DMSMS

INTRODUCTION

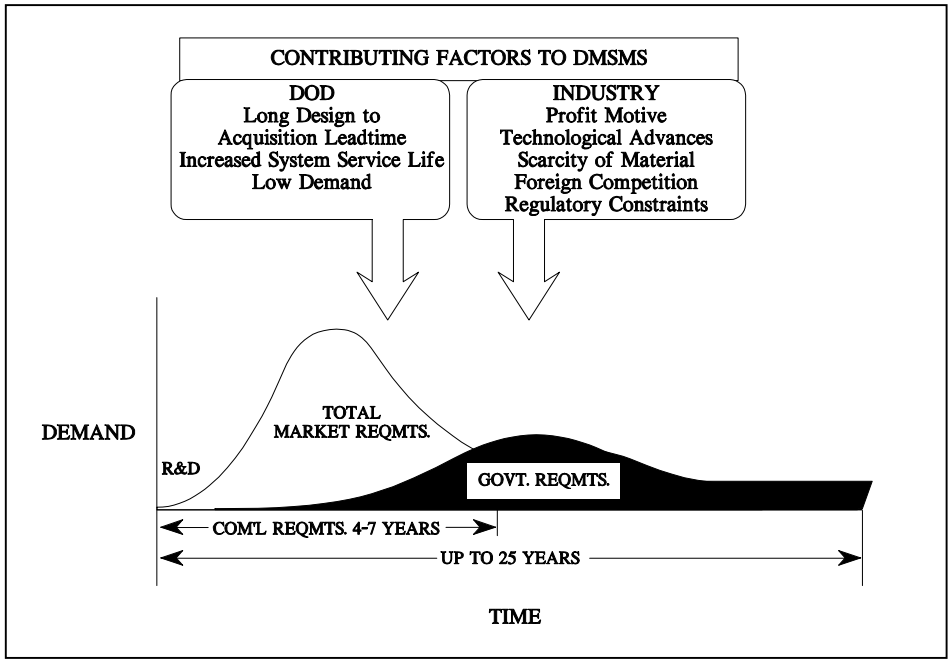
The DMSMS is defined in Department of Defense Material Management Regulation 4140.1-R as, “the loss of, or impending loss of, the last known supplier of an item or raw materials. DMSMS occurs when manufacturers of items or raw material suppliers discontinue production due to reasons such as rapid change in item or material technology, uneconomical production requirements, foreign source competition, Federal environmental or safety requirements, or limited availability of items and raw materials used in the manufacturing process. DMSMS situations tend to have a pervasive effect that not only precludes repair of materiel but also precludes procurement of additional systems, equipment, spare assemblies, and subassemblies that depend on the DMSMS items and raw materials for their manufacture.” It means that the last known supplier or manufacturer will no longer produce a particular item. This document is intended to provide assistance in management of Diminishing Manufacturing Sources and Material Shortages (DMSMS).

BACKGROUND

DMSMS is a problem that has been confronting program managers, logisticians, and item managers in both the Department of Defense (DoD) and private industry, for more than twenty years. Almost anything can become a DMSMS item, including electronics, connectors, racks, motors, valves, adhesives, switches, circuit breakers, propellers, metal alloys, ceramic composites, gases, clothing or its various components and materials, etc. DMSMS is a potential showstopper. It can prevent aircraft from flying, ships from sailing, and tanks from deploying. DMSMS cases may occur at any phase in the acquisition cycle, from design and development through post-production, and have the potential to severely impact weapon system supportability and life cycle costs. The majority of DMSMS cases have historically been in the electronics area (primarily microcircuits); however, DMSMS problems affect all weapon systems and material categories. DMSMS problems are not always confined to piece parts. Material obsolescence situations may occur at the part, module, component, equipment, or other system indenture level. Obsolete parts can be mistakenly designed into new systems every day. Obsolescence is also very expensive, costing the U.S. military hundreds of millions of dollars each year.

