and the effects of each failure (which may be different for each mission phase) (MIL-STD-1388-1A).

FIRST UNIT EQUIPPED (FUE) — The scheduled date a system or end item and its agreed upon support elements are issued to the designated IOC unit and training specified in the NET Plan has been accomplished. Support elements to be issued with system or end items will be specified in the Materiel Fielding Plan or other gaining command-developer agreement documents (AR 700-127).

FOLLOW-ON TEST AND EVALUATION (FOT&E) — That test and evaluation which is conducted after the production decision to continue and refine the estimates made during previous OT&E, to evaluate changes, and to evaluate the system to insure that it continues to meet operational needs and retain its effectiveness in a new environment or against a new threat (MIL-STD-1388-1A).

FOREIGN MILITARY SALES (FMS) — That portion of United States security assistance authorized by the Arms Export Control Act (AECA), as amended (Section 21 and 22, AECA).

FUNCTIONAL BASELINE — The technical portion of the program requirements (type A specifications); provides the basis for contracting and controlling system design (DSMC).

FUNCTIONAL CONFIGURATION AUDIT (FCA) — Verifies that the actual item which represents the production configuration complies with the development specification (DSMC).

FUNCTIONAL SUPPORT REQUIREMENT (FSR) — A function (transport, repair, re-supply, recover, calibrate, overhaul, etc.) that the support system must perform for the end item to be maintained in or restored to a satisfactory operational condition in its operational environment (MIL-STD-1388-1A).

GOVERNMENT FURNISHED MATERIAL (GFM) — Material provided by the government to a contractor or comparable government production facility to be incorporated in, attached to, or used with or in support of an end item to be delivered to the government or ordering activity, or which may be consumed or expended in the performance of a contract. It includes, but is not limited to, raw and processed materials, parts, components, assemblies, tools and supplies. Materials categorized as Government Furnished Equipment (GFE) and Government Furnished Aeronautical Equipment (GFAE) are included (MIL-STD-1388-1A).

ILS ALTERNATIVE/TRADE-OFFS — Supporting data comes from "Lessons Learned" files, comparative analysis, technological opportunities, use studies, field visits, standardization requirements, functional and military requirements, constraints, maintenance and operational approaches. This information is used in analyses and assessments of support for the identified alternatives system designs, using established lists of design criteria, utility curves and criteria weights (DSMC).

INITIAL OPERATIONAL CAPABILITY (IOC) — The first attainment of the capability to employ effectively a weapon; item of equipment; or system of approved specific characteristics, and which is manned or operated by a trained, equipped, and supported military unit or force (DoDI 5000.2).

INTEGRATED LOGISTICS SUPPORT (ILS) — A disciplined, unified and iterative approach to the management and technical activities necessary to develop support requirements that are related consistently to readiness objectives, to design, and to each other; integrate support considerations into system and equipment design; identify the most cost-effective approach to supporting the system when it is fielded; and provide the required support during the operational phase at minimum cost (DoDI 5000.2).

INTEGRATED LOGISTICS SUPPORT MANAGEMENT TEAM (ILSMT) — A team of government and industry functional and management personnel formed to advise and assist the ILS manager with planning, coordinating, monitoring schedules and contractor performance, ensuring accuracy and timeliness of government inputs, and compliance with applicable requirements, regulations, specifications, standards, etc., (Adapted from AR 700-127).

INTEGRATED LOGISTICS SUPPORT PLAN (ILSP) — The formal planning document for logistics support. It is kept current through the program life. It sets forth the plan for operational support, provides a detailed ILS program to fit with the overall program, provides decision-making bodies with necessary ILS information to make sound decisions in system development and production and provides the basis for the ILS portion of procurement packages (DSMC).

INTEGRATED SUPPORT PLAN (ISP) — A comprehensive plan to demonstrate how a contractor intends to manage and execute the contractor's ILS program (DI-L-6138).

INTEROPERABILITY — The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together (DoDI 5000.2).

