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PROGRAM MANAGERS HANDBOOK

Common Practices to Mitigate the Risk of Obsolescence

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Common Practices to Mitigate
the Risk of Obsolescence

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FOREWORD

The Defense Microelectronics Activity (DMEA), Department of Defense (DoD) Executive Agent for Microelectronics Diminishing Manufacturing Sources and Material Shortages (DMSMS) operates under the authority, direction, and control of the Deputy Under Secretary of Defense for Logistics (DUSD (L)). Its primary mission is to leverage the capabilities and advantages of advanced technology to solve operational problems in existing weapon systems, increase operational capabilities, reduce operating and support (O&S) costs, and reduce the effects of DMSMS. In this capacity, DMEA is collecting the common practices used today that are minimizing the risk of obsolescence. ARINC, under contract GS-35F-4825G, task order DMEA90-99-F-A0013, is responsible for developing these common practices into this program managers handbook.

The *Program Managers Handbook—Common Practices to Mitigate the Risk of Obsolescence*—provides practices and a list of resources that other program managers have used to minimize the impacts and cost of obsolescence. The primary audience for this handbook is a program manager who has been recently introduced to DMSMS. This handbook provides the program manager a shopping list of common practices and resources. The handbook complements the commonly used resolution guides—the Naval Sea Systems Command *Case Resolution Procedures Guide,* the Air Force Materiel Command *DMSMS Program Case Resolution Guide*, and the Army Materiel Command *DMSMS Case Resolution Guide*. Common practices in this handbook can be implemented to minimize the impact of DMSMS.

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ABBREVIATIONS AND ACRONYMS

AFMC	Air Force Materiel Command
AMC	Army Materiel Command
AMS	Aftermarket Supplier
ASIC	Application-Specific Integrated Circuit
CAGE	Commercial and Government Entity
CBA	Cost Benefit Analysis
CONOPs	Concept of Operations
COTS	Commercial Off-the-Shelf
CPU	Central Processing Unit
DLA	Defense Logistics Agency
DMEA	Defense Microelectronics Activity
DMSMS	Diminishing Manufacturing Sources and Material Shortages
DoD	Department of Defense
DT&E	Development Test and Evaluation
DTC	Design to Cost
DUSD (L)	Deputy Under Secretary of Defense for Logistics
ECP	Engineering Change Proposal
EDI	Electronic Data Interchange
EEIC	Expense Element Investment Code
EIA	Electronic Industries Alliance
EMD	Engineering and Manufacturing Development
F3I	Form, Fit, Function, and Interface
FOT&E	Follow-On Test and Evaluation
FYDP	Five-Year Defense Plan
GIDEP	Government-Industry Data Exchange Program

ABBREVIATIONS AND ACRONYMS (continued)

IOT&E	Initial Operational Test and Evaluation
IPT	Integrated Product Team
JSTARS	Joint Surveillance Target Attack Radar System
JTIDS	Joint Tactical Information Distribution System
LCC	Life-Cycle Cost
LOT	Life of Type
LRE	Logistics Retrofit Engineering
LRIP	Low Rate Initial Production
LRU	Line Replaceable Unit
MAIS	Major Automated Information Systems
MDAP	Major Defense Acquisition Programs
MDS	Mission Design Series
MRP	Material Review Planning
MTBF	Mean Time Between Failures
MTI	Manufacturing Technology Incorporated
MTTR	Mean Time To Repair
NAVICP	Naval Inventory Control Point
NAVSEASYSCOM	Naval Sea Systems Command
NAVSUP	Naval Supply Systems Command
NHA	Next Higher Assembly
O&M	Operations and Maintenance
O&S	Operating and Support
OEM	Original Equipment Manufacturer
OJT	On-the-Job Training
ORD	Operational Requirements Document
PDR	Preliminary Design Review
PDRR	Program Definition and Risk Reduction
PEM	Program Element Monitor
PF/DOS	Production, Fielding/Deployment, and Operational Support
PM	Program Manager
PPL	Preferred Parts List
QPA	Quantity per Assembly
QPL	Qualified Parts List

ABBREVIATIONS AND ACRONYMS (continued)

R&D	Research and Development
RFP	Request for Proposals
RRT	Rapid Retargeting
RTOC	Reduction in Total Ownership Cost
SCD	Specification Control Drawing
SDR	System Design Review
SE	Support Equipment
SOO	Statement of Objectives
SOW	Statement of Work
SRU	Shop Replaceable Unit
TACTech	Transition Analysis of Component Technology
TDP	Technical Data Package
TOC	Total Ownership Cost
TSPR	Total System Performance Responsibility
VHDL	VHSIC Hardware Description Language
VHSIC	Very High Speed Integrated Circuit

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ILLUSTRATIONS

SECTION 1

INTRODUCTION

1.1 HANDBOOK OVERVIEW

Diminishing Manufacturing Sources and Material Shortages (DMSMS) concerns the loss or impending loss of manufacturers or suppliers of critical items and raw materials due to discontinuance of production. DMSMS can be caused by rapid changes in item or material technology, uneconomical production requirements, foreign source competition, federal environmental or safety requirements, and limited availability or increasing cost of items and raw materials.

This *Program Managers Handbook—Common Practices to Mitigate the Risk of Obsolescence* provides practices and a list of resources that other program managers (PMs) have used to minimize the impact and cost of obsolescence. The primary audience of this handbook is a program manager who has been recently introduced to DMSMS. This handbook provides the program manager a shopping list of common practices and resources. Common practices in this handbook can be implemented to minimize the impact of DMSMS. Selection and investment in appropriate practices can be a judicious cost-avoidance strategy. A secondary objective is to foster dialog among integrated product team members to provide visibility into life-cycle support challenges. This handbook offers encouragement to:

- The new system developer program manager to apply common practices during design
- The production manager who seeks guidance on minimizing the impact of obsolescence during production
- The sustainment program manager who seeks practices that allow long-term resolution of obsolescence within the constraints of the operating budget

The practices in this handbook were provided in collaboration with members of the Department of Defense (DoD) DMSMS Teaming Group, other DoD programs involved with minimizing the impact of DMSMS, and industry. This handbook was coordinated with DMSMS focal points within the Army, Navy, Air Force, and Defense Logistics Agency (DLA). The handbook complements the commonly used resolution guides—the Naval Sea Systems Command

(NAVSEASYSCOM) *Case Resolution Procedures Guide* (NAVSEASYSCOM undated), the Air Force Materiel Command (AFMC) *DMSMS Program Case Resolution Guide* (AFMC 1998), and the Army Materiel Command (AMC) *DMSMS Case Resolution Guide* (AMC undated). The DMSMS resolutions from these documents are known and usually are applied to existing or newly arising problems. As appreciation and recognition of DMSMS problems have become more widespread, it is now clear that the best DMSMS resolution is to avoid or minimize the effect of obsolescence early in engineering and manufacturing development (EMD) by making DMSMS planning a part of the design engineering process. The practices presented in this handbook form the basis of a DMSMS program that can be used to mitigate the impact of DMSMS. It is expected that, as the DoD and Defense Microelectronics Activity (DMEA) obtain additional lessons learned, these practices will be updated accordingly. This handbook will help program managers stay current with emerging technology and cost-avoidance strategies.

1.2 DMSMS BACKGROUND

The DoD defines obsolescence as diminishing manufacturing sources and material shortages. DMSMS is a serious issue for the DoD, airline community, and many commercial industries. Although increased reliability has lengthened system life cycles, decreased demand, fewer manufacturers, and rapid advances in technology have shortened component life cycles from between 10 and 20 years to between 3 and 5 years. This decrease is particularly acute for electronic systems but affects nonelectronic systems as well. The disparity between the long life cycles of systems and the short life span of microelectronics requires the consideration of obsolescence and risk management as an adjunct to systems engineering. The extended life-cycle requirements of existing systems, especially in the military and aviation industry, demand the sharing of knowledge through the development of a lessons-learned, best practice approach. The application of these common practices can mitigate the effect of obsolescence and may extend the useful life of systems.

In the DoD, concern is growing about the costs of resolving current and future DMSMS problems. The Deputy Under Secretary of Defense for Logistics (DUSD (L)) indicates that the average cost to redesign a circuit card to eliminate obsolete components is $250,000. The Electronic Industry Association (EIA) Manufacturing Operations and Technology Committee reported a cost range for redesign of between $26,000 and $2 million (ARINC 1999).

To minimize the impact of DMSMS, DoD agencies, organizations, and program offices must be able to incorporate timely and cost-effective engineering practices during development, production, and sustainment. To assure the goal of least total ownership cost (TOC), the concept of DMSMS management must be accepted at the highest programmatic levels and contractually invoked during the system life cycle. Over the past decade, DoD program managers and industry have implemented programs and developed techniques and tools to actively manage DMSMS. Although implementing a DMSMS program requires some cost, far greater cost avoidance can be realized. To do this, program managers must carefully select the practices needed to minimize the impact of obsolescence.

1.3 ROLE OF DEFENSE MICROELECTRONICS ACTIVITY

DMEA, located in Sacramento, California, operates under the authority, direction, and control of DUSD (L). Its primary mission is to leverage the capabilities and advantages of advanced technology to solve operational problems in existing weapon systems, increase operational capabilities, reduce operating and support (O&S) costs, and reduce the effects of DMSMS. In this capacity, DMEA assists weapon systems managers and managers of other operational or developmental systems in inserting advanced microelectronics technologies, ensuring lifetime sustainment of systems that depend on microelectronics, and providing studies and analyses of existing and future obsolescence problems. DMEA is also the DoD Executive Agent for microelectronics DMSMS. In this role, it helps to identify microelectronics obsolescence problems and uses its logistics retrofit engineering (LRE) process to offer a comprehensive mix of solutions to these problems.

DMEA is an active member of both the DoD DMSMS Working Group and DoD DMSMS Teaming Group. DUSD (L) established the DMSMS Working Group to foster the development of DMSMS management techniques, tools, and policies to increase readiness, sustain wartime operations, and reduce life-cycle costs of DoD weapon systems. To that end, the Working Group established and chartered the DoD DMSMS Teaming Group, a formalized group of representatives from DoD programs and industry who work together to share solutions to common DMSMS problems. The experiences and lessons learned from DMSMS Teaming Group members and other DoD programs serve as a basis for many practices and resources used today to minimize the risk of obsolescence.

1.4 HANDBOOK ORGANIZATION

Section 1 presents background information and the overall role of DMEA. Section 2 presents procedures on how to use the handbook (i.e., how a program manager could select the practices). Section 3 describes the common practices that could be selected. Section 4 provides a list of resources available to the program manager and a summary of the practices. Section 5 lists the references cited in this handbook. Appendix A provides a supportability checklist. Appendix B provides a worksheet to allow a program manager to estimate the implementation cost.

SECTION 2

PROCEDURES TO SELECT COMMON PRACTICES

2.1 INTRODUCTION

This handbook provides the program manager a shopping list of common practices and resources. Common practices in this handbook can be implemented to minimize the impact of DMSMS. Selection and investment in appropriate practices can be a judicious cost-avoidance strategy. Factors that influence the selection of common practices for particular programs include acquisition[1] life-cycle phase, management philosophy, program complexity, and available resources. The latter three factors also establish implementation levels for the common practices. As a program manager selects the practices, a common theme should emerge: Communication and sharing of knowledge among all product team members is essential to minimizing the impact of obsolescence.

2.2 ACQUISITION LIFE-CYCLE PHASES

DoD Regulation 5000.2-R (DoD 1996) describes the acquisition process as a series of logical phases separated by major decision points called milestones. In addition, it discusses acquisition phases and accomplishments and establishes certain core activities that must be accomplished by all programs. The regulation further acknowledges that tailoring that is consistent with common sense and sound business practice is allowed. It is acknowledged that every program is different and that key acquisition officials, program managers, and milestone decision authorities may tailor the acquisition management process, as applicable, to best match the conditions of individual non-major programs. Details of acquisition categories and milestone decision authorities may be found in Part 1 of DoD Regulation 5000.2-R, which states that the acquisition management process consists of a logical sequence of phases with each phase required to meet specific objectives. These phases and objectives are listed in Table 2-1.