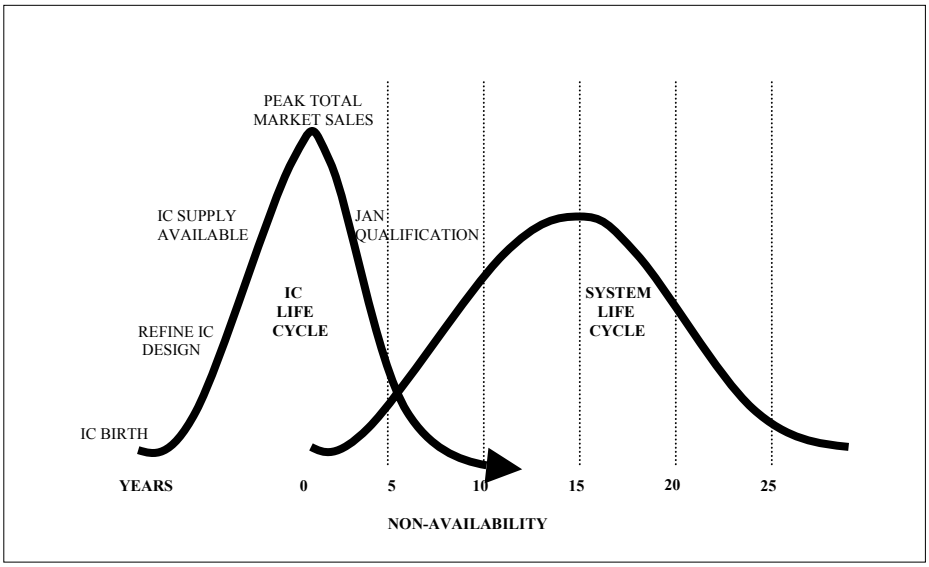
A number of factors contribute to cause DMSMS (Figure 1). The prime driver of DMSMS situations is the commercial profit motive; when a part is no longer economical to produce, manufacturers will shut down product lines and move on to more profitable items. Manufacturers end production of older items and begin production of new items to stay on the leading edge of technology and maintain their competitive edge. A product market may be too small to be profitable. A combination of both DoD and industry driven factors has created the magnitude of the DMSMS problem existing today. The new emphasis by the DoD to use commercial rather than military standard

parts, has caused some manufacturers to cease production of all military standard parts. From a manufacturer perspective, rapidly changing technologies, increased foreign competition, federal environmental and safety regulations, and/or limited availability of materials may make continued manufacture of selected items uneconomical or otherwise unattractive. DoD procurement practices further compound the problem (Figure 2). Long design to acquisition lead-times, as well as increasing service life extension of programs, mean that support requirements for military systems generally extend from 25 to 30 years, as opposed to the 4 to 7 year support cycle expected for many commercial electronic systems. In addition, in many cases the military percentage of total commercial demand has dropped sharply. In the early 1960s, the U.S. Government's procurement of integrated circuits (ICs) accounted for approximately 95% of the market, and is less than 2% today. This combination of extended support periods and diminished overall demand has left military systems highly susceptible to DMSMS problems.



Source: DMS Case Resolution Guide

Figure 1. Contributing Factors to DMSMS



Source: ICE

Figure 2. IC/System Life Cycle

Even after DMSMS situations are identified, resolution efforts are often hampered by a number of factors, including: short notification response timeframes, which leave insufficient time for the DoD to review options in end of production cases; lack of coordination among impacted parties (both government and industry), which affects development of cost-effective resolutions; and lack of dedicated DMSMS funding, which means that dollars from other program areas must be found to resolve obsolescence issues. At the same time, if cognizant systems/equipment were not provisioned to the piece part or microcircuit level, or if provisioning data is incomplete/inaccurate, it may be difficult or infeasible to cross DMSMS part numbers to specific system applications.