LIFE-CYCLE COST (LCC) — The total cost to the government of acquisition and ownership of the system over its useful life. It includes the cost of development, acquisition, support and, where applicable, disposal (DoDI 5000.2).

LINE REPLACEABLE UNIT (LRU) — An LRU is an essential support item, which is removed and replaced at field level to restore the end item to an operationally ready condition (MIL-STD-1388-2A).

LOGISTICS SUPPORT ANALYSIS (LSA) — The selective application of scientific and engineering efforts undertaken during the acquisition process as part of the systems engineering process to assist in: causing support considerations to influence design; defining support requirements that are related optimally to design and to each other; acquiring the required support; and providing the required support during the operational phase at minimum cost (DoDI 5000.2).

LOGISTICS SUPPORT ANALYSIS DOCUMENTATION — All data resulting from performance of LSA tasks pertaining to an acquisition program (MIL-STD-1388-1A).

LOGISTIC SUPPORT ANALYSIS RECORD (LSAR) — That portion of LSA documentation consisting of detailed data pertaining to the identification of logistics support resource requirements of a system/equipment. See MIL-STD-1388-2A/2B for LSAR data element definitions (MIL-STD-1388-1A).

MAINTAINABILITY — 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 (DoDI 5000.2).

MAINTENANCE CONCEPT — A narrative description identifying the broad, planned approach to be employed in sustaining the system/equipment at a defined level of readiness or in a specified condition in support of the operational requirement. Provides the basis for the maintenance plan.

MAINTENANCE PLANNING — The process conducted to evolve and establish maintenance concepts and requirements for the lifetime of a materiel system (DoDI 5000.2).

MANPOWER AND PERSONNEL — The identification and acquisition of military and civilian personnel with the skills and grades required to operate and support a materiel system over its lifetime at peacetime and wartime rates (DoDI 5000.2).

MATERIEL SYSTEM — A final combination of subsystems, components, parts and materials that make up an entity for use in combat or in support thereof, either offensively or defensively, to destroy, injure, defeat or threaten the enemy. It includes the basic materiel items and all related equipment, supporting facilities, and services required for operating and maintaining the system.

MEAN TIME BETWEEN FAILURES (MTBF) — For a particular interval, the total functional life of a population of an item divided by the total number of failures within the population. The definition holds for time, rounds, miles, events or other measures of life units, a basic technical measure of reliability (MIL-STD-1388-2A), a basic technical measure of reliability.

MEAN-TIME-TO-REPAIR (MTTR) — The total elapsed time (clock hours) for corrective maintenance divided by the total number of corrective maintenance actions during a given period of time, a basic technical measure of maintainability (MIL-STD-1388-2A).

MISSION NEED STATEMENT (MNS) — A statement of operational capability required to perform an assigned mission or to correct a deficiency in existing capability to perform the mission (DoDI 5000.2).

MISSION RELIABILITY — The probability that the system will perform mission-essential functions for a period of time under the conditions stated in the mission profile (DoDI 5000.2).

OBJECTIVES — Qualitative or quantitative values or range of values apportioned to the various design, operational and support elements of a system, which represent the desirable levels of performance. Objectives are subject to trade-offs to optimize system requirements (MIL-STD-1388-1A).

OPERATING AND SUPPORT (O&S) COSTS — The cost of operation, maintenance and follow-on logistics support of the end item and its associated support systems. This term and "ownership cost" are synonymous (MIL-STD-1388-1A).

OPERATIONAL AVAILABILITY (Ao) — The probability that, when used under stated conditions, a system will operate satisfactorily at any time. Ao includes standby time and administrative and logistics delay time (MIL-STD-1388-2A).

OPERATIONAL R&M VALUE — Any measure of reliability or maintainability that includes the combined effects of item design, quality, installation, environment, operation, maintenance and repair (DoDI 5000.2).

OPERATIONAL REQUIREMENT — An established need justifying the timely allocation of resources to achieve a capability to accomplish military objectives, missions, or tasks (JCS Pub 1).