This handbook focuses on Phases I through III, where a DMSMS activity would most likely be established. These phases are Program Definition and Risk Reduction (PDRR), EMD, and

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[1] Note that *acquisition* life cycle and *system* life cycle are used interchangeably in this handbook.

Production, Fielding/Deployment, and Operational Support (PF/DOS)[2], respectively. The many government and industry representatives who provided source data for this handbook agreed that it is during these phases that the opportunity for mitigating obsolescence risks promises the best return on investment.

Table 2-1. Acquisition Phases and Objectives

Phase 0—Concept Exploration
Perform competitive, parallel short-term concept studies
Analyze alternatives
Establish cost, schedule, and performance objectives
Establish software requirements, trade-off opportunities, acquisition strategy, and test and evaluation strategy
Phase I—Program Definition and Risk Reduction
Refine design approaches and parallel technologies
Assess alternative concepts
Prototype operational assessments, risk reduction
Perform an analysis of cost drivers, life-cycle-cost estimates, cost-performance trades, interoperability, acquisition strategy alternatives including evolutionary and incremental software development
Phase II—Engineering and Manufacturing Development
Translate design approach into stable, interoperable, producible, supportable, and cost-effective design
Validate manufacturing/production processes
Demonstrate system capabilities through testing
Develop low-rate initial production (LRIP) to provide representative articles for operational test and a production base
Phase III—Production, Fielding/Deployment, and Operational Support
Achieve an operational capability that satisfies mission needs
Conduct development test and evaluation (DT&E) and initial operational test and evaluation (IOT&E)
Resolve DT&E and IOT&E deficiencies and verify fixes during follow-on test and evaluation (FOT&E)
Execute a support program that meets support performance thresholds in a cost-effective manner
Execute operational support plans to transition from contractor to organic support

The common practices presented in this handbook apply to either DoD or industry program managers. Unless a significant difference exists between the DoD (as the buyer) and industry (as the seller), no attempt was made to identify to whom a particular practice applies. In the case of total system performance responsibility (TSPR)[3] programs, this distinction is not needed. Although many common practices are closely aligned with a specific program phase, they may also be appropriate throughout the system life cycle.

2.3 IMPLEMENTATION INTENSITY LEVEL

This handbook discusses three intensity levels of common practices influenced by the resources available to manage DMSMS. The three levels include practices that could be implemented to mitigate the effect of DMSMS and are defined as:

[2] The Fielding/Deployment and Operational Support portion of Phase III is often termed *sustainment*.

[3] TSPR requires the system contractor to assume total responsibility for system performance in accordance with specified requirements and to waive any claims or demands against the government with respect to specifications.

- Level 1—Practices are implemented to resolve current obsolete items. Some of these activities may be considered reactive.

- Level 2—Minimal required practices are needed to mitigate the risk of future obsolete items. The majority of these activitives are perceived as proactive.

- Level 3—Advanced practices are required to mitigate the risk of obsolescence when there is a high opportunity to enhance supportability or reduce total cost of ownership. These proactive activities may require additional program funding.

The practices associated with these levels form the basis of a DMSMS program that can be used to mitigate the impact of DMSMS. When no DMSMS program is established and none of the activities are implemented, an additional level could be considered—Level 0. Although an expense is associated with the implementation of a DMSMS program, cost avoidance can be realized from such a program. A list of the practices is presented in Table 2-2, and they are described in Section 3.

Table 2-2. Common Practices

Level 1	Level 2	Level 3
DMSMS Focal Point	Awareness Training	Circuit Design
Awareness Briefing	DMSMS Prediction	VHDL
Internal Communications	DMSMS Steering Group	Technology Assessment
External Communications	COTS List	EDI
DMSMS Plan	DMSMS Solution Database	Technology Insertion
Parts List Screening	Opportunity Index	
Parts List Monitoring	Web Site	
Resolution of Current Items		
Supportability Checklist		

2.4 SELECTION OF PRACTICES

For the selection of practices to begin, an event usually occurs that convinces the program manager that one or more practices need to be implemented. These events are called *triggers*. Qualitative triggers form the basis of the questionnaire shown in Table 2-3. To assess the situation, program managers who have not been faced with a DMSMS problem should complete the questionnaire in Table 2-3. Quantitative triggers form the basis of the selection process shown in Figure 2-1. Program managers who have been faced with a DMSMS problem and know the extent of the problem should use both the questionnaire and the selection process shown in Figure 2-1.

Table 2-3. Common Practices Selection Questionnaire

Question Number	Question to Program Manager	If Yes, Review Intensity Level(s)
1*	Is there an opportunity to enhance supportability or reduce TOC?	1, 2, and 3
2	Has higher management (above PM) become aware of supportability problems?	1 and 2
3	Have you increased your awareness of DMSMS problems?	1
4	Have you recently become aware of DMSMS problems?	1
* For further insight to supportability issues, see Appendix A.		

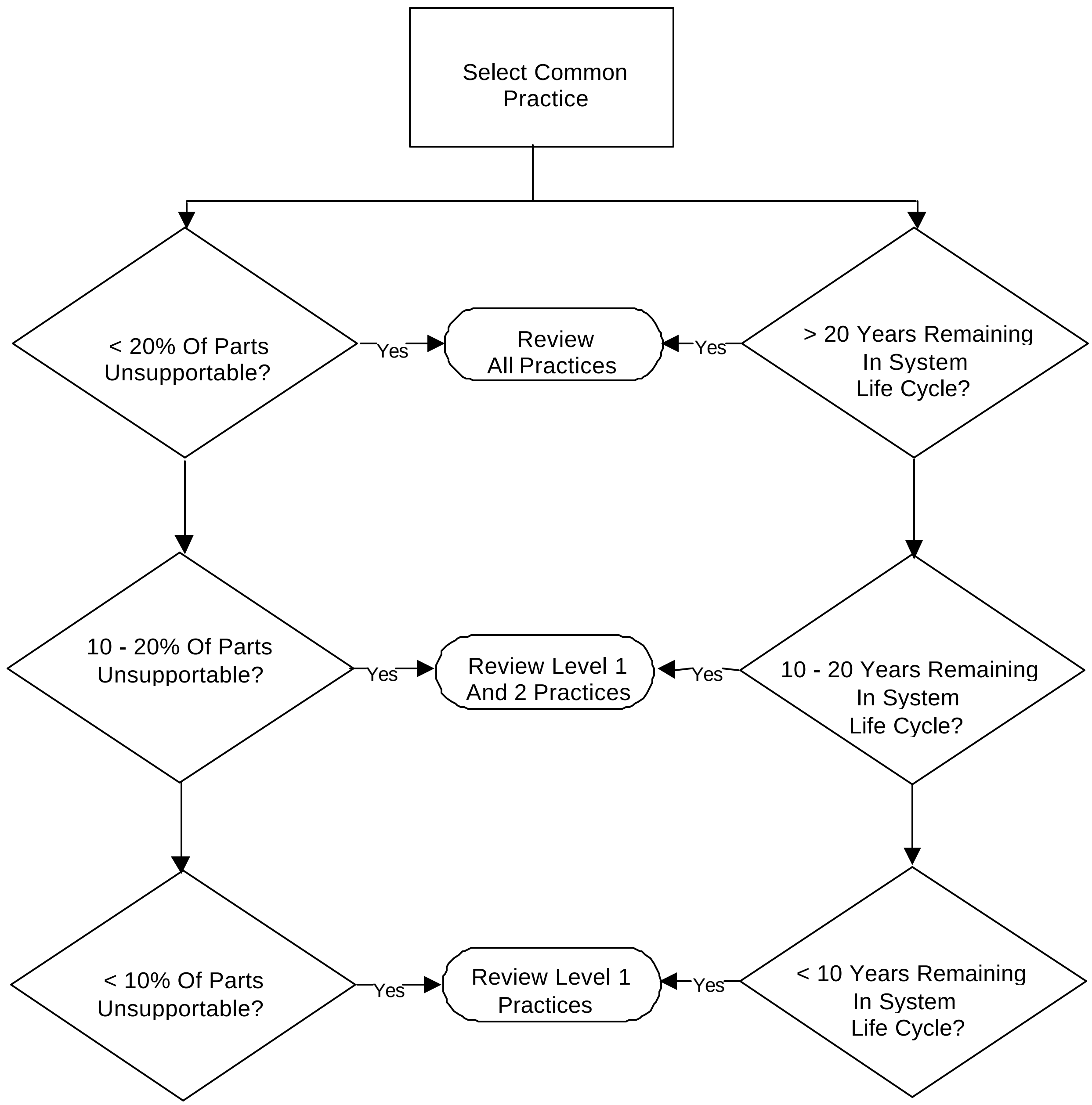


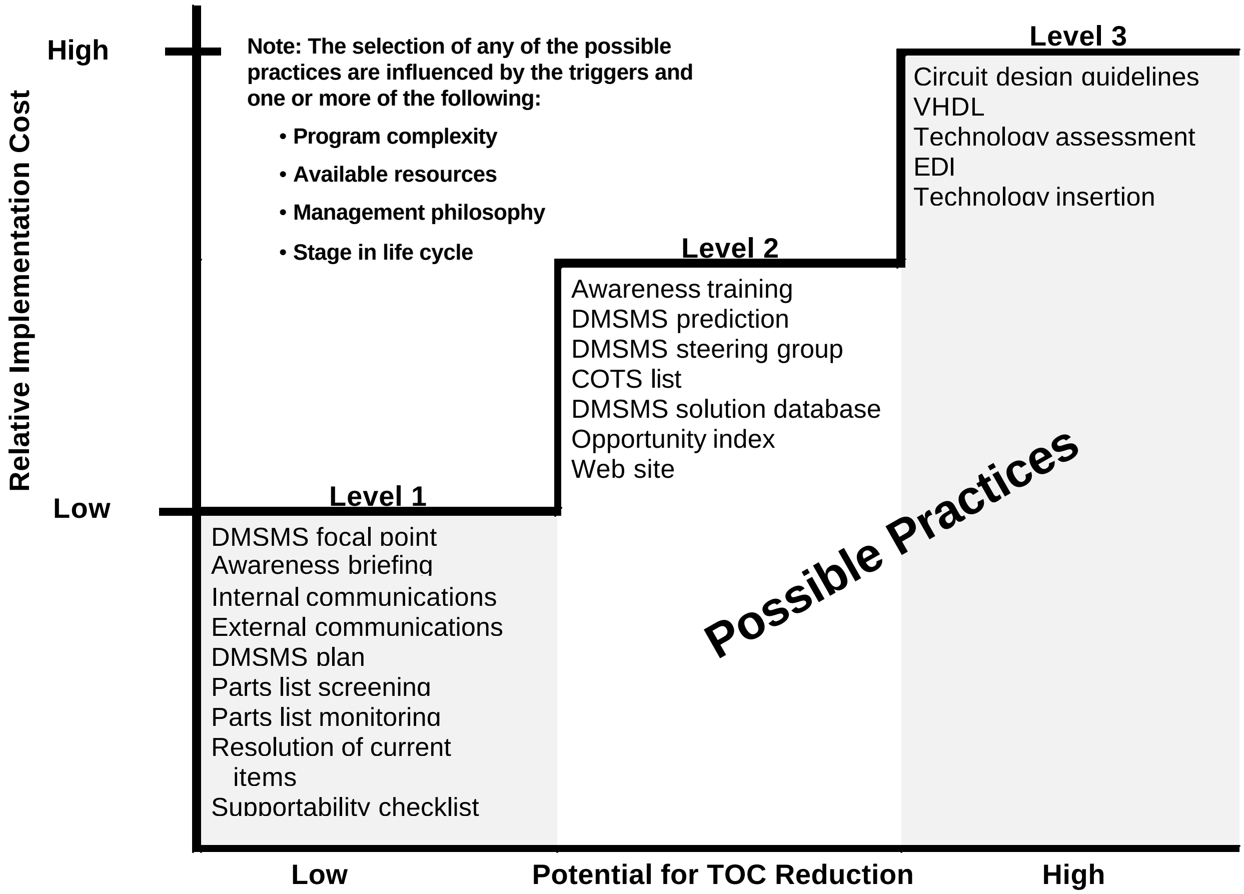
Figure 2-1. Selection Process When the Extent of DMSMS Problems Are Known

In addition to using the questionnaire in Table 2-3 and the selection process in Figure 2-1, the selection of the appropriate practices must also consider the complexity of the program, available resources, management philosophy, and the life-cycle phase. For example, a program entering the PDRR phase may be able to plan for the incorporation of Level 3 practices in the EMD phase request for proposals (RFP). Alternatively, a program in sustainment may not be able to afford to convert all the drawings into an electronic data interchange (EDI) format. The selection should also consider how practices may affect:

- Unit production cost estimates
- Life-cycle costs
- Cost performance versus schedule
- Acquisition strategy
- Affordability constraints
- Risk management

The collection of this information puts the program manager in the best position to select the common practices most applicable to the program. Program managers have realized a cost avoidance by implementing these practices and have “stepped up” their programs to reduce the risk of obsolescence. To evaluate the economic effectiveness of an obsolescence management program a business case analysis should be conducted. Business case analyses from the B-2, AEGIS, and Joint Stars programs have shown that the implementation of these practices can result in lowering the cost of resolving obsolescence problems and reducing TOC. It is important to note that as more practices are selected, the potential for reduction of TOC increases. The relative implementation cost versus potential for TOC reduction, along with a summary of the possible triggers, are shown in Figure 2-2.