GENERAL GUIDANCE

The selection and application of parts to meet the performance requirements of the system or equipment are very important in DMS management. To assure meeting those objectives, it is recommended to have parts engineering processes and procedures in place. The following is list of some primary area of concerns in device selection.

IC Products Technology Selection And Trends

The IC industry is often looked upon to introduce new and innovative devices. Ever-increasing electrical and technological advances necessitate that new products enter the market. As new products are introduced to the marketplace, existing components are pushed further along their lifecycle patterns.

In general, the introduction-position IC is an upgrade in circuit density over existing parts. Although introduction-type ICs receive most of the trade press publicity, the IC manufacturer makes the majority of its money on ICs in their growth and maturity

stages. However, because of the competitive nature of the marketplace and the need to acquire production experience (to move down the learning curve), it has proven very difficult to enter a market segment in the “profitable” stages without having had a part available in the introduction stage.

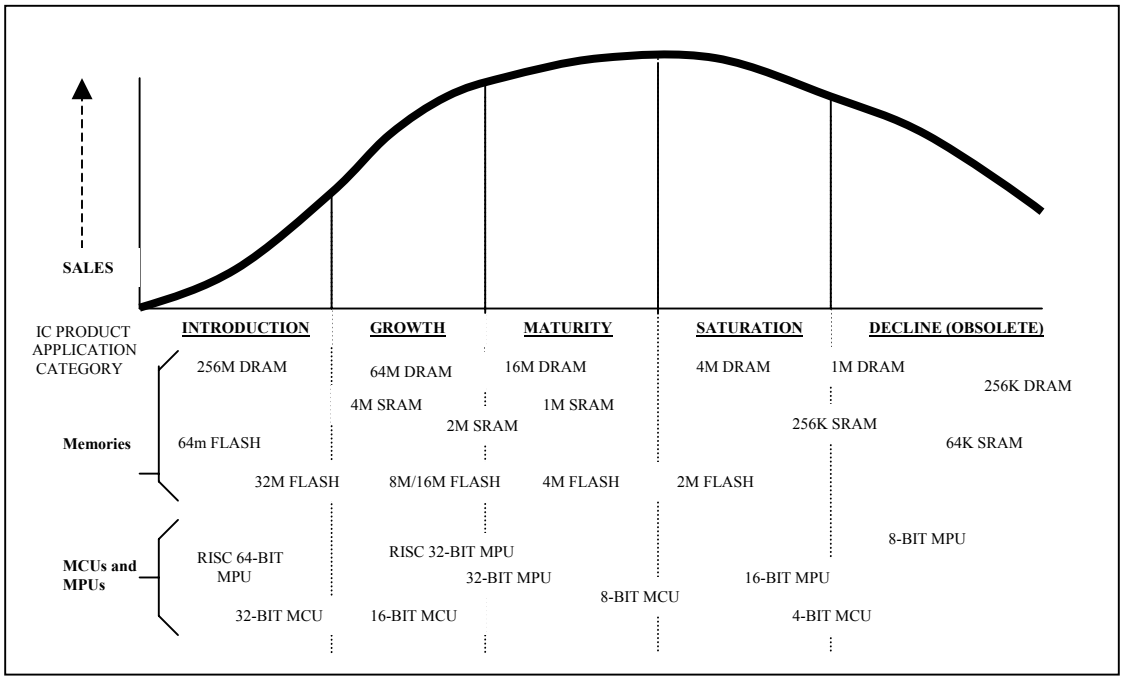
The IC industry has historically introduced or described products well before the time that the devices were ready for commercial mass production. While some of the advances tout device or process enhancements or unique design methods, it usually takes some time before most introductory products are embraced by the IC industry. The underlying causes of this typically slow acceptance of new ICs are high initial costs, existing infrastructures, and oftentimes, user concerns about the quality and reliability of the new technology or products.

Military ICs are typically one to two lifecycle stages behind commercial ICs (Figures 3, 4). Because of long lifecycles of many military electronic systems, ensuring a consistent supply of hi-rel ICs has been a demanding task.