OPERATIONAL SUITABILITY — The degree to which a system can be satisfactorily placed in field use, with consideration being given to availability, compatibility, transportability, interoperability, reliability, wartime usage rates, maintainability, safety, human factors, manpower supportability, logistics supportability, natural environment effects and impacts, documentation and training requirements (DoDI 5000.2).

OPERATIONAL TEST AND EVALUATION (OT&E) — Test and evaluation conducted to determine the operational effectiveness and suitability of a system under realistic combat conditions and to determine if the minimum acceptable operational performance requirements, as specified in the Operational Requirements Document, have been satisfied (DoDI 5000.2M)

OPTIMIZATION MODELS — Models that accurately describe a given system and can be used, through sensitivity analysis, to determine the best operation of the system being modeled (MIL-STD-1388-1A).

PACKAGING, HANDLING, STORAGE AND TRANSPORTATION (PHS&T) — The resources, processes, procedures, design considerations and methods to ensure that all systems, equipment and support items are preserved, packaged, handled and transported properly, including environmental considerations, equipment preservation requirements for short- and long-term storage and transportability (DoDI 5000.2).

PARAMETRIC ESTIMATING RELATIONSHIP (PER) — A statistical parametric analysis that involves development and application of mathematical expressions commonly called "cost-estimating relationships" (CERs). CERs are developed by statistically analyzing past history to correlate cost with significant physical and functional parameters (MIL-STD-1388-1A).

PHYSICAL CONFIGURATION AUDIT (PCA) — A technical examination of a designated configuration item to verify that the item "as built" conforms to the technical documentation which defines the item (DSMC).

PLANNING, PROGRAMMING, BUDGETING SYSTEM (PPBS) — An integrated system for the establishment and maintenance of the FYDP and the DoD budget (DSMC).

POST-PRODUCTION SUPPORT (PPS) — Systems management and support activities necessary to ensure continued attainment of system readiness objectives with economical logistics support after cessation of production of the end item (weapon system or equipment) (DoDI 5000.2).

PRELIMINARY DESIGN REVIEW (PDR) — A review conducted on each configuration item to evaluate the progress, technical adequacy and risk resolution of the selected design approach; to determine its compatibility with performance and engineering requirements of the development specification; and to establish the existence and compatibility of the physical and functional interfaces among the item and other items of equipment, facilities, computer programs and personnel (DoDI 5000.2).

PREVENTIVE MAINTENANCE — All actions performed in an attempt to retain an item in specified condition by providing systematic inspection, detection and prevention of incipient failures (MIL-STD-1388-1A).

PRODUCIBILITY — The relative ease of producing an item or system. This relative ease is governed by the characteristics and features of a design that enable economical fabrication, assembly, inspection and testing using available manufacturing techniques (DoDI 5000.2).

PRODUCT BASELINE — Specifications (type C) that establish the detailed design documentation for each configuration item. Normally also includes Process Baseline (type D) and Material Baseline (type E) (DSMC).

PRODUCTION READINESS — The state or condition of preparedness of a program to proceed into production. A system is ready for production when the producibility of the production design and the managerial and physical preparations necessary for initiating and sustaining a viable production effort have progressed to the point where a production commitment can be made without incurring unacceptable risks that will breach thresholds of schedule, performance, cost or other established criteria (DoDI 5000.2).

PROVISIONING — The process of determining and acquiring the range and quantity (depth) of spares and repair parts, and support and test equipment required to operate and maintain an end item of materiel for an initial period of service (MIL-STD-1388-1A).

READINESS DRIVERS — Those system characteristics which have the largest effect on a system's readiness values. These may be design (hardware or software), support or operational characteristics (MIL-STD-1388-1A).

RELIABILITY — The ability of a system and its parts to perform its mission without failure, degradation or demand on the support system (DoDI 5000.2).

REPAIR LEVEL ANALYSIS (RLA) — The RLA limits the depth of maintenance task analysis in the LSA process by distinguishing between repairable and nonrepairable components, and by selecting the most cost-effective repair level. An RLA is normally conducted on all LRUs.

REPAIR PARTS — Consumable bits and pieces, that is, individual parts or nonreparable assemblies, required for the repair of spare parts or major end items (DoDI 5000.2).