Because of the wide variations between programs, only the relative implementation cost can be provided. Once a program manager completes the selection process, a worksheet to estimate the implementation cost based on the selected practices is provided in Appendix B. The completion of the worksheet is the first of two basic steps in determining a business case that validates the implementation of a program that mitigates the impact of obsolescence. The second step is to determine the cost of resolving obsolescence problems if a program is not or has not been implemented. This requires the estimation of TOC when no mitigation techniques have been implemented and a program has to react to supportability problems caused by obsolescence.



Possible Triggers

Level 1	Level 2	Level 3
Initial DMSMS awareness by program manager (PM) <10% of parts unsupportable <10 years remaining in system life cycle	Increased awareness from PM 10–20% of parts unsupportable 10–20 years remaining in system life cycle	Higher management (above PM) awareness of supportability problems >20% of parts unsupportable >20 years remaining in system life cycle Opportunity to enhance supportability or reduce total cost of ownership

Figure 2-2. Stepping Up to Minimize the Risk of Obsolescence

SECTION 3

COMMON PRACTICES

3.1 INTRODUCTION

The experiences and lessons learned from DMSMS Teaming Group members and other DoD programs serve as a basis for many practices and resources used today to minimize the risk of obsolescence. The most common practices are presented in this section and form the basis of a DMSMS program that can be used to mitigate the impact of DMSMS. It is expected that, as the DoD and DMEA obtain additional lessons learned, these practices will be updated accordingly and new practices will be added.

The practices are organized by level. Although many are tied to a specific level, we recognize that some may be applicable to other levels as well. Many of these practices are closely aligned within a specific program phase; however, they may also be appropriate throughout the system life cycle. Where applicable, recommended reading and web sites are provided. Section 2 provides guidance for selecting these practices.

3.2 LEVEL 1 PRACTICES

Level 1 practices are implemented to resolve current obsolete items. Some of these activities may be considered reactive. If a DMSMS problem exists, these practices represent a small investment to establish a DMSMS program that could pay significant dividends over the life cycle of the program. Although these practices may require some time to implement, depending on the processes already established, many DoD program managers have absorbed them into the day-to-day work without significantly increasing the workload. Therefore, these practices can be implemented with minimal cost to the program manager and at the same time provide confidence that any funds expended would be justified by the return on investment potential.

3.2.1 Assign DMSMS Focal Point

Recommended reading:

None

Individual product team members have their own areas of responsibility or concerns. For example, Contracts and Engineering could have conflicting viewpoints.

- Contracts—Ensures that the offeror is capable of meeting contractual DMSMS responsibilities; primarily, establishing and maintaining subsupplier relationships, and meeting post-delivery support commitments. Neither cost nor technical performance is the overriding concern of Contracts—contract enforcement is their point of focus.

- Engineering and technical—DMSMS considerations are focused on ensuring that adequate consideration is given to part and subassembly selection (i.e., long-term availability of parts and estimated life expectancy of the design approach). Cost is a concern, but more emphasis is placed on technical performance.

To ensure that the interests of the entire product team are considered as a whole, the program manager should assign a DMSMS focal point. If funding constraints do not permit a full-time manager, a product team member from the logistics or sustainment staff should assume the duties, at least as a collateral duty. Essentially, the DMSMS focal point should be someone especially interested in or conditioned toward obsolescence issues. Many considerations that require program-specific attention from the DMSMS focal point include:

- System Design
  - Design life expectancy
  - Platform useful life
  - External relationships—the extended product team

- Technology Insertion Plans
  - Software and hardware upgrades
  - Commercial off-the-shelf (COTS) DMSMS

- Life Cycle
  - Spares plans
  - Operations and maintenance (O&M) plans

- Documentation designed for DMSMS:
  - Emphasis on functional specification control drawings (SCDs)
  - As-built, as-maintained records for configuration control

3.2.2 Conduct DMSMS Awareness Briefings

Recommended reading:

> ***Product Life Cycle Data Model*** **(EIA 1997)**
>
> ***DMSMS Management Practices*** **(EIA 2000)**

To avoid DMSMS problems, the single most effective tactic is educating entire product teams so that they understand that DMSMS is not only a significant industry-wide problem but also a growing one. *Product team* is an all-inclusive term, bringing together all product stakeholders from management, engineers, designers, buyers, and planners to those responsible for sustainment. In many organizations, the logistics and sustainment staffs are at least minimally acquainted with DMSMS issues and resolutions because they are the ones most often dealing with DMSMS problems. Unfortunately, the logistics and sustainment staff are at the “tail,” reacting to situations that could have been avoided with up-front DMSMS awareness.

An overview of DMSMS educates the product team about system life cycle and emphasizes that every component used in the design follows a life cycle of its own (see Figure 3-1) and the component reaches its sales peak during stage three. The key point to emphasize is that every component progresses through its life cycle at its own rate. For many microelectronic components, that rate is accelerating. DMSMS awareness briefings must also include introduction to the following DMSMS activities:

- Conducting formal DMSMS programs and processes—Educating the product team to be aware that the most successful (i.e., most cost-efficient, effective) DMSMS programs include formal processes for not only the EMD phase, but also the PF/DOS phase.

- Including DMSMS during design reviews—Inviting comments from entire product teams, emphasizing that the entire team can have valuable insight into DMSMS issues resulting from different perspectives and specialized skills.

- Structuring parts list formats—Stresses the need to use standard parts list styles that permit review by outside industry (e.g., Transition Analysis of Components Technology [TACTech] and Manufacturing Technology Incorporated [MTI]) and government DMSMS organizations such as the Government-Industry Data Exchange Program (GIDEP). These organizations are set up to help monitor parts and note when parts become obsolete; however, their databases are structured around generic part numbers. Rather than developing specialized review lists, manufacturer part numbers, along with generic part numbers, should be included on the master part lists.

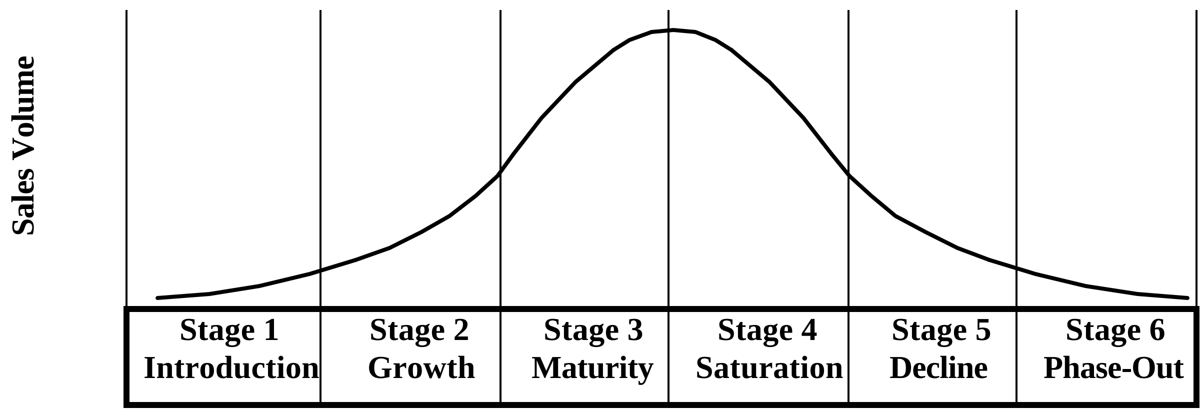


Figure 3-1. Life Cycle Model (EIA 1997)

- Awareness of DMSMS resolutions—Permit the product teams to become knowledgeable about DMSMS resolutions. Resolutions are well-known among the logistics and sustainment staff members in their day-to-day product support practices; however, they are less well known among the designers—the staff that can build in DMSMS avoidance. Briefings must include, at a minimum, an introduction to the two key elements that make implementing cost-effective DMSMS resolutions possible:
  - Understanding resources and resolutions available to the product team
  - Understanding that each resolution has an impact on cost and schedule
- Participation in industry and government DMSMS conferences—Allowing active participation in industry and government DMSMS conferences to stay current with the latest resolutions available from both government and industry. Established DMSMS resolutions did not happen accidentally. They represent the contributions of people in government and industry—contributions of their experience and know-how—and have been documented in the resolution guides.

3.2.3 Facilitate Internal Communication

Recommended reading:

None

A common theme identified by many of the programs was the importance of communication. Touch-effective stakeholders are those on the product team whose day-to-day work can proactively include DMSMS avoidance practices. Recently, with the influence of concurrent engineering, the stakeholders have been working together to select parts and materials to meet specified requirements for performance, reliability, quality, producibility, vendor past performance, and cost. At Level 1, the DMSMS common practice goal is for the stakeholders to add a requirement to ensure that the parts used in a new design are not obsolete. Touch-effective stakeholder responsibilities include considering possible obsolescence in the design approach and ensuring long-term parts availability. Specific responsibilities are detailed as follows:

- Design engineers—Beyond ensuring that the design approach meets specification requirements, design engineers are responsible for knowing the following:
  - Design life expectancy
  - Technology life expectancy
  - DMSMS risk of critical COTS components identified during development
- Logistics or sustainment personnel—In addition to their traditional life-cycle support role, sustainment staff must:
  - Proactively participate in the design review process and intervene when indicated
  - Understand the current state and availability of DMSMS resolutions
- Component engineers—They have the same DMSMS responsibilities as a design engineer, but with more depth for component selection, including:
  - Contacting component manufacturers for new, developing, and alternative product recommendations
  - Identifying the DMSMS risk of each component
- Buyers and planners—These are the last defense in DMSMS problem avoidance. When placing orders with suppliers, their responsibilities include final screening of new design parts lists for current and future availability.

3.2.4 Facilitate External Communication

Recommended reading:

> ***DoD DMSMS Teaming Group Process* (ARINC 1998)**
>
> ***707 Airframe Product Integration Working Group Charter* (ESC/AW 1999)**

A common theme identified by many of the programs was the importance of communication, both internal as discussed in section 3.2.3 and external. A primary resource that encourages external communication is the DoD DMSMS Teaming Group, which is a formalized group of representatives from DoD programs and industry that work together to share solutions to common component obsolescence problems. The Teaming Group maintains a database of current information on component obsolescence, and whenever possible explores resolutions that will work for all programs experiencing the obsolescence problem, often reducing the cost. For example, if a specific component used by more than one program is no longer offered by either the original equipment manufacturer (OEM) or an aftermarket supplier (AMS), each affected program may determine that emulation—developing a form, fit, function, and interface (F3I) replacement—is the best resolution. Each affected program could then share the nonrecurring engineering costs equally.

Figure 3-2 illustrates the DoD DMSMS Teaming Group process (ARINC 1998). The figure is not intended to illustrate the process for addressing DMSMS by any specific program. In addition, the generic term *procuring activity* is used in place of *government program office*, *contractor*, *depot*, or any other term used to describe a program acquisition support center.

The communications that the teaming group process provides can be used to build external relationships. Addressing ongoing production and post-deployment sustainment requires that external relationships be put in place to ensure continued parts availability. The relationships should be built with the following considerations:

- Acquisition authority and system manufacturer relationships require assurances that a contract vehicle is provided for future support.