As IC manufacturers concentrate capital resources and Research & Development (R&D) efforts on commercial ICs in the early part of their lifecycles, less support will be given to devices in the saturation and decline stages. This situation becomes especially serious for military IC users when an IC part type that is in the maturity stage of the military lifecycle is also in the decline stage of the commercial IC lifecycle.

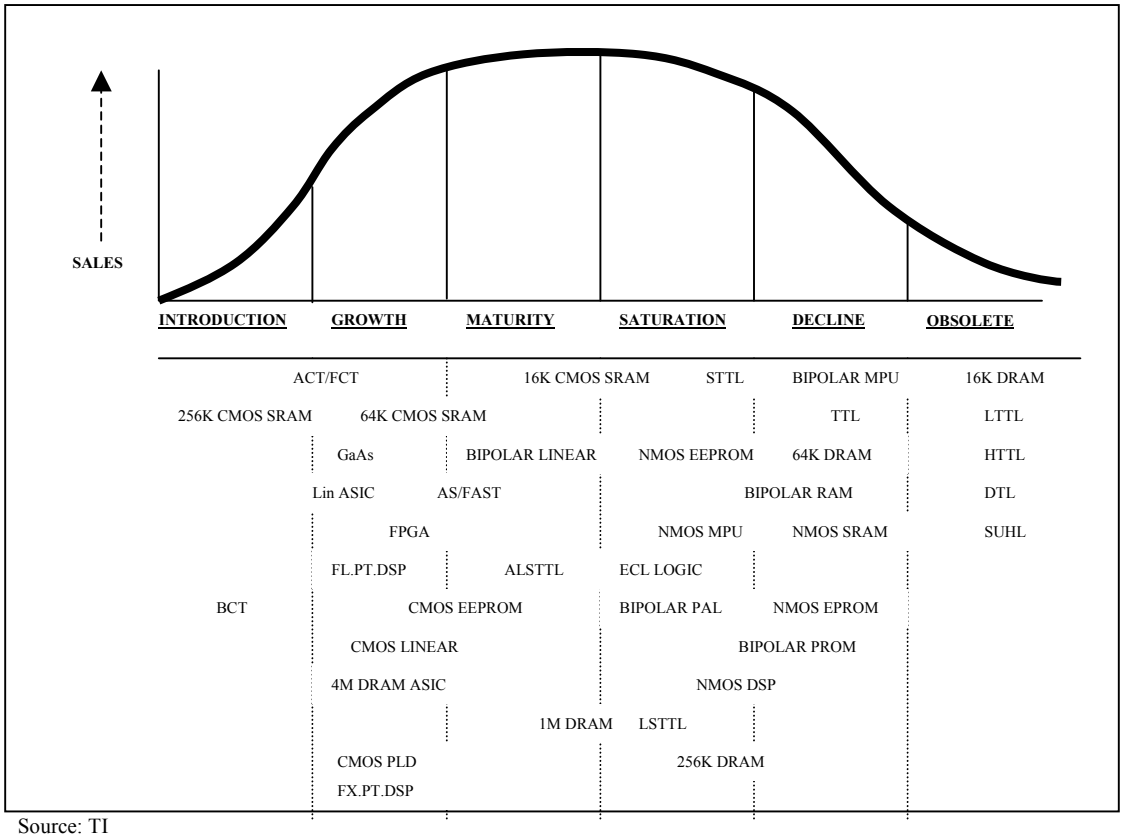
The following two figures represent the 1998 status of commercial and military IC lifecycles. In selection of parts, it is generally recommended to avoid those IC products in Introduction, Saturation, and Decline (Obsolete) stages of the IC Lifecycle curves. It is recommended to selects parts from Growth and Maturity stages where these parts are free of initial problems, readily available through multiple sources, and have moderate cost.