RISK — A subjective assessment made regarding the likelihood or possibility of not achieving a specific objective by the time established with the resources provided (DoDI 5000.2).

SCHEDULED MAINTENANCE — Preventive maintenance performed at prescribed points in the item's life (MIL-STD-1388-1A).

SPARE PARTS — Repairable components or assemblies used for maintenance replacement purposes in major end items of equipment (DoDI 5000.2).

STANDARDIZATION — The process by which member nations achieve the closest practicable cooperation among forces; the most efficient use of research, development and production resources; and agree to adopt on the broadest possible basis the use of: (a) common or compatible operational, administrative, and logistics procedures; (b) common or compatible technical procedures and criteria; (c) common, compatible, or interchangeable supplies, components, weapons, or equipment; and (d) common or compatible tactical doctrine with corresponding organizational compatibility (MIL-STD-1388-1A).

SUPPLY SUPPORT — All management actions, procedures and techniques used to determine requirements to acquire, catalog, receive, store, transfer, issue and dispose of secondary items. This includes provisioning for initial support as well as replenishment supply support (DoDI 5000.2).

SUPPORT CONCEPT — A complete system level description of a support system, *consisting of an integrated set of ILS element concepts, which meets the functional support* requirements and is in harmony with the design and operational concepts (MIL-STD-1388-1A).

SUPPORT EQUIPMENT — All equipment (mobile or fixed) required to support the operation and maintenance of a materiel system. This includes associated multiuse end items, ground-handling and maintenance equipment, tools, metrology and calibration equipment, test equipment and automatic test equipment. It includes the acquisition of logistics support for the support and test equipment itself (DoDI 5000.2).

SUPPORT RESOURCES — The materiel and personnel elements required to operate and maintain a system to meet readiness and sustainability requirements. New support resources are those which require development. Critical support resources are those which are not new but require special management attention because of schedule requirements, cost implications, known scarcities or foreign markets (MIL-STD-1388-1A).

SUPPORTABILITY — The degree to which system design characteristics and planned logistics resources, including manpower, meet system peacetime readiness and wartime utilization requirements (DoDI 5000.2).

SUPPORTABILITY ASSESSMENT — An evaluation of how well the composite of support considerations necessary to achieve the effective and economical support of a system for its life cycle meets stated quantitative and qualitative requirements. This includes integrated logistics support and logistics support resource related O&S cost considerations (MIL-STD-1388-1A).

SUPPORTABILITY FACTORS — Qualitative and quantitative indicators of supportability (MIL-STD-1388-1A).

SUPPORTABILITY-RELATED DESIGN FACTORS — Those supportability factors which include only the effects of an item's design. Examples include inherent reliability and maintainability values, testability values, transportability characteristics etc. (MIL-STD-1388-1A).

SUSTAINABILITY — The "staying power" of our forces, units, weapon systems and equipment often measured in numbers of days (JCS Pub 1, subset of Military Capability).

SYSTEM DESIGN REVIEW — Reviews the conceptual design of the system and establishes its capability to satisfy requirements (DSMC).

SYSTEM ENGINEERING — The application of scientific and engineering efforts to (a) transform an operational need into a description of system performance parameters and a system configuration through the use of an iterative process of definition, synthesis, analysis, design, test and evaluation; (b) integrate related technical parameters and ensure compatibility of all physical, functional, and program interfaces in a manner that optimizes the total system definition and design; (c) integrate reliability, maintainability, safety, survivability, human and other such factors into the total engineering effort to meet cost, schedule and technical performance objectives (MIL-STD-499).

SYSTEM READINESS OBJECTIVE — A criterion for assessing the ability of a system to undertake and sustain a specified set of missions at planned peacetime and wartime utilization rates. System readiness measures take explicit account of the effects of system reliability and maintainability system design, the characteristics and performance of the support system, and the quantity and location of support resources. Examples of system readiness measures are combat sortie rate over time, peacetime mission capable rate, operational availability and asset ready rate (DoDI 5000.2).