- Manufacturers must ensure, via contractual agreement, that future support from major component suppliers guarantees continued parts availability.

- Integrators, who may also be manufacturers, must address the need to ensure that they are protected from supplier product changes beyond their control. The controls include the following:

  — Establish relationships with major component supplier—These are in the form of parts availability changes. These will usually require nondisclosure agreements.

  — Regression testing for upgraded designs—This is needed to ensure F3I requirements.

  — Repair program/agreement—These are needed to ensure continued product support. The planning authority must recognize that plans may be made for out-year support, but anything beyond five years, regardless of contractual agreements, should be considered speculative and the logistics plan must address the out-year contingencies.

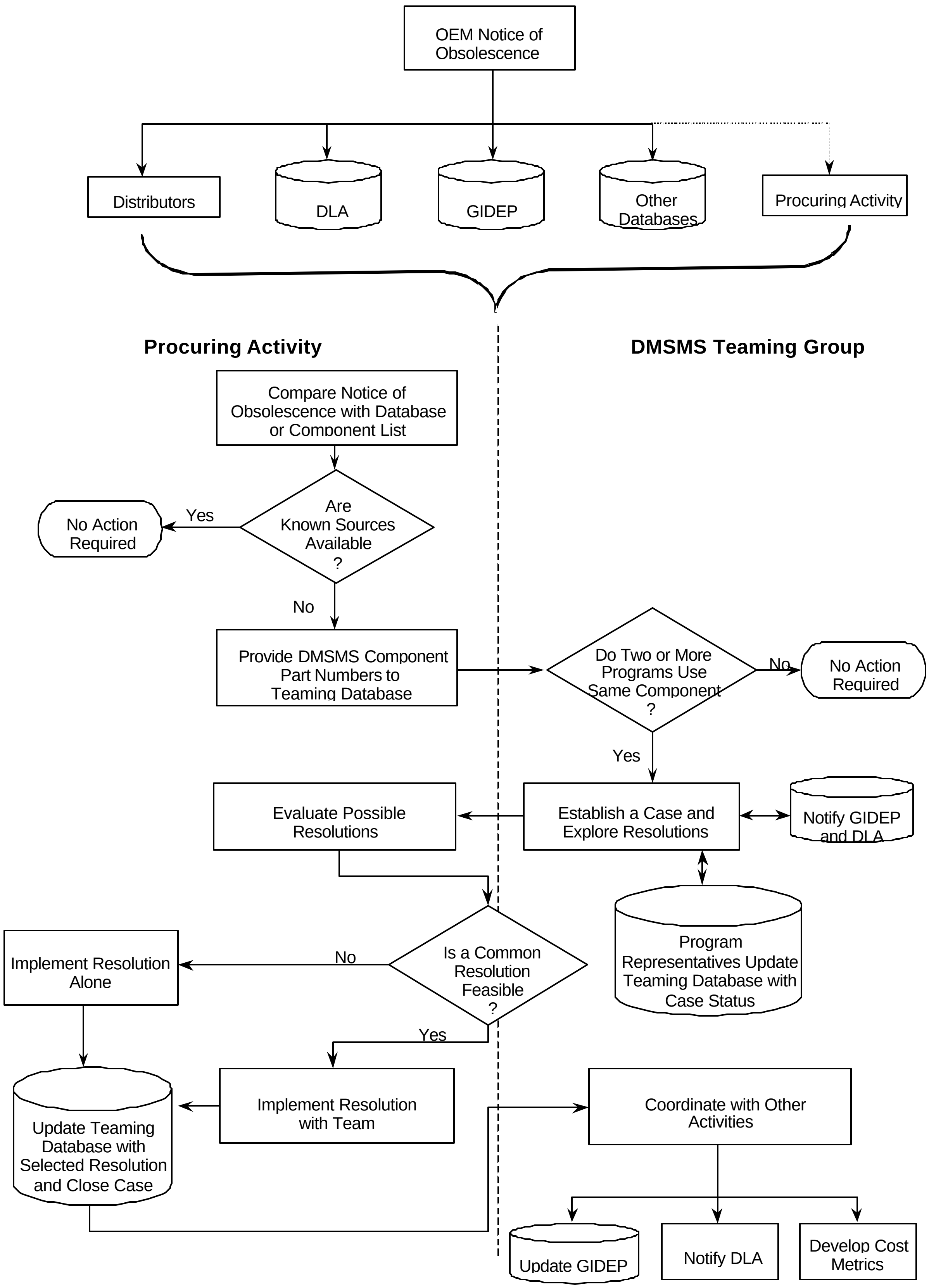


Figure 3-2. DoD DMSMS Teaming Group Process

The primary focus of the DoD DMSMS Teaming Group is on electronic parts; future plans will address nonelectronic parts as well. For nonelectronics, the 707 Airframe Users Working Group is chartered to establish a common organization for all DoD programs employing the Boeing 707 aircraft (ESC/AW 1999). The purpose of the 707 Airframe Users Working Group is to provide a channel for the cross-flow of information on all logistics issues, aircraft mission design series (MDS), common or unique, affecting the Boeing 707 airframe. General topics include, but are not limited to, airframe improvements, modifications, and sustainment. To minimize the impact of obsolescence, the following objectives were established:

- Provide for a regularly scheduled, structured sharing of information among all DoD Boeing 707 acquisition and support agencies
- Benefit from the experiences and solutions to common/related problems of other programs
- Minimize duplication of effort
- Ensure that a lead program office is responsible for each aircraft initiative and derived information and results receive the widest possible dissemination among all users
- Realize cost savings by:
    - Decreasing nonrecurring engineering expenditures by considering all applicable programs jointly
    - Obtaining price breaks through increased-quantity parts procurements

Both the DoD DMSMS teaming group and the 707 Airframe Users Working Group encourage participation by all programs. The more participation the better the chance of minimizing the impact of obsolescence. There are no charges to participate other than labor cost for travel and voluntarily attending meetings. Contact information for both organizations is found in Section 4.

3.2.5 Implement Comprehensive DMSMS Plan

Recommended reading:

None

Although implementing a comprehensive DMSMS plan is possible during all life-cycle phases, it is most effective in mitigating DMSMS risk during the EMD phase. A comprehensive plan for DMSMS avoidance begins with the preparation of design documentation. The goal is to gather sufficient parts detail to enable PF/DOS staff to procure out-of-production parts with minimum re-engineering. The process relies not only on careful step-by-step preparation but also on continuous review of earlier practices to ensure continuous integration with the entire project plan.

The system design life must be considered in the program planning documentation by specifically establishing three sequential life requirements, since these will drive the DMSMS avoidance strategies, and specifying the need for various life-cycle plans. As the system design documentation matures, the specific requirements must be incorporated in the statement of work (SOW) or the statement of objectives (SOO). The three sequential life requirements are:

- Threshold—The minimum acceptable operational life of a system below which the utility of the system becomes questionable. A minimum acceptable life, which, in the user's judgment, is necessary to provide an operational capability that will satisfy the mission need.

- Objective—An operationally significant service life increment above the threshold. An objective value may be the same as the threshold when an operationally significant increment above the threshold is not identifiable or useful.

- Extended—Careful consideration must be given to the possibility that the actual system life expectancy may be many years beyond the objective life expectancy, for example, the B-52. This can be very difficult to quantify but "what-if" scenarios should be developed during the design phase to capture the "corporate memory" of the design team.

A comprehensive plan must include provision for upgrades and added functionality. Failure to consider and provide for an upgrade plan early in the EMD phase can be expected to add substantial cost later. Three key upgrade areas to address are software, hardware, and custom-built components.

- Software—It must be expected that software upgrade opportunities will become available that offer improved functionality. The development plans must define logical break-in points and ensure that system users are provided an opportunity to participate in the plan during the design stage. To facilitate future software upgrades, behavioral models should be developed for line replaceable units (LRUs) wherever possible. Software modeling should include and relate the operational requirements to the system architecture and reach to the actual software code—link the operational requirements document (ORD) "shalls" to the code. Additional value will result from partitioning software segments into stand-alone modules—minimizing interrelationships. The modeling record should become part of the configuration management documentation.

- Hardware—It must be expected that hardware upgrade opportunities will become available that offer improved functionality or that current hardware will become unavailable or obsolete. The development plans must define logical break-in points for hardware upgrades and ensure that system users are provided an opportunity to participate in the plan during the design stage.

- Custom built—The use of custom-built components presents a high risk in both the design and support phases. While the use of custom-built components is essentially unavoidable, using very high speed integrated circuit (VHSIC) hardware description language (VHDL) and other modeling technology at all levels (e.g., part, LRU, and functional assembly to define the part) can dramatically mitigate the associated risk.

In addition to the plans mentioned above (e.g., life cycle and upgrade), spares and sustainment plans should also be included. A spares plan is needed to ensure that spares are available to meet both threshold and objective requirements, and, at a minimum, an outline recommending DMSMS strategies for managing extended life is also needed. A sustainment plan is needed to ensure post-deployment support is available. The sustainment plan must include the requirement for maintaining a complete technical data package (TDP) and contingencies if the original contractor will not provide continued support into sustainment.

3.2.6 Implement Parts List Screening Processes

Recommended reading:

GIDEP DMSMS web site http://www.gidep.org/dmsms/

The parts list becomes the final repository of data used in DMSMS avoidance. Parts list screening could occur during all phases; however, it is most cost-effective during the EMD phase. During the PF/DOS phase, it is more cost-effective to perform parts list monitoring and prediction. To ensure its usefulness as a DMSMS avoidance tool, the parts list must be developed correctly in the EMD phase, that is, it must contain data beyond basic purchasing information. The additional data are directed toward functional performance that can be used to develop parts or LRU-level components that are no longer available.

For microelectronic and COTS components, the final parts list using in-house SCDs must include a complete part description to a level that permits purchasing from alternative sources. For microelectronic parts, the SCD must include the following elements:

- Functional description and schematic
- Input/output pins
- Voltages
- Structural VHDL data

A recommended source of supply and manufacturer part number may be listed on an SCD but it must be subordinate to the SCD. Source control drawings may not be used as a substitute for an SCD. Final schematics should use component reference numbers leading to an SCD. Manufacturer part numbers may be noted on schematics but should be in “Reference Only” parentheses. Before parts lists are made final and released they should be submitted to GIDEP for screening and loaded into a commercial obsolescence tool to ensure that selected parts are available or are not scheduled for discontinuance. The two most popular commercial tools are available from TACTech Incorporated and MTI. Refer to Section 4 of this handbook for contact information. Note that for complex programs (greater than perhaps 10 LRUs), the use of commercial obsolescence database tools may be considered a Level 2 practice.

3.2.7 Implement Parts List Monitoring Processes

Recommended reading:

None

Lessons learned from DoD programs have indicated that implementing parts list monitoring initially during Phase II EMD and continued during Phase III PF/DOS[4] is cost-effective. The parts lists should be loaded into a database that can automatically provide an alert or notification if one of the parts becomes obsolete. GIDEP, TACTech Incorporated, and MTI can provide this notification (monitoring) service. If the system is no longer in production, it would be more appropriate during sustainment to have the capability to both monitor and predict future obsolescence (refer to section 3.3.2). One of the newer services of GIDEP is automated parts matching. Through this service, a member organization can submit their parts list and it will be compared to the GIDEP database to determine if there are any obsolete parts reported against it. A report is then returned to the member showing any DMSMS information against their parts list. This automated parts matching can be tailored for the individual member organization and be compared one time or at regular intervals as desired, at no cost to a member organization.

Efficient program assessment requires a compatible, universally acceptable computerized breakdown of the complete system parts list with fields that include manufacturer part number, commercial and government entity (CAGE) code, quantity per next higher assembly (NHA), and quantity per system. In addition, mean time between failures (MTBF) and mean time to repair (MTTR) data for shop replaceable units (SRUs) and LRUs are useful. Once the database is established, a variety of resources or tools can be used to help identify existing or potential DMSMS cases. Depending on the time-phasing of these DMSMS cases and the system life cycle, an analysis of DMSMS case resolution alternatives can be performed. Candidate alternatives would be refined, and the most desirable alternatives would then be subjected to a cost-benefit analysis (CBA) to select the optimal resolution within the threshold imposed by budget constraints.