The electronics industry is being driven by the commercial marketplace for higher speeds and more efficient power management leading to lower voltage operation in higher density components. Five-volt (5-V) electronic systems have been the industry standard for active devices such as microcircuits, diodes and transistors for the last several decades. However, due to processing advancement in device design; 3-V, 2-V, and 1-V have emerged as the new low power technology. The trend in the electronics industry going towards these lower operating voltages will impact Navy system acquisition and sustainment. The trend indicates that there will be less and less of 5V market for all new design as time goes by and it will be harder to sustain old legacy systems. Long-term strategic DMSMS planning is needed for better management of the upcoming technology transition issues.



Source: ICE

Figure 3. Commercial - IC Lifecycle



Source: TI

Figure 4. Military - IC Lifecycle

Order Of Preference In Parts Selection

In general, the following are the order of preference in parts selections (in the descending order):.

a. Parts required to meet Government regulatory organization's regulations.
b. Parts defined by standards produced by recognized national consensus standard societies and organizations.
c. Military or Government standard parts.
d. OEM corporate standard type parts.
e. Source control drawings or vendor item drawings.
f. Parts identified by part manufacturer part numbers, which are controlled by their drawings, catalogs, or company standards.

Source Selection Considerations

The DMS task could be applicable to all options, and the Acquisition Activity (AA) must decide if the period of expected use, criticality, and cost of the hardware to be purchased warrant a DMS task. The following statement of work (SOW) is suggested for guidance.

"The contractor shall review, through the period of performance of the contract, the Government/Industry Data Exchange Program (GIDEP) Diminishing Manufacturing Source (DMS) notices and other supplier notifications for applicability of the hardware being delivered. The contractor shall notify the Acquisition Activity within ____ days of any DMS situation that effects current deliveries or subsequently will effect equipment maintenance and repair (data item number for notification of DMS problems)."

Optional Task: "Through the period of performance of the contract, the contractor shall: (1) Identify alternate sources, replacement parts, or optional part numbers for parts and materials that become obsolete, and (2) revise the assembly drawings to incorporate the new information. If a direct replacement is not possible, the contractor shall notify the Acquisition Activity."

The acquisition activity (AA) or designated representative would need to review the contractor's proposed parts management plan or internal parts management procedures for the following criteria.

Parts Management Criteria

To better manage the selection and use of parts to reduce life-cycle cost and to avoid unnecessary proliferation of part types, procedure is recommended to:

a. Define the parts selection process or criteria, including an order of preference.

b. Establish the parts evaluation and authorization processes.

c. Use and maintain an approved corporate baseline, parts selection list, or other database to give visibility to designers and subcontractors of parts preferred for use.

d. Manage subcontractors.

Parts Quality and Availability

To ensure part quality, enhance equipment/system reliability and supportability, and reduce DMS occurrence, the contractor should have provision for:

a. Assessing parts suppliers and their technology roadmaps.
b. Documenting and maintaining part failure information.
c. Using Government Industry Data Exchange program (GIDEP) data.
d. Using DMS information databases.
e. Enhancing competitive re-procurement of spares.

LIFE CYCLE SUPPORT

Provisions must be made to ensure system support throughout its life cycle. Programs must use information sources and processes to alleviate the DMSMS issues that will occur.

Discontinuance Notifications

Initial DMSMS alerts may be promulgated by a variety of sources, subsequent to manufacturer discontinuance of part or a line of products. Alerts may also be originated when Navy activities receive a “no bid” on parts orders for manufacturing components, or a “not available” response to a depot requisition for repair orders or the manufacturing of parts. Part manufacturers and OEMs generally provide discontinuance information directly to major government and commercial customers; in addition, a variety of internal government systems have been established to distribute DMSMS alert data. The following is a summary of the primary DMSMS alert sources.