TAILORING — The process by which the individual requirements (sections, paragraphs or sentences) of the selected specifications and standards are evaluated to determine the extent to which each requirement is most suitable for a specific materiel acquisition and the modification of these requirements, where necessary, to assure that each tailored document invoked states only the minimum needs of the government. (MIL-STD-1388-1A).

TECHNICAL DATA — Recorded information regardless of form or character (such as manuals and drawings) of a scientific or technical nature. Computer programs and related software are not technical data; documentation of computer programs and related software are. Also excluded are financial data or other information related to contract administration (DoDI 5000.2).

TESTABILITY — A design characteristic which allows the status (operable, inoperable or degraded) of an item and the location of any faults within the item to be confidently determined in a timely fashion (MIL-STD-1388-1A).

TRADE-OFF — The determination of the optimum balance between system characteristics (cost, schedule, performance and supportability) (MIL-STD-1388-1A).

TRAINING AND TRAINING SUPPORT — The processes, procedures, techniques, training devices and equipment used to train civilian and active duty and reserve military personnel to operate and support a materiel system. This includes individual and crew training; new equipment training; initial, formal and on-the-job training; and logistics support planning for training equipment and training device acquisitions and installations (DoDI 5000.2).

TURN-AROUND TIME (TAT) — The time required to return an item to use between missions (MIL-STD-1388-2A).

UNSCHEDULED MAINTENANCE — Corrective maintenance required by item conditions (MIL-STD-1388-1A).

APPENDIX B
LOGISTICS MODELS

A large number of models have been developed to support quantitative determination of requirements for logistics support and related disciplines.

Model Categories

Availability	Maintainability
Budgeting	Manpower
Design Interface	Operational Suitability
Facilities	Provisioning
Life-Cycle Cost	Reliability
Training	

Catalogs of Logistics Models

The following documents provide a structured format which summarizes each model with a narrative description, model applications, capabilities, compatible software, custodian and other useful information which can be used to obtain documentation and conduct a preliminary evaluation for applicability to a particular program need.

Title: **Department of Defense Catalog of Logistics Models**

Contact: Defense Logistics Studies Information Exchange
U.S. Army Logistics Management College
Fort Lee, Virginia 23801
DSN: 539-4007; Commercial (804) 765-4007

Title: **Logistics Support Analysis Techniques Guide (AMC-P 700-4)**

Contact: Headquarters
U.S. Army Materiel Command
Attn: AMCLG-ME
Alexandria, VA 22333-0001
DSN: 284-5464; Commercial (703) 274-5464

Title:	**Selected Logistics Models and Techniques**
Contact:	Aeronautical Systems Center ASC-ALTD Wright Patterson Air Force Base, OH 45433-7642 DSN: 785-2122; Commercial (513) 255-2122
Title:	**Operational Suitability Modeling and Simulation**
Contact:	The Office of the Director of Operational Test and Evaluation Office of the Secretary of Defense Washington, DC 20301-1700 DSN: 227-3895; Commercial (703) 697-3895

APPENDIX C
LOGISTICS COURSES

This appendix contains information on the courses currently offered on ILS. The courses are arranged by the offering command or school. General information is provided on course content, course length and location. The courses listed cover all aspects of ILS. The schools may be contacted directly for information on additional courses that cover specific ILS aspects (such as materiel management).

School

Air Force Institute of Technology, School of Systems and Logistics
2950 P Street
Wright Patterson AFB, OH 45433-7765
AFIT/LSA DSN: 785-7777; Commercial (513) 255-7777

Course

Acquisition Logistics

Length

10 days

Content

Provides the student with a broad-based understanding of the logistics activities involved in the acquisition/modification of systems andequipment; enables students to gain an understanding of the wide range of early logistics activities necessary to support the design, production and deploying of systems and equipment.

Course

Combat Logistics

Length

12 days

Content

Provides an overview of the wartime roles and responsibilities of the logistics manager and an understanding of how logistics contributes to the overall war effort; provide an introduction to combat logistics planning, strategies and contingency procedures tha are likely to be implemented in a wartime scenario.