[4] The Fielding/Deployment and Operational Support portion of Phase III is often termed *sustainment*.

With Level 1 funding, potential DMSMS cases may not require immediate resolution; rather, they may need to be placed on a watch list with a suspense date reminder. Also, based on the subscription services available, automatic notices or other means of notification may provide ample notice of a pending DMSMS problem.

3.2.8 Resolve Current DMSMS Items

Recommended reading :

> ***DoD Materiel Management Regulation* (DoD 1998)**
>
> ***DMSMS Program Case Resolution Guide* (AFMC 1998)**
>
> ***Diminishing Manufacturing Sources and Material Shortages* (AMC 1999)**
>
> ***Case Resolution Procedures Guide* (NAVSEASYSCOM undated)**
>
> ***Acquisition Practices for Parts Management* (MIL-HDBK-965 1996)**
>
> ***Resolution Cost Factors for Diminishing Manufacturing Sources and Material Shortages* (ARINC 1999)**

Resolutions will likely be required during production and, in some cases, EMD. During production, given that parts list screening and parts list monitoring have been performed, DMSMS problems are often resolved with life-of-type (LOT) buys or bridge buys. Without a proactive program, the majority of DMSMS problems will not be resolved until sustainment, which typically is not the most cost-effective approach. Table 3-1 lists resolutions contained in four of the recommended reading references.

If funding is not available to implement the resolutions, program managers must be willing to petition their program element monitor (PEM) or other higher acquisition authorities for the necessary funding. The program manager and PEM must work together to input DMSMS requirements into the Five-Year Defense Plan (FYDP), taking into consideration the program phase, as well as the color and type of money required. For example, a program in the sustainment portion of Phase III PF/DOS could use 3400 money (color) expense element investment code (EEIC) 583 (type) to investigate a DMSMS problem and verify a fix. However, this money cannot be used to procure the fix. The color of money categories vary by DoD service (e.g., Air Force, Navy, Army). This example illustrates that program managers are affected by funding policy and that various color of money categories may be required to completely resolve a DMSMS problem.[5]

[5] The problems of funding policy and the impact it has on mitigating the risk of DMSMS has been recognized and will require support from all DoD stakeholders to resolve.

Table 3-1. DMSMS Resolutions Contained in Four Sources*

DoD 4140.1-R	Air Force Resolution Guide	Navy Resolution Guide	MIL-HDBK-965
Reclamation	Reclamation	Reclamation	
Substitute			Alternate
Limited Substitute	Substitute	Substitute	Substitute
Aftermarket	Alternate	Aftermarket	
Emulation	Emulation	Emulation	
Redesign	Redesign	Redesign	
LOT Buy	LOT Buy	LOT Buy	
Existing Source	Existing Source		
New Source	New Source	New Source	
Redefine Mil-Spec	Redefine Mil-Spec		
Replace System	Replace System		
Contractor Inventory	Contractor Inventory		
Production Warranty	Production Warranty		
Reverse Engineering	Reverse Engineering	Reverse Engineering	
* Each of these publications does not address every resolution, and names for each resolution vary.			

3.2.9 Supportability Checklist

Recommended reading:

***Research and Development (R&D) Supportability Design Guide* (AFRL 1998)**

The Air Force Research Laboratory *Research and Development (R&D) Supportability Design Guide* (AFRL 1998) provides a supportability checklist for new or proposed R&D programs. The checklist contains 53 topics with questions that ensure supportability for new programs if the answers are affirmative. Our review indicates that many of these topics represented by the questions could also be techniques to mitigate the impact of DMSMS. The checklist is provided in Appendix A and the DMSMS mitigation techniques have been highlighted in bold. The completed checklist provides an opportunity to analyze the responses and formulate an early assessment as to the potential depth and complexity of future DMSMS issues. In addition, this activity provides a means for generating programmatic documentation that not only raises the awareness level of potential DMSMS impacts, but also may serve as a catalyst for obtaining resources necessary to resolve the problems.

3.3 LEVEL 2 PRACTICES

Level 2 practices recognize that DMSMS risk could be evident in a design and set forth a program for the inevitable outcome that during Phase III PF/DOS microelectronics used in the design will become obsolete. A Level 2 DMSMS program includes all of the practices discussed in Level 1 as well as those introduced in Level 2. Level 2 practices are the minimal required practices needed to mitigate the risk of future obsolete items. The majority of these activitives are perceived as proactive.

3.3.1 Conduct DMSMS Awareness Training

Recommended reading:

None

DMSMS awareness training is required for both government (buyer) and manufacturer (seller). Because conflicting viewpoints are possible, the training required would be slightly different.

3.3.1.1 Conduct DMSMS Awareness Training (Buyer)

Level 2 DMSMS training begins with the program manager. Without raising program management sensitivity to the importance of preventing DMSMS problems, success is highly unlikely—program management must be committed to an effective program. Program management must first understand that DMSMS is good business and recognize and accept that DMSMS avoidance may cost more up-front but will yield lower long-term costs—TOCs. Second, program management must be trained to evaluate the quality of the seller's DMSMS capability or skill.

The technical staff must be educated to appreciate the impact of their early program concept design acceptance decisions on the long-term logistics "tail." These decisions are not usually part of the concept of operations (CONOPs) but are more likely to be made at the System Design Review (SDR) or Preliminary Design Reviews (PDRs)—when acceptance (or rejection) of design specifics will have the most effect on future DMSMS issues. Again, the engineering staff must be educated to recognize good DMSMS avoidance techniques during the SDR or PDRs. Basically, this means that a design that will clearly meet performance objectives is not necessarily the best design in terms of DMSMS avoidance and TOC.

The contracting staff has the problem of being in the forefront of source selection. After evaluating technical proposals, the primary role of the contracting office has been negotiations. The term *negotiation* has the connotation of lower up-front or initial acquisition cost. This aspect of an acquisition may present the contracting office with a serious dilemma, defending higher up-front costs with yet-to-be-proven lower TOC, versus a lower up-front cost that serves to meet a budget immediately.

Similarly, other acquisition team staff members, such as Documentation Management, Logistics, Test, and Customer (user) Representatives, must have their role in DMSMS management defined as it applies to their own field of expertise with emphasis on how they can mitigate the risk of obsolescence.

The key to Level 2 training is to ensure that it is not an overview approach. Because on-the-job training (OJT) will not meet Level 2 requirements, the training must be:

- In-depth with each element directed toward specific disciplines
- Written in handbook or similar form
- Presented in a classroom environment

3.3.1.2 Conduct DMSMS Awareness Training (Seller)

Level 2 requires extensive training, beginning with senior management. It will take little effort to make the technical staff—the touch labor—appreciate, understand, and implement DMSMS avoidance techniques. The primary effort must be directed toward increasing senior management sensitivity to the importance of preventing DMSMS problems. Success is highly unlikely if the underlying motivation is to accommodate a customer requirement. Senior management must be committed to an effective program and provide the training to raise the level of DMSMS consciousness among the entire organization.

The discussion for Level 1 describes the content for awareness *briefings*. Briefings should not be confused with training. Training means that each organization and organization team member is educated to understand in broad terms every aspect of DMSMS issues. Beyond that, the staff must be educated to understand DMSMS issues within the precise context of their own role in the organization. From the seller's perspective, this means that:

- Senior management must first understand that DMSMS is good business, and recognize and accept that DMSMS avoidance may cost more up-front but will yield lower long-term TOCs.[6] Second, they must be committed to implementing at least Level 2 DMSMS common practices throughout their organization.
- The technical staff must be educated to realize that the impact of their early program concept design decisions will have long-term effects on TOC. These decisions are most likely made at System or Preliminary Design Reviews when acceptance (or rejection) of a design will have the most effect on future DMSMS issues.
- The engineering staff must be educated to recognize good DMSMS avoidance designs in advance to minimize redesign, and the associated rework costs. Basically, this means realizing that a design that will clearly meet performance objectives is not necessarily the best design in terms of DMSMS avoidance.

[6] To help the sellers assume this risk, new DoD acquisition practices and source selection guidance should be developed that will emphasize TOC.

- The marketing and contracting staff must recognize the problems they will encounter during source selection fact-finding and negotiations. For the seller, negotiation has the connotation of maximizing the price without becoming or appearing noncompetitive or nonresponsive. This aspect of a sale presents the marketing and contracting office with its own dilemma—defending higher up-front costs with yet-to-be-proven, lower TOC.

- Other seller team staff (e.g., Documentation Management, Production, Logistics, and Test) must have their roles in DMSMS management defined as they apply to their specific field of expertise, with emphasis on how they can control DMSMS avoidance.

OJT will not meet Level 2 requirements. The key to Level 2 training is to ensure that it is:

- Not an overview approach
- In-depth, with each element directed toward specific disciplines
- Written in handbook or similar form
- Presented in a classroom environment

3.3.2 Perform DMSMS Prediction

Recommended reading:

MTI web site: http://www.mtifwb.com

TACTech web site: http://www.tactech.com

At this point in the DMSMS risk mitigation process, product teams should be aware of the impact of DMSMS, that parts lists are being screened and monitored, and that the support staff is resolving current DMSMS problems. DMSMS prediction allows the support staff to resolve future DMSMS problems. Again, as in other Level 2 practices, DMSMS prediction could be performed during all phases; however, if resources are limited, performing this during the sustainment portion of Phase III may be the only choice.

DMSMS prediction is similar to the screening practices from section 3.2.6 that determined whether parts were available or would soon be scheduled to be discontinued (within 18 months). For prediction, an attempt is made to project which parts will become obsolete in the near future (within 18 months). Prediction data are then used during the resolution process to determine if it is more cost-effective to find a solution for a single obsolete device, implement board replacements or plan on total system replacement. Note that the prediction information changes with technology roadmaps and market demand fluctuations on a particular device. TACTech reports that the semiconductor technology baseline is changing every 3.25 years (see Figure 3-3). Prediction services of both MTI and TACTech are available by subscription. Refer to Section 4 of this handbook for contact information.

Average Introduction Rate* For New Generations Of Commercial Integrated Circuits

LOGIC FAMILIES...............6 yrs
MEMORY FAMILIES...........9 mos
MICROPROCESSORS.......2 yrs
DSP ....3 yrs
PLD ....1 yr
LINEAR/INTERFACES.......8 yrs
GATE ARRAYS ....2 yrs
***Overall Average: 3.25 yrs**

Low Voltage Digital Technologies are projected to last an average of 12 to 15 years. This would include all 3V, 2V and 1V or less.

Source: TACTECH, Inc.

Figure 3-3. Semiconductor Technology Baseline

3.3.3 Implement DMSMS Internal Steering Group

Recommended reading:

None

To achieve lower TOC, a steering group should be established to monitor and manage all the problems associated with DMSMS or component or COTS products (e.g., computers, disk drives) obsolescence. This steering group should compare the component-level solutions for obsolescence to the possible enhanced system level capabilities that may be available.

Some programs have found that without a steering group, impacts on the system may be overlooked. This oversight may require additional engineering change proposals (ECPs) to account for system level integration and testing. To mitigate this risk, an internal steering group that addresses issues and decisions at a system level is necessary together with a DMSMS working group that focuses on the alternative solution at the component replacement level. Figure 3-4 illustrates this oversight. This Level 2 practice is most cost-effective during the sustainment portion of Phase III PF/DOS. Having this group in place during the entire life cycle is considered a Level 3 practice.