Part Manufacturers and OEMs

Discontinuance notifications are often received from part manufacturers and OEMs via letter or telephone call. In both cases, manufacturers will generally notify only known customers of the part or component in question. If the government is not a direct purchaser of the material, discontinuance information must then be passed through suppliers and OEMs who are under contract to government activities. For example, alerts may be originated by OEMs when a component manufacturing contract cannot be filled because a supplier has provided them a discontinuance notice on a part needed for a contracted component. To ensure receipt of such notifications, NAVSEA programs should insert appropriate requirements and clauses in system support and production contracts.

Government Procurement/Repair Activities

Internal government alerts may be generated subsequent to "no bid" or "not available" responses to equipment or part procurement/repair efforts. In these cases, a technical referral has historically been generated and forwarded on a Defense Logistics Agency (DLA) Form 339 to an Inventory Control Point (ICP), which may pass the information to an in-service Engineering Agent (ISEA) for further review and analysis. Contact with ICP/ISEA technical referral personnel may therefore be necessary to obtain specific alert information.

Inventory Control Points (ICP)

ICP DMSMS alerts may be promulgated in the course of part application reviews during ICP case research. The center will generally provide impacted activities with problem part numbers, end item application data, and the case number via telephone.

Government-Industry Data Exchange Program (GIDEP)

These alerts originate when GIDEP is notified by a part manufacturer or GIDEP participant that a part or production line will be discontinued. GIDEP promulgates alerts to representatives at subscriber activities in DoD, and to member organizations in private industry. These alerts sometimes duplicate DESC or DTC information as discussed below, and normally contain data such as the last date of part manufacture, last date for order processing, and minimum order quantity or buy value.

Defense Supply Center Columbus (DSCC)

DSCC alerts are received by naval message and generally identify a DMSMS problem with a fairly immediate response requirement. They generally request identification of quantities required for Life-of-Type (LOT) support, and submission of funded requisitions and/or Military Interdepartmental Purchase Requests (MIPRs) for hardware to be acquired for subsequent use in new higher assemblies. These alerts usually have a short lead-time for response and are frequently promulgated before research to identify alternate sources of supply can be completed.

DMS Technology Center (DTC)

The DTC, located at Naval Surface Warfare Center (NSWC) Crane, Indiana provides DMSMS alerts via the Internet and Rapid Alert Notifications (RAN) via E-mails.

Monitoring Technology

To mitigate DMSMS risks in a configuration item, you must first know the parts and their indentured relationship in that item. Upon receipt of a discontinuation notification, research has to be conducted to verify if the DMSMS situation exists or not. Therefore, it is very important to maintain an accurate and comprehensive baseline

configuration. The following are some of the primary products, which may be useful for obtaining configuration data.

- Management Data List-Consolidated (ML-C)
- Management List, Navy (MLN)
- Master Cross Reference List (MCRL)
- Consolidated History of Alternate Identification Numbers (CHAIN)
- Master Repairable Items List (MRIL)
- Identification List (IL)
- Federal Item Logistics Data Record (FILDR)
- Master Index of Allowance Part Lists (APLs)/Allowance Equipage Lists (AELs)
- Navy Activity Specific Databases
- Original Equipment Manufacturers Systems.

Resolutions

The following list of resolutions, are not necessarily mutually exclusive; the potential may exist to combine resolution options to achieve cost, technical or schedule benefits. Depending on the situation, some options may be deemed inherently more feasible or appropriate by the analyst, and this determination may have the potential to affect the degree to which each solution is investigated. Nonetheless, in each case the analyst should ensure a baseline evaluation of all available resolution options in order to facilitate comprehensive resolution analyses.

AfterMarket

Obsolete parts can often be obtained from aftermarket manufacturers and brokers. These companies buy entire production lines, with manufacturing rights, for parts from the original manufacturers. Some aftermarket companies have ongoing agreements with the big manufacturers for the first chance at buying production lines about to be closed down. Aftermarket manufacturers are a good source for reliable parts, since the process and materials are the same. Many OEMs have established routine transfer agreements with aftermarket activities for discontinued product line support. Unfortunately, these parts can be significantly more expensive than those offered by the original manufacturer. The aftermarket supplier has smaller production runs, and must recoup his initial costs of buying the line and setting it up.