Course

Logistics Management

Length

10 days

Content

This course broadens and enhances the understanding of logistics management at various levels throughout the Air Force an is directed to the critical examination of interrelationships and interdependencies that prevail in strategic, support and operational logistics. In these contexts, strategic logistics entails the interrelationships of strategy and logistics and the influence they exert upon each other at the national level; support logistics is concerned largely with the acquisition of systems and their contingent supply, equipment and allied support functions; operational logistics relates to the direct functional support of the Air Force in the operational environment.

School

Army Logistics Management College
Commandant, ALMC, ATSZ-ASO-R
Fort Lee, VA 23801-6041
DSN: 539-4965/4149; Commercial (804) 765-4965/4149

Course

Army Integrated Logistics Support Seminar

Length

1 week

Content

This course is designed to provide senior managers of ILS or ILS-relateddisciplines with an opportunity to exchange ideas, view points problems and management approaches under strict rules of non-attribution. Policy and procedure updates and concepts are well as managerial and technical ILS procedures and concepts, are presented. Ranking guest speakers address ILS topics of greatest current interest.

Course

Logistics Executive Development (LEDC)

Length

19 weeks resident or 600 hours correspondence

Content

This course provides in-depth logistics education for selected managers, prepares them for positions of responsibility in logistics management, and develops their intellectual depth and analytical ability. LEDC serve as the Army's senior logistics course to prepare civilian/military managers for key executive positions with the Army and DoD logistics systems; to broaden the individual's logistics foundation developed by earlier logistics functional courses and personal experience; to provide insights into the multifunctional areas of logistics and their integration into the overall DoD logistics system; to expand and enhance the fundamental management skills of the individual; to provide an understanding of the interface between the Army in the field, the logistics structure and industry. The course of instruction includes: development of strategy, force structure; equipment and logistical support; acquisition management and ILS; inventory; distribution and maintenance of equipment; logistical support to the Army in the field; organization and personnel management; DoD resource management; managerial macro economics; analytical techniques; automated information technology; force modernization; and an electives program.

Course

Logistics Management Development

Length

4 weeks resident, 18 class days on site

Content

The course is designed to develop the managerial skills of selected militaryand civilian personnel assigned to, or anticipating assignment to, the Army wholesale logistics system by providing a broad knowledge of the Army wholesale logistics system. The instruction enhances understanding of the interrelationships and interdependence among logistics functions and the organizational structure for logistics management, and provides insights into the impact of a functional management decision on other logistics functions and on the logistics system as a whole. The course provides an overview of the Army logistics system. The life-cycle management model is the common thread of the course. It is used to highlight the more significant considerations of RDT&E, procurement, inventory management, maintenance, and disposalof Ar my materiel. Management skills instruction includes basic statistical and probability techniques and aspects of interpersonal behavior. This ininstruction is oriented toward improving the decision-making abilities of the students by providing knowledge of the techniques and consideration involved in logistics management.

Course

Logistics Support Analysis

Length

2 weeks

Content

This course provides the student with an understanding of the purpose and objectives of the LSA process and the techniques and tasks necessary to accomplish the LSA process. It provides an overview of MIL-STD1388-1A and MIL-STD 1388-2A/2B tasks, techniques for accomlishing the tasks, an examination of the use of LSAR data records in the generation and recording of logistics support data, the use of the LSA/LSAR as a management tool and as a force to integrate all ILS elements for an item/system. Specific instructional topics included in the course are an overview of the materiel Acquisition Process; an introduction to ILS and its relationship to LSA/LSAR; requirements generation; trade-offs; supportability testing; developing comparative analysis; identification of manpower, support, cost and readiness drivers; life-cycle costing; support modeling and simulation; risk analysis; a discussion of terms needed to describe maintenance tasks; detailed review and explanation of the LSAR data records and output summaries; a discussion of LSAR data utilization; contracting for LSA/LSAR; and review and validation of LSA data.