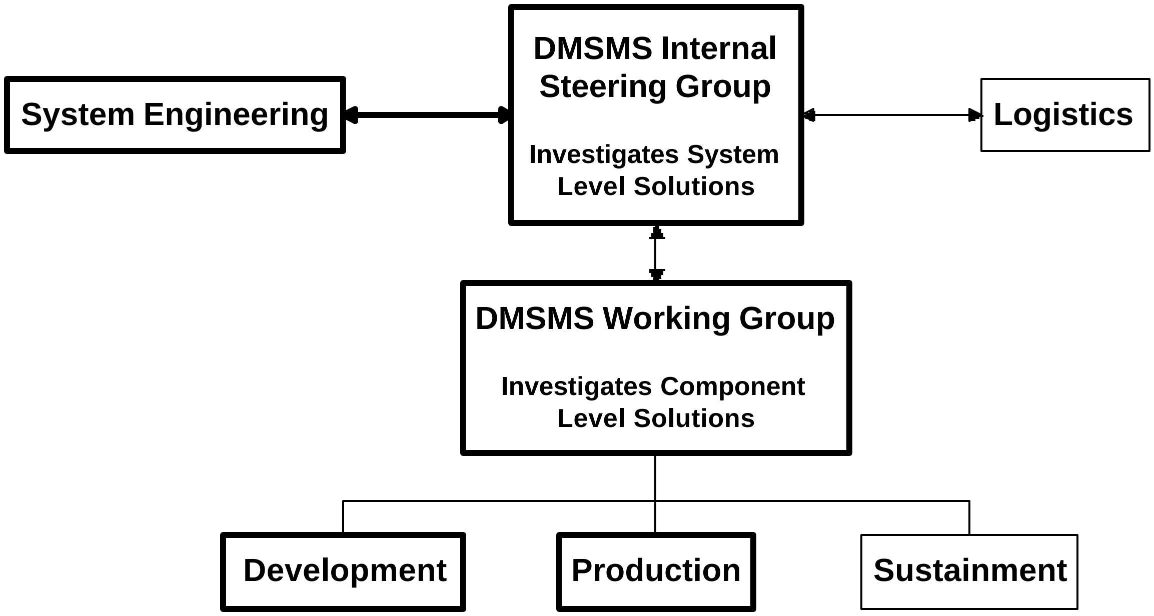


Figure 3-4. Steering Group Oversight

3.3.4 Build Commercial Off-the-Shelf List

Recommended reading:

None

DMSMS in COTS equipment is inevitable. DMSMS avoidance in COTS equipment requires developing relationships between program participants—the COTS supplier, system developer and integrator, and the buyer. Most significant is that while all COTS equipment is subject to DMSMS, particular component classes or parts are prone to specific problems—ranging from minor to volatile. The term *volatile* refers to frequent and likely changes. The volatile category includes software, central processing units (CPUs), memory chips, and disks. Graphic displays, keyboards, and system controlling switches are less volatile. In the case of the more volatile components, OEMs reveal that a degree of obsolescence is always in place in the form of planned minor upgrades or refreshers. For computers, these can be expected in two increments, at the 2- and 4-year points. Beyond that, a complete, major upgrade should be expected—a next generation.

A key step in developing an obsolescence management strategy for COTS equipment is to compile a list of COTS equipment in the system. For each item on the list, the design team must query COTS manufacturers as follows:

- Current availability—Will sufficient parts be available during the production cycle to support not only the projected deployable systems but also the spares needs?

- Future product plans—What are the component manufacturer's plans with respect to the component? Is it targeted for discontinuance? Will manufacturing drawings be available?

- Upgrades—Is the component targeted for an upgrade? Will it meet the F3I specifications of the current product?

- Timeline—When will changes be made?

- Customer upgrade support policy—The supplier must be contractually locked-in to support the product at least until the threshold life cycle is achieved.

- Parts availability support/inventory—What is the current parts availability state? Will they enter into special microcircuit support agreements?

- How does the COTS timeline compare with life cycles?

The completion of the COTS list with answers to the above questions provides the basis of the obsolescence management strategy. Studies disclose that this up-front action can prevent many DMSMS COTS management problems

3.3.5 Develop DMSMS Solution Database

Recommended reading:

None

The DoD DMSMS teaming group database (section 3.2.4) may not contain detailed engineering data required by a specific program office or company. A DMSMS solution database provides detailed program-specific data that includes information on alternative part numbers, next higher assembly (NHA), quantity per assembly (QPA), special testing required, cost, reliability, inventory levels and other comments that include the ongoing status. Ideally, the database should be developed during the EMD phase or once >10% of the parts are obsolete. The touch-effective stakeholder primary responsibilities for the database include:

- Design engineers—Ensure that the alternative devices entered into the database meet system specification requirements.

- Logistics or sustainment personnel—In addition to entering part numbers, NHA, QPA, and reliability information into the database, logistics or sustainment staff must ensure that the information is complete and correct.

- Component engineers—Same database responsibility as a design engineer, but with more depth for alternative component selection, including:

  — Ensuring that new, developing, and alternative product recommendations from component manufacturers meet component level specification requirements

  — Identifying special testing requirements

  — Identifying the DMSMS risk of each component

- Buyers and planners—Provide inventory levels, cost and status on current and future availability of alternate parts.

The database should be reviewed and updated at least quarterly. During the sustainment portion of Phase III PF/DOS, the database becomes the source for an interchangeable parts list that can be used by maintainers at the depot, item managers, and inventory control points.

3.3.6 Develop Opportunity Index

Recommended reading:

Naval Inventory Control Point (NAVICP) web site: www.boss3.navy.mil

The concept for developing an opportunity index for DMSMS was developed based on the review of the Navy BOSS-III Program. The BOSS-III program evaluates equipment on Navy aircraft and ranks it (creates an index) based on reliability and depot repair data. The index provides a ranked list of equipment that may be candidates for reduction in total ownership cost (RTOC) opportunities. Developing an opportunity index that also incorporated DMSMS could serve the same purpose—provide a ranked list of opportunities for RTOC.

A DMSMS opportunity index requires the development of a database[7] that includes:

- A breakdown of the complete system parts list with fields that include manufacturer part number, quantity per NHA, and quantity per system.

- MTBF and MTTR data for SRUs and LRUs.

- Component obsolescence prediction data.

[7] In lieu of developing a new database, the database from 3.3.5 could be used.

- Estimated cost to resolve DMSMS cases—can be determined from Resolution Cost Factors for Diminishing Manufacturing Sources and Material Shortages (ARINC 1999).

The DMSMS opportunity index is generated based on information in this database. The index can be used to identify the LRUs or SRUs that would benefit the most from the higher nonrecurring engineering cost resolutions. Such as, resolutions for SRUs that could be modified or replaced with new technology, modeled using VHDL, updated with emulated components, or upgraded using rapid retargeting (RRT). For example, Naval Supply Systems Command (NAVSUP) has developed a spreadsheet that evaluates potential opportunities to determine if rapid retargeting (RRT), a solution for DMSMS, could be cost-effective. Rapid Retargeting is a design process that uses a collection of sophisticated analysis, simulation, and modeling tools to transform an existing electronic module from the fielded system into a new module with identical form, fit, and function with respect to the target module. For more information, NAVSUP contact information is provided in Section 4.

As a Level 2 proactive practice, this ranked list of DMSMS problems, provides a program manager the insight into RTOC opportunities and minimizes the risk of future of obsolescence.

3.3.7 Create Web Site for DMSMS Management

Recommended reading:

None

The advent of information sharing and evolving information technology dictates that creating a web site for programmatic documentation and DMSMS management data are a cost-effective means of providing on-demand access to authorized individuals.

Many program integrated product teams (IPTs) are not collocated and are usually geographically dispersed. By hosting programmatic documentation on the web (may be password-protected if required), the program manager should be assured of the configuration integrity of the information being accessed.

The structure and control of the web site will be as authorized by the host program manager. Web structure may consist of the following elements:

- Home page (including site directory)
- Key program organization (e.g., focal points, e-mail links)
- Program documents (e.g., briefings, analyses)

- Program calendar
- Action items (closed and open)
- DMSMS links
- DMSMS database
- Problem part reports
- Web site procedures

3.4 LEVEL 3 PRACTICES

A Level 3 DMSMS program includes all of the practices discussed in Levels 1 and 2 as well as those introduced in Level 3. The advanced practices of Level 3 are required to mitigate the risk of obsolescence when Level 1 or Level 2 activities are no longer cost-effective. Although these proactive activities may require additional program funding, implementing Level 3 DMSMS practices provides a comprehensive program, highly focused on the organization viewpoint or goals. In general, the two entities are the buyer and the seller. Their perspectives are not always the same.

The buyer's perspective on DMSMS management is usually "How do I protect myself?" While cost is a valid consideration, the focus must be on guarding against future DMSMS problems. A superficial review of current DoD DMSMS management efforts reveals a wide range of activity from no program DMSMS awareness even among logistics staff, to management and logistics staff awareness without action, to full programs. The latter seem focused on problem resolutions and for the most part remain in the purview of the logistics team with some program management awareness. Many Level 1 and Level 2 DMSMS resolution practices are well understood and widely known, but are in fact, after-the-fact solutions. To implement Level 3 practices, successful organizations will have to reach beyond DMSMS damage control and focus time, energy, and resources toward ensuring that future problems are minimized if not eliminated. Although the implementation cost will be high, the potential for cost avoidance is also high.
The seller's perspective on DMSMS management is a dichotomy. "How do I do the right thing (add overhead cost) and maintain a competitive edge (lower overhead cost)?" The primary objective of a manufacturing organization is to keep costs down and profits up. It is clear that to implement Level 3 DMSMS avoidance management standards, the seller must expend time and manpower resources—the overhead expense. The problem becomes one of helping the seller senior management accept that DMSMS avoidance management is good business. To accomplish this objective requires two distinct approaches, both of which reach the same conclusion:

- Apply DMSMS avoidance techniques in products to make products more attractive to buyers by reducing TOC

- Develop a DMSMS awareness organization as a defensive strategy against competition, paving the way for increased sales and profits

While the buyer is concerned with initial acquisition cost and TOC, the seller generally does not need to deal with the long-term carrying costs associated with post-deployment sustainment, but is concerned with the perception of higher acquisition cost introduced by DMSMS avoidance overhead. Since the issue of DMSMS avoidance must be addressed head-on, the solution lies in incorporating DMSMS avoidance techniques in the design and emphasizing long-term TOC savings to potential buyers. The solution for the buyer and the seller is to accept the basic one-time costs associated with implementing Level 3 practices—*biting the bullet*—then recognize that these practices during the life cycle should lower the TOC. Of course, it can be expected that designing in DMSMS avoidance will be a cost driver; however, two other offsetting results may occur:

- Increased sales for the seller

- Decreased TOC for the buyer

3.4.1 Implement Circuit Design Guidelines

Recommended reading:

None

The circuit design effort offers the single best opportunity for DMSMS avoidance. Exploitation of this opportunity begins with DMSMS awareness education to alert the touch-effective stakeholders to DMSMS avoidance opportunities in the EMD phase. These avoidance opportunities could also be applied to any design efforts during the PF/DOS phase. The following lists some common steps that provide a path to minimize the risk of future DMSMS problems. This list should be tailored based on program-specific requirements.

1. Develop preliminary circuit design:
   (a) Select microelectronic components from qualified parts list (QPL), preferred parts list (PPL), and other databases
   (b) Submit list to GIDEP and commercial DMSMS database services
   (c) Revise microelectronic component list in accordance with GIDEP Alerts and DMSMS status

2. Develop final microelectronic component type and quantity:
   (a) Establish life-cycle required quantities
   (b) Review with purchasing department for reported problems

3. Conduct material review planning (MRP):
   (a) Stock status
   (b) Where used
   (c) Reserve
   (d) Anecdotal information

4. Query microelectronic component manufacturer about current availability to establish:
   (a) Initial system needs
   (b) Initial spares buy
   (c) Future spares support—Determine producers future production plans
   (d) Repair support over life cycle—Establish a contractual vehicle to ensure continued support

5. Implement voltage regulators on high-value, high-reliability circuit boards to prepare for future lower voltage requirements.

6. Develop VHDL models.

3.4.2 Produce Behavioral VHDL Model

Recommended reading:

DMEA web site: http://www.dmea.osd.mil/vhdl.html

With the exponentially increasing complexity of microelectronics, it is becoming imperative to find more efficient methodologies and tools to design, simulate, and build microcircuits. Traditional tools like schematic capture are becoming cumbersome and time-consuming for designing application-specific integrated circuits (ASICs) that now have more than 1 million transistors. It is apparent that tools and methodologies providing greater efficiency are necessary to reduce the design cycle of these highly complex designs. Hardware description languages are meeting this challenge and becoming the accepted methodology for digital hardware designs.