Reclamation

This alternative should be considered primarily to resolve crisis DMSMS situations, as a short-term resolution alternative, or in cases where remaining LOT demand is minimal. It will be most effective when a supply of end items has been identified and resources are available for recovery, testing, repackaging and storage. Potential sources for this alternative include Beyond Economical Repair (BER) equipment at depot repair facilities; surplus and stored material removed due to

modernization programs; or items resident within deactivated or decommissioned units. Reclamation does work as a resolution occasionally.

Emulation

Emulation is the process of developing Form-Fit-Functional (FFF) replacements for obsolete microcircuits using state of the art material design and processing techniques. Emulated items are not intended to be substitutes, but rather valid alternate parts for the non-available components; however, a risk does exist in that emulated parts may fail to meet certain unspecified performance characteristics of the original item, and thus suitability for all applications may not be guaranteed. As with aftermarket manufacturers, price per unit for emulated items is likely to be extremely sensitive to order quantities, and the analyst must consider this fact developing a procurement strategy for this alternative. At the same time, the emulation process involves creation of a design library supporting wafer fabrication; therefore, if the DMSMS item is a common or previously emulated design, preliminary engineering costs may be greatly reduced. The emulation process may be conducted at the IC, circuit card, or other designated system indenture level, and often considered a subset of redesign initiatives.

GEM

Generalized Emulation of Microcircuits (GEM) technology provides the capability to manufacture military quality microcircuits, in small quantities, of older technologies such as RTL, DTL, TTL, NMOS, CMOS, etc., using modern technology and fabrication methods. That means if you need a handful of ancient technology, obsolete microcircuits in a hurry, the GEM can be an attractive solution. Prototype microcircuits are generally delivered in ninety days from data sheets, military slash sheets, source control drawings, or other custom specifications.

VHDL

A vendor independent data specification for microcircuits is potentially the best approach for solving the DMS problems in military electronics. Most of components designed today are for specific applications, eliminating the possibility for finding a direct substitute. Each of these high-density components is designed to perform unique functions specific to that single board or application. This virtually ensures that there will not be a directly replaceable substitute when this part becomes obsolete. This creates two extremely critical DMS problems: (1) Since these devices are typically complex, those without appropriate documentation (very common in military systems) are very difficult and costly to reverse engineer. (2) If the functions are known, but not in vendor independent format, a considerable amount of engineering time and cost will be incurred developing a solution. To alleviate these problems, Very High Speed Integrated Circuit Hardware Description Language (VHDL), which allows the vendor-independent attributes can be design solution choice for the long-term support of digital Application Specific Integrated Circuits (ASICs).

VHDL is a computer programming language that has been designed and optimized for describing the functionality of digital circuits and systems. Once a system is described in VHDL, its functionality can be identically recreated in a different technology through computer automation. Designs ranging from simple gates to complex functions can be "described" in VHDL. The designer retains the flexibility to write code for specific implementations, or for the more abstract "behavioral" level. Advanced synthesis tools are applied to convert the vendor-independent design descriptions to vendor-specific data files for silicon fabrication. For example, the first computer was implemented with vacuum tubes and discrete wires. If this first computer had been described in VHDL, its exact same functionality could be easily and inexpensively recreated in today's technology (integrated circuits on a printed-wire circuit board) instead of the original technology (tubes and discrete wires). VHDL is a potential solution to the Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) problem because it will allow today's systems to be easily and inexpensively recreated through computer automation in tomorrow's technologies when its components become obsolete.