Course

Integrated Logistics Support -Basic

Length

2 weeks

Content

This course covers basic information on the Army acquisition process; ILS organizations, roles and purposes; and basic interfaces between ILS and other materiel acquisition processes. Information is provided to give an overview of ILS in materiel acquisition and prerequisite knowledge required for entry into the ILS-Advanced Course.

Course

Integrated Logistic Support-Advanced Course

Length

3 weeks

Content

Prepares students in current or scheduled ILS assignments for ILS management duties. It provides an in-depth approach and emphasizes hands-on management, covers all aspects of ILS and ILS-related activities, and includes application of the Logistics Planning and Requirements Simplification System (LOGPARS).

Course

Associate Logistics Executive Development (ALEDC)

Length

10 weeks (5 phases, 2 weeks active duty training each or a combination of active duty and correspondence)

Content

This course provides, over a period of three years, five phases of advanced broad logistics management education for Reserve Component (RC) officers. The course prepares officers for executive and policy-making mobilization assignments in logistics. The course provides insights into the multi-functional areas of logistics and their integration within the DoD. Students gain a fuller understanding of the interface between the Army in the field, DoD's logistics structure, and industry. The course expands and enhances fundamental management skills. Course completion qualifies anRCofficer for promotion through 0-5. ALEDC consists of five phases:

1. Management Systems. This phase offers specific instruction inthe use of human, financial, and mechanical (computer) resources to accomplish the goal of effective logistics management. Instruction is given through an in-depth study of the various management systems applicable to logistics and identification of their applications, limitations and values in various management situations.

2. The Acquisition Process. This phase provides an insight into the total DoD and Department of the Army logistics systems. It also provides a general knowledge of the management process for the acquisition of Army materiel to include research, development, test, evaluation and contracting.

3. Materiel Readiness. This phase provides an understanding of requirements, determination for, and management of, major and secondary items and the relationship and significance of maintenance, transportation, distribution and disposal.

4. Scientific Techniques. This phase provides a general knowledge of the application of mathematics, economics, computer technology and systems analysis in the formulation and solution of complex logistics problems.

5. Logistics Support Concepts. This phase provides an interface betweenthe logistics base and the Army in the field through application of current doctrine for logistics support. It also serves as a vehicle for recognition, analysis and solution of logistics support problems within the Army in the field. It includes command and control problems encountered in contingency planning, and combat service support force planning. This phase also includes a familiarization with the Security Assistance Program.

School

Defense Systems Management College
Registrar
9820 Belvoir Road, Suite G38
Fort Belvoir, VA 22060-5565
DSN:655-2227; Commercial (703) 805-2227

Course

Management of Acquisition Logistics (MALC)

Length

1 week

Content

Provides an understanding of ILS policy, requirements, and practices applicable to major and nonmajor defense programs during the defense system life cycle. The course begins with a basic overview of the system life-cycle process and the system engineering process, and a fundamental discussion on the role that ILS plays in these two processes. It continues with lessons on ILS considerations and activities during RDT& phases of the system life cycle, during the transition to production, during fieldingand deployment, and during the post-production (operation and support) phase.

Compendium-type presentations cover ILS-related subjects, such as LCC, reliability-maintainability-availability, the logistics support analysis process, logistic-relevant tests and evaluations, logistics modeling, CALS and other emerging ILS-relevant technologies. Selectedguest lecturers from government and industry discuss "real world"examples of DoD programs and policies . Special experience-based case studies offer the student an opportunity to address weapon-system logistics problems and devise both theoretical and pragmatic solutions.

School

Navy Acquisition/Logistics Management
Training Center
U.S. Naval Station-Anacostia, Bldg 150
Washington, D.C. 20374-1502
DSN: 288-3384; Commercial (202) 433-3384

Course

Integrated Logistics Support Overview

Length

1 week

Content

Provides the framework for the other courses in this program. It discusses the management tools available to logistics managers and places ILS in perspective in the weapon system acquisition process. Covers all ILS elements and chapters on program management, configuration management, logistic support analysis, and ILS tailoring.

APPENDIX D
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