VHDL is a language to describe the behavior of digital logic to be implemented in hardware. VHDL contains levels of representation that can be used to describe digital circuitry from the bidirectional switch to complete digital systems and all levels in between. VHDL provides a method to abstract or "hide" the implementation details of a design. This feature readily enables the designer to describe large functions as well as individual components very quickly and efficiently. These functions then become the building blocks for developing large designs. The VHDL tools also provide a direct path to implementation in hardware.

VHDL has proved to be extremely valuable to the DMSMS community. As an IEEE and vendor-independent standard, VHDL provides accurate documentation of digital electronic circuitry. This technical documentation has been invaluable for engineers working to replace obsolete microcircuits. DMEA has implemented a standard practice to deliver VHDL in the data package for all digital redesigns.

Of particular importance from a DMSMS perspective is ensuring an accurate VHDL description accompanies the latest generation devices. DMEA is finding that many of the most recent designs are experiencing obsolescence at a disproportionately high rate. This is not entirely unexpected, however, as most of these designs are implemented in custom logic tailored for specific applications. When these devices are no longer procurable, there is seldom an alternate source. Additionally, the technology is growing so rapidly that many products have an extremely short fabrication cycle.

DMEA is working to develop methodologies to reverse engineer and redesign this new generation of devices. They are, however, very complex and can be time consuming to redesign. The best approach is to ensure all new designs are executed with a premium on mitigating future obsolescence.

3.4.3 Conduct Technology Assessment

Recommended reading:

None

A technology assessment is a comprehensive analysis that provides the visibility necessary to maintain a strategy that aligns product life cycles to take advantage of technology insertion and product update opportunities. The goal is to maintain awareness of the rapid evolution of microelectronics technology accelerating throughout the military and commercial industrial complex. This assessment determines the maturity of the technologies used in the current design. The steps involved include, but are not limited to:

- Conduct detailed configuration audit
- Identify technologies in design
- Collect market survey data
    - Review changes and trends
    - Identify product life cycles
- Obtain semiconductor technology roadmap (usually fee involved)
- Identify opportunities for technology insertion

3.4.4 Implement Electronic Data Interchange (EDI)

Recommended Reading:

None

If EDI has not already been implemented as part of the overall design process, it may be a useful Level 3 activity to facilitate the future resolution of obsolete devices. For new acquisitions, DoD Regulation 5000.2-R (DoD 1996), directs that "technical data will be prepared, delivered, and used in digital form unless it is not cost-effective to the Government." This requirement implies that all technical data management decisions, including format, storage, and retrieval, must be made based on anticipated use of the data.

Automated Interchange of Technical Information (MIL-STD-1840 1997) is the military interface standard that defines the means for exchanging large quantities of engineering and technical support data among heterogeneous computer systems. MIL-STD-1840 applies selected federal, DoD, international, national, and Internet standards, specifications, and practices for the exchange of digital information between organizations or systems and for the conduct of business by electronic means.

Although EDI would also be beneficial during PF/DOS, the cost to convert to an EDI format would require extensive funding. Continuous advances in computing technology create opportunities for migration toward the "perfect" data world, but not without significant costs. Anticipated user requirements factor into system-wide improvements and specific data management decisions. The U.S. Air Force has made a tremendous investment during the last decade for conversion of aperture cards, mylars, paper, and other nonelectronic media into electronic formats to keep pace with user needs. Nonetheless, electronic data format standards are changing, creating compatibility issues for application software. In addition, current system repositories are diverse, using a variety of database engines, archival schema, and indexing methods. Compatibility between new systems and legacy systems is always required to maintain accessibility and reduce overall costs.

The implementation of EDI should provide awareness to the program manager that the Level 1 practices-related data, such as parts list screening, should be in an EDI format. EDI can facilitate the future resolution of obsolete components by ensuring that data (e.g., drawings, specifications, standards, baseline documents, engineering change proposals, custodial changes) can be electronically transferred among the touch-effective stakeholders. Data in EDI format will also facilitate the development of the DMSMS solution database as discussed in section 3.3.5.

3.4.5 Investigate Technology Insertion

Recommended reading:

None

Technology insertion is an engineering-intensive alternative accompanied by significant cost and schedule implications. When a program or system is confronted with obsolescence of major components or subsystems, and the mission of the system is critical, technology insertion demands consideration.

Technology insertion may provide the opportunity to develop a new product, enhance performance and functionality, resolve several outstanding DMSMS issues, and provide an opportunity to reduce total ownership cost.

The best way to protect source availability and avoid diminishing sources is to have a program of continuous technology upgrades. This can be accomplished with sustaining commercial engineering; SCDs based on realistic objectives, value engineering incentive programs; and well-defined interfaces.

In the past, buyers maintained large infrastructure overhead to support organic supply and maintenance, but with rapid changes in technology, largely in the control of COTS OEMs, this has become an ineffective, costly strategy. Over a typical system life cycle, the cost to maintain and support original technology can be much more than inserting technology in an evolutionary manner. Using evolutionary technology to insert new technology, especially software, is the most cost-effective way to manage software driven DMSMS while keeping systems up-to-date with evolving technology. As stated previously, COTS OEMs will make changes at their convenience. The users’ protection against obsolescence is to be aware of their suppliers’ plans and to have plans in place to incorporate them.

Technology insertion can develop alternatives that leverage state-of-the art technology that not only resolves the critical part problem, but may also enhance performance and decrease cost. These alternatives will be developed through:

- Open system architectures
- Common and advanced materials
- High-reliability modules
- Improved manufacturing processes

If it is determined that a technology insertion resolution is potentially applicable, then program managers should conduct a detailed design analysis and trade-off study to determine if the resolution is technically sound and economically feasible. The trade-off analysis will consider performance, cost, schedule, risk, safety, producibilitiy, operational readiness, logistics, and long-term support requirements. The final output of a technology insertion analysis effort should be a report that documents the results of the investigations and provides conclusions concerning the viability of the new technology and the incorporation of the new technology into the candidate system.

SECTION 4

RESOURCES AND DMSMS AVOIDANCE PRACTICES SUMMARY

4.1 DMSMS RESOURCES AND SUPPORT

The guidance in this handbook focuses on implementing proactive cost-effective practices to mitigate the risk of DMSMS. Programs implementing microelectronics technology will eventually be confronted with DMSMS issues, and our research indicates that many sources of information are available to support these issues.

The amount of research into the DMSMS challenges is immense and has produced useful and informative documents, many available on the Internet. The majority of these sources offer free access, while others may require registration, membership, or a fee for service.

Table 4-1 provides sources that may belong in several categories that may serve the needs of program managers. This list is not all-inclusive, but it does provide source data for information presented in this handbook. For a comprehensive listing of DMSMS resources, use the GIDEP web site. Many of the resources in Table 4-1 have been hyperlinked to areas within GIDEP.

Table 4-1. Resources and Support

Resource	Organization	URL
DMSMS Case Resolution Guide	Air Force Materiel Command, DMSMS Program Office, AFRL/MLMP Area B, Bldg. 22B 2700 D Street, Suite. 2 Wright-Patterson AFB, OH 45433-7405	http://www.ml.afrl.af.mil/ib/dpdsp/crgv10.pdf
DoD Material Management Regulation, DoD 4140.1-R, May 1998	Department of Defense (DoD)	http://204.255.70.40/supreg/
DMSMS Teaming Group Process	PHD NSWC (AEGIS)	http://www.gidep.org/dmsms/initiatives/teamgroup.htm
707 Airframe Working Group	ESC/AW Program Office 3 Eglin Street Hanscom AFB, MA 01731-2115	URL requires username and password. Send request to ESC/AW Program office attention 707 Airframe Working Group.
GIDEP	Government-Industry Data Exchange Program (GIDEP) OASN (RD&A) PR Bldg. CP5, Room 568 2211 South Clark Place Arlington, VA 22214-5104	http://www.gidep.org/dmsms/Dmslinks.htm
AMC-P 5-23, Diminishing Manufacturing Sources and Material Shortages	United States Army Materiel Command (AMC) 5001 Eisenhower Avenue Alexandria, VA 22333-0001	http://www.gidep.org/dmsms/library/5_23pdf
PARTSPLUS Database Services	Manufacturing Technology Inc. 70 Ready Avenue NW Ft. Walton Beach, FL 32548	http://www.mtifwb.com
TACTech and TACTrac	Transition Analysis of Component Technology (TACTech) 22687 Old Canal Road Yorba Linda, CA 92887	http://www.tactech.com
Rapid Retargeting	Naval Supply Systems Command 5450 Carlisle Pike PO Box 2050 Mechanicsburg, PA 17055-0791	http://www.navsup.navy.mil/main/cor_serv/flo/logrd/rrt.htm
VHDL	Defense Microelectronics Activity (DMEA) 4234 54th Street, Bldg. 620 McClellan AFB, CA 95652-1521	http://www.dmea.osd.mil/vhdl.html

4.2 DMSMS COMMON PRACTICES SUMMARY

Printed versions of this common practices handbook are not controlled. Current, online practices will be updated and new practices will be added as the DoD and DMEA obtain additional lessons learned. To obtain the online version, visit http://www.dmea.osd.mil. A summary of the triggers (discussed in Section 2) and practices (described in Section 3) are provided in Table 4-2.

Table 4-2. Summary of Triggers and Practices

Level	Triggers If any of these triggers or events occur…	Practice … implement any of these practices	See Section
1	Initial DMSMS awareness by PM <10% of parts unsupportable <10 years remaining in system life cycle	DMSMS Focal Point Awareness Briefing Internal Communications External Communications DMSMS Plan Parts List Screening Parts List Monitoring Resolution of Current Items Supportability Checklist	3.2.1 3.2.2 3.2.3 3.2.4 3.2.5 3.2.6 3.2.7 3.2.8 3.2.9
2	Increased awareness from PM 10–20% of parts unsupportable 10–20 years remaining in system life cycle Level 1 practices are not cost-effective	Awareness Training DMSMS Prediction DMSMS Steering Group COTS List DMSMS Solution Database Opportunity Index Web Site	3.3.1 3.3.2 3.3.3 3.3.4 3.3.5 3.3.6 3.3.7
3	Higher management (above PM) awareness of supportability problems >20% of parts unsupportable >20 years remaining in system life cycle Level 1 or 2 practices are not cost-effective Opportunity to enhance supportability or reduce total cost of ownership	Circuit Design Guidelines VHDL Technology Assessment EDI Technology Insertion	3.4.1 3.4.2 3.4.3 3.4.4 3.4.5

SECTION 5

REFERENCES

AFMC 1998. *DMSMS Program Case Resolution Guide*. Air Force Materiel Command, July 15, 1998.

AFRL 1998. *Research and Development (R&D) Supportability Design Guide*. Appendix A. Air Force Research Laboratory, Wright Patterson Air Force Base, Ohio, November 30, 1998.

AMC 1999. *Diminishing Manufacturing Sources and Material Shortages*. AMC-P 5-23, United States Army Materiel Command, Alexandria, Virginia, March 18, 1999.

AMC undated. *DMSMS Case Resolution Guide*. U.S. Army Materiel Command.

ARINC 1998. *DoD DMSMS Teaming Group Process.* Prepared by Jerry G. Martinez, Port Hueneme Division Naval Surface Warfare Center, Jack T. McDermott, ARINC Incorporated (Joint STARS USAF/DoD Teaming Cochairman) for Rules for Component Selection in Avionics (RCSA) Working Group Meeting, Annapolis, Maryland, October 21–23, 1998.

ARINC 1999. *Resolution Cost Factors for Diminishing Manufacturing Sources and Material Shortages.* Prepared for Defense Microelectronics Activity (DMEA), McClellan Air Force Base, California, by ARINC Incorporated. Revised May 1999.

DoD 1996. *Mandatory Procedures for Major Defense Acquisition Programs (MDAP) and Major Automated Information Systems (MAIS).* Regulation 5000.2-R, Department of Defense.

DoD 1998. *DoD Materiel Management Regulation*. Regulation 4140.1-R, Chapter 1, Section C1.4, Department of Defense, May 1998

EIA 1997. *Product Life Cycle Data Model*. Electronic Industries Alliance (EIA) Bulletin EIA-724, EIA Engineering Department, Arlington, Virginia, November 1997.

EIA 2000. *DMSMS Management Practices.* EIA Government Electronics and Information Technology Association Engineering Department, EIA Engineering Bulletin GEB1, Draft May 24, 2000.