Redesign

It is another DMSMS solution, but requires the biggest effort with the highest cost. Redesign is where the engineers redesign a piece of the affected equipment or the entire equipment, to either design the obsolete part out, or accommodate a new part (a new technology part or same technology, different part). Redesigns are often the most expensive solution, costing millions of dollars for design work, modifications to fielded and production systems, changes to technical data, training material and models, and on and on. Sometimes a redesign is the best choice for the affected equipment as a whole. Older equipment becomes so full of near obsolete or obsolete parts that DMSMS management is no longer cost effective and the equipment should be redesigned or even replaced. In addition, redesign is often the favorite solution of the Original Equipment Manufacturer since it brings more profit to the company, where an alternate part solution means only a small change for the company.

New Sourcing

Development of new sources for DMSMS items may be considered when a complete reprocurement technical data package is owned or purchased by the government. This option may be appropriate when the DMSMS problem occurs at either the equipment or component level, and the LOT demand is projected to be high. Developing new sources for the part is a viable option, but often may not solve the immediate problems. Developing a new source takes time. Modifying a production line, getting the part to turn out reliably, finding enough customers to generate a profit, testing the part to meet performance standards, are just some of the hurdles a manufacturer must jump to produce parts.

Reverse Engineering

Development of replicas of candidate items is accomplished through review of available technical data and physical disassembly and analysis of item components. When a part is obsolete, there are no others available, even closely related parts to choose from, and the technical data package is incomplete or nonexistent, then that part is dissected and a new data package is recreated. That package can then be taken to industry for competitive bidding. This process is usually undertaken as an extreme measure, and mostly for mechanical parts. This option traditionally has been expensive and takes a long time.

Life Of Type Buy (LOT)

This option involves purchasing a supply of DMSMS items to support total demands for the life of impacted systems/equipment. Based on the procurement quantities, it can be classified into several categories of buys. Life of Type Buy, Extended Buy, or Bridge Buy. The concept is to make one last big buy of an item before the manufacturer ceases production. The amount purchased depends on whether enough stock is being bought to cover all requirements for the remaining life of the equipment, or just enough to last until another solution comes on line (Bridge Buy). This type of quick, large quantity buy, especially a Life of Type Buy, seems on the surface to be a fast and easy way out of a DMSMS problem. However, there are some hidden pitfalls, especially if you have to support your equipment for many years to come. Calculating how many items to buy, especially over a period of ten or more years, is very difficult at best. Operation tempo changes constantly, so usage will fluctuate from year to year. The number of platforms in service changes over time, so that if a program manager buys twenty years of stock and then the number of active platforms is halved, he suddenly has forty years of stock on hand. Also, during that twenty year period of time, the equipment will usually be modified and upgraded so many times, that the part will probably be designed right out of the equipment, and therefore all those items in storage will be useless. Storage of items can be expensive, especially for long periods in specialized environments. In addition, items purchased may not have as long a shelf life as expected. Many of the new technology items haven't been in existence long enough for us to know what their useful shelf life is. This is especially true of microelectronics. A finished part is not the only thing that can be purchased. Microelectronics die is a good example of an item that can be stored for long periods, and as needed, sent to a fabrication shop for final assembly.

LIST OF DMSMS RELATED DOCUMENTS

a. NAVSUP INSTRUCTION 4800.6 (Dated 26 February1985) Diminishing Manufacturing sources and material shortages (DMSMS) program

b. Department of Defense Material Management Regulation (4140.1-R)

c. DMS Case Resolution Procedure Guide (Prepared by Naval Sea Systems Command – NAVSEA 0416)

d. Flexible Sustainment Guide (Dated 14 August 1997) (Joint Logistics Commanders - Joint Aeronautical Commanders' Group)

e. Acquisition Practice for Parts Management (MIL-HDBK-965)

f. Guidelines for the Implementation of the DOD Parts Control Program (MIL_HDBK-402A)

LIST OF DMSMS RELATED INTERNET WEBSITES

a. DMS Technology Center (DTC):
http://dtc-dms.crane.navy.mil/dtc.htm

b. Government-Industry Data Exchange Program (GIDEP):
http://www.gidep.corona.navy.mil/dmsms

c. Defense Microelectronics Activity (DMEA):
http://www.mcclellan.af.mil/DMEA