ESC/AW 1999. *707 Airframe Product Integration Working Group Charter*. ESC/AW Program Office, Hanscom Air Force Base, Massachusetts.

MIL-HDBK-965 1996. *Acquisition Practices for Parts Management*, September 26, 1996.

MIL-STD-1840 1997. *Automated Interchange of Technical Information*, June 26, 1997.

MTI, http://www.mtifwb.com.

Naval Inventory Control Point, http://www.boss3.navy.mil.

NAVSEASYSCOM undated. *Case Resolution Procedures Guide.* Naval Sea Systems Command.

TACTech. http://www.tactech.com.

APPENDIX A

SUPPORTABILITY CHECKLIST

The following checklist has been obtained directly from Appendix A of the Air Force Research Laboratory *Research & Development Supportability Design Guide*.* Although developed for research and development (R&D) projects it use is applicable for any DMSMS program. The only change made in this handbook is the bold highlighting of questions that could affect DMSMS. Review of all the questions would be appropriate for any program in Phase 0 Concept Exploration or Phase I Program Definition and Risk Reduction. The summary that follows the checklist explains why each of the questions in bold has an impact on DMSMS.

A.1 SUPPORTABILITY CHECKLIST

Project Identification: ____

Project Manager: ____

1. What is the purpose of the R&D project?
   Is the project basic research, exploratory research and development, or advanced research and development?
   ___ For internal lab use only?
   ___ For technology transition to using command or SPO? Identify customers below:
   ____

2. (Y | N) **Is the technology applicable to more than one system?**
   (Y | N) **Is the technology applicable to more than one use?**
   (Y | N) **Is the technology applicable to more than one military service?**
   (Y | N) **Is the technology applicable for allied service use?**
   (Y | N) **Is the technology applicable for commercial use?**
   (Y | N) **Is commercial technology being adapted for military use?**
   For any "Yes" answers, specify below:
   ____

* *Research and Development (R&D) Supportability Design Guide*. Appendix A. Air Force Research Laboratory, Wright Patterson Air Force Base, Ohio, November 30, 1998.

3. (Y | N) Has a baseline program (i.e., a fielded system or technology currently in use) been chosen for comparison against the R&D technology/ project? This information will provide the baseline data for showing reliability, maintainability, affordability and life cycle cost improvements.
If yes, identify below:
____

4. (Y | N) Should Air Logistics Center (ALC) engineers be involved with the project?
If yes, which ALC?
____

5. (Y | N) **Are reliability, maintainability, and supportability (RM&S) design tasks on contract covered in the statement of work (SOW) or the statement of objectives (SOO)?**

6. What are the reliability goals of the project?

7. (Y | N) **Has the projected reliability improved over the reliability of the baseline?**
(Y | N) **(If there is no baseline, is the projected reliability an improvement over similar fielded system(s)?)**
How much improvement?
____
How will the reliability improvement be measured (proved)?
____

8. What are the maintainability/supportability goals for the R&D project?
____

9. (Y | N) Is the equipment/system compatible with the two-level maintenance concept?

10. (Y | N) **Was the one-level maintenance concept (throw away) considered for the equipment/system components?**

11. (Y | N) Has the projected maintainability improved over the maintainability of a similar system which is fielded (e.g., project improves mean time between maintenance: less maintenance is required on the R&D technology when compared to the fielded technology or the frequency of downtime due to maintenance or length of repair time is calculated to be less)?
How much improvement?
____
How will the maintainability improvement be measured (proved)?
____

12. (Y | N) Are there any periodic maintenance requirements, inspections, calibrations, or limited life components in the design?
If yes, specify below:
____

13. (Y | N) Can maintenance requirements, inspections, calibrations, and limited life components be eliminated from the design?

14. (Y | N) If they cannot be eliminated, are components requiring maintenance readily accessible?
15. (Y | N) Is the system being designed to withstand abuse by minimally skilled maintainers and operators?
16. (Y | N) **Does the new technology contribute to reducing the amount of support equipment and/or tools needed by maintainers and operators?**
17. (Y | N) Will the technology/system allow for tool-less maintenance?
18. (Y | N) Can required maintenance be accomplished with common hand tools?
19. (Y | N) Does the system require specially designed tools or support equipment?
    If yes, identify below:
    ____
20. (Y | N) Can special tools or equipment be eliminated?
21. (Y | N) Does any required support equipment exist in the present AF inventory?
    If no, identify short-falls below:
    ____
22. (Y | N) **Does the new design incorporate open system architecture concepts?**
23. (Y | N) **Are commercial-off-the-shelf (COTS) and nondevelopmental items (NDI) components being used if available?**
24. (Y | N) **If using COTS/NDI, has an obsolescence management strategy been adopted?**
25. (Y | N) **Has the overall number of modules/components decreased compared to the baseline?**
26. (Y | N) Has there been a significant reduction in size, weight, and/or power consumption compared to the baseline?
27. (Y | N) Does it provide a form, fit, and function upgrade?
28. (Y | N) Does the project include testability features for the project engineer during the R&D phase?
29. (Y | N) Does the project include testability features for future application by maintenance personnel?
30. (Y | N) Are built-in-test (BIT) functions being designed into the system up front?
31. (Y | N) Will self-calibration be employed?
32. (Y | N) Will the technology yield consistently repeatable performance with minimum outside calibration or special attention required?
33. (Y | N) **Will the technology operate satisfactorily within the environmental constraints and restrictions of present aircraft or weapon systems?**
34. (Y | N) **Will the system require any special cooling (conductive, forced air, liquid)?**
    Also, how much of an impact will the new technology have on the present weapon system’s environmental control system? Specify below:
    ____

35. (Y | N) Will the technology be electrically compatible with present aircraft or weapon systems? Specify electrical system requirements below:

____

36. (Y | N) Will the technology meet electromagnetic interference/electromagnetic compatibility (EMI/EMC) constraints? If no, identify any shortfalls below:

____

37. (Y | N) Can the technology be made to withstand the difficult and realistic military combat environment that it is expected to encounter (extremely high or low humidity, extreme temperatures, shock and vibration, field, storage and transportation abuse)?

38. (Y | N) Are there any special transportation/transportability requirements or goals? Consider how the item will get from the place of manufacture or storage to the point where it will ultimately be used.

- (Y | N) Does it have to be man-portable?
- (Y | N) Does it have to fit in a vehicle, aircraft, or other system, e.g., satellite, rocket booster?
- (Y | N) Should it be designed to tolerate ground transport over rough terrain?
- (Y | N) Is the system/component subject to electrostatic discharge (ESD) requirements during transportation?
- (Y | N) Does the system contain hazardous materials with special transportation requirements?
  If yes, coordinate with the safety office in your technology directorate or site business office.
- (Y | N) Does it require specially designed shipping/storage containers?
- (Y | N) Are there any size or weight restrictions?

For any “Yes” answers, specify the details below:

____

39. (Y | N) Are there any special storage requirements or goals?

- (Y | N) Will the system remain in storage for a long time before use?
- (Y | N) Does the system require any environmental control while it is in storage?
- (Y | N) Is the system/component subject to ESD requirements during storage?
- (Y | N) Does it require specially designed shipping/storage containers?
- (Y | N) Does the system contain hazardous materials with special storage requirements?
- (Y | N) Will the system need periodic maintenance or inspection while it is in storage?

For any “Yes” answers, specify the details below:

____

40. (Y | N) Is the technology affordable?

41. (Y | N) Will life-cycle-cost (LCC) savings be realized compared to the baseline or a similar fielded system?

42. (Y | N) Are LCC and/or design-to-cost (DTC) tasks on contract to allow monitoring of LCC drivers?

43.	(Y | N)	Producibility: Is the technology being designed and developed for manufacturing simplicity?
43.	(Y | N)	Does the system require new or unproven manufacturing methods? If yes, specify below: ______________________________
44.	(Y | N | N/A)	**Is the contractor using very high speed integrated circuit (VHSIC) hardware description language (VHDL) to develop and capture designs for new integrated circuits?**
45.	(Y | N | N/A)	**Is software being designed using top-down, structured, and modular techniques?**
46.	(Y | N | N/A)	**Is the software reusable and partitioned to ease supportability functions?**
47.	What programming language will be used? ______________________________	
48.	(Y | N | N/A)	Does the software design include fault-tolerance and graceful degradation?
49.	(Y | N)	**Is the software being adequately documented to ensure supportable software?**
50.	(Y | N)	Will coordination for compatibility be required between the lab project office and the SPO or SPM? If yes, identify below: ______________________________
51.	(Y | N)	Have any trade-offs or alternatives been proposed or evaluated? If yes, identify below: ______________________________
52.	(Y | N)	**Will the contractor be providing technology and supportability improvement recommendations in the final report?**
53.	(Y | N)	**Will the contractor provide a roadmap of where the technology will be in the future and what kind of investments will be needed to mature the technology?**

A.2 JUSTIFICATION OF HIGHLIGHTED QUESTIONS

Question 2. Common use of products among many programs reduces the risk that a component could become obsolete.

Question 5. Clearly defining obsolescence mitigation methods in the Statement of Work (SOW) or Statement of Objectives (SOO) improves supportability.

Question 7. Ideally, if the product does not fail, the impact of obsolescence is eliminated.

Question 10. The airline community believes that one mitigation technique is throw-away functional modules within a shop replaceable unit (SRU) (i.e., a sub-subassembly).*

* *Rules for Component Selection in Avionics.* ARINC Project Paper 662 Aeronautical Radio, Inc. Annapolis, Maryland, October 22, 1999. (Also published as Avionics Publication 99-104/FCM-91.)

Question 16. Components within support equipment (SE) also become obsolete. Reduced SE implies less of a chance of obsolescence issues.

Question 22. Open system architecture can minimize the impact of obsolescence.

Questions 23 and 24. Proceed with caution, COTS and nondevelopmental items can be a blessing or a disaster in terms of obsolescence risk reduction. Successful programs will answer yes to question 24.

Question 25. Decreased number of components equals decreased risk of obsolescence.

Questions 33 and 34. Careful analysis of the environmental constraints may allow a wider use of components.

Questions 44, 45, 46, and 49. Use of VHDL, modular techniques, and reusable software will result in long-term supportability and minimize the impact of obsolescence.

Questions 52 and 53. Support plans and technology roadmaps provide insight into the long-term supportability of the program.

APPENDIX B

ESTIMATING THE COST OF DMSMS MANAGEMENT

The *Program Managers Handbook—Common Practices to Mitigate the Risk of Obsolescence*, provides a solid foundation for creating a DMSMS management program. Determining the budget requirements for your DMSMS management program will require the knowledge and expertise of the program IPT. The recommended tool to assist you in completing your estimate is Figure 2-2, Stepping up to Reduce the Risk of Obsolescence, presented in Section 2 of this common practices handbook. Once your team has studied and absorbed the information in Figure 2-2, the concepts, the triggers for various levels, relative implementation cost, and preparation of the cost estimate may commence. Using the cost-estimating worksheet in Table B-1, select the applicable common practices, estimate the labor hours, estimate any possible additional costs, and calculate the estimated cost.

Table B-1. Cost-Estimating Worksheet

Level	Common Practice	Labor Hours	Possible Additional Cost to Consider	Estimated Cost
1	DMSMS Focal Point			
	Awareness Briefing		Travel	
	Internal Communications			
	External Communications		Travel	
	DMSMS Plan			
	Parts List Screening		Database Subscription	
	Parts List Monitoring		Database Subscription	
	Resolution of Current Items		Nonrecurring Engineering (NRE)	
	Supportability Checklist			
	Subtotal Level 1 Practices			
2	Awareness Training (Buyer)		Travel	
	Awareness Training (Seller)		Travel	
	DMSMS Prediction		Database Subscription	
	DMSMS Steering Group			
	COTS List			
	DMSMS Solution Database		Software	
	Opportunity Index			
	Web Site		Software	
	Subtotal Level 2 Practices			
3	Circuit Design Guidelines		Documentation	
	VHDL		Modeling and Simulation	
	Technology Assessment		Configuration Audit, Research	
	EDI		Technical Data	
	Technology Insertion		Research, NRE	
	Subtotal Level 3 Practices			
	Total DMSMS Program			

Document Improvement Form